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Personal Development Project Planner: Advanced 2015	_____ @ \$27.50	_____ @ \$220	_____

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Community Services - Foundation 2015	_____ @ \$33	_____ @ \$165	_____
Community Services - Intermediate 2015	_____ @ \$33	_____ @ \$165	_____

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VCAL/ Applied Learning Resource Sets	Printed text/workbook	Printed activities book	CD Master text/workbook	CD Master activities book	Combined CD master sets	or license with master e version
*Literacy Foundation 2ed (Updated for 2019)	_____ @ \$35	_____ @ \$27.50	_____ @ \$250	_____ @ \$99	or _____ @ \$330	or _____ @ \$440
*Literacy Intermediate 4ed (Updated for 2019)	_____ @ \$35	_____ @ \$27.50	_____ @ \$250	_____ @ \$99	or _____ @ \$330	or _____ @ \$440
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PDS Foundation 2018	_____ @ \$35	_____ @ \$27.50	_____ @ \$165	_____ @ \$77	or _____ @ \$220	na
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WRS Foundation 2014	_____ @ \$35	_____ @ \$27.50	_____ @ \$165	_____ @ \$77	or _____ @ \$220	na
WRS Intermediate 3ed. 2016	_____ @ \$35	_____ @ \$27.50	_____ @ \$165	_____ @ \$77	or _____ @ \$220	na
WRS Senior 2ed. 2014	_____ @ \$35	_____ @ \$27.50	_____ @ \$165	_____ @ \$77	or _____ @ \$220	na
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Numeracy Senior: Workbook 2ed.

Contents

Unit 1

1. Doing the Numbers	1
2. Seeing The Numbers.....	37
3. Dealing with Money	67
4. Money Management	91
5. Showing The Way	119
6. Got The Time?	137
7. Measure By Measure	159
8. Representation & Design.....	181

Unit 2

9. Applied Numeracy Project.....	201
10. Numeracy-Based Project Plan	221
11. Industry Stages - Inputs.....	233
12. Industry Stages - Processing	259
13. Industry Stages - Outputs.....	285
14. Reporting.....	307

Important: All material, advice and assessment tasks are provided as a guide only and do not constitute official advice. As always you must check with the VCAA and any other relevant authorities about the suitability of a task.

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Numeracy Senior: Workbook 2ed.

By Michael Carolan

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- Literacy - Foundation 2ed (2019)
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- Personal Development - Foundation (2018)
- Personal Development - Intermediate 3ed (2016)
- Personal Development - Senior 2ed (2016)
- Work Related Skills - Foundation (2014)
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- Work Placement Journal (2015)
- Work Experience Journal (2014)
- Personal Development Planner - Introductory (2015)
- Personal Development Planner - Advanced (2015)

Available for industry-specific work education

- Retail Trade Industry - Foundation (2014)
- Retail Trade Industry - Intermediate (2014)
- Community Services - Foundation (2014)
- Community Services - Intermediate (2014)

Also available for Industry & Enterprise

- I&E Unit 1: Workplace Participation 4ed (2019)
- I&E Unit 1: Workplace Participation - e-version (2019)
- I&E Units 1&2: Towards an Enterprising You 5ed (2019)
- I&E Units 3&4: Towards an Enterprising Australia 4ed (2019)

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Carolan, Michael

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Advice to students

- ✓ Use this resource to build, develop and apply skills to assist your numeracy development. Complete the tasks in the spaces and pages provided.
- ✓ Use the pro-formas and self-reflections as part of your Numeracy program.
- ✓ You will also need to maintain your own workbook to complete other tasks given to you by your teacher. You may need to collect and keep copies of resources, handouts and evidence of your numeracy skills in your own workbooks.
- ✓ You might also use your *Activities Portfolio* to complete tasks as directed by your teacher. This portfolio will give you a body of work to keep as a reference. It will also enable you to review and improve upon numeracy and transferable skills.
- ✓ You might be directed to complete some or even all of the assessment tasks listed opposite.
- ✓ Throughout this workbook there are a number of quick-reference *Numeracy Superskills*. Use the table opposite to locate these.
- ✓ When dealing with problems related to visual numeracy it is a good idea to draw a diagram.
- ✓ Remember that your development of numeracy skills will provide you with the tools for a more successful personal, social and work life. So best wishes with your numerical journey.

Projects I am required to organise and participate in for Numeracy Senior are...

Assessment Tasks

Unit 1

AT1 Do The Numbers	34-35
AT2 Communicating Information	64-65
AT3 Working With Money	88-89
AT4 Financial Literacy.....	116-117
AT5 Old school vs Nu skUL battle	134-135
AT6 Where, How and Why?	156-157
AT7 Measuring Up.....	178-179
AT8 Make Me Up	198-199

Unit 2

AT1a Numeracy-based Project - Planning	224
AT1b Numeracy-based Project - Organising ..	226
AT1c Numeracy-based Project - Doing	228
AT1d Numeracy-based Project - Software Tools & Devices.....	230
AT1e Numeracy-based Project - Reporting	231.
AT2 ANP - EBT: Inputs.....	256
AT3 ANP - EBT: Processing.....	282
AT4 ANP - EBT: Outputs.....	304
AT5 Numeracy-based Project: Reporting	316

Numeracy Superskills

1.03 Order, order!.....	4
1.07 Power calculations	8
1.08 Pythagoras' Theorem.....	9
1.10 Tree diagram	11
1.13 Mean.....	14
1.15 Median	16
1.17 Mode.....	18
1.25 Formula for success.....	26
2.07 Effective checksheets	44
2.11 Line graphs	48
2.15 Bar graphs	52
2.19 Pie charts.....	56
3.03 Estimating percentages	70
3.04 Percentage change	71
3.06 Fractions: Addition & subtraction.....	73
3.06 Fractions: Multiplication & division	73
3.09 Discounts.....	76
3.15 Spreadsheets.....	82
4.03 Budgeting.....	94
4.07 Main types of income	98
4.17 Managing your money	108
4.21 Loan repayment calculator.....	111
5.03 Mapping features	122
6.03 Converting time.....	140
6.06 Elapsed time (duration)	143
7.02 Units of measurement	161
7.05 Perimeter	164
7.06 Area	165
7.07 Volume.....	166
7.14 Types of angles	173
7.15 Types of triangles.....	174
8.03 Solid objects	184
8.05 Flowcharts	186
8.09 Scale	190
8.13 Scale and ratio	194
9.13 Calculating productivity	214
9.15 Fixed and variable costs.....	216
9.18 Break-even point	219

Doing The Numbers 1

Contents

1.01 Introduction.....	2	1.15 Average - Median	16
1.03 Doing the Numbers.....	4	1.17 Average - Mode	18
1.07 Powers and Roots	8	1.19 Spread and Deviation	20
1.09 Chance and Probability	10	1.25 Using Formulae.....	26
1.13 Average - Mean	14	1.31 Assessment Task.....	34

Activities 1: Doing the Numbers	p.	Due date/Done?	Comment
1.04A Freshen up	5	<input type="text"/>	<input type="text"/>
1.06B Solving problems	7	<input type="text"/>	<input type="text"/>
1.08A Powers and roots	9	<input type="text"/>	<input type="text"/>
1.10A Probability	11	<input type="text"/>	<input type="text"/>
1.11B Dream on	12	<input type="text"/>	<input type="text"/>
1.14A Average - Mean	15	<input type="text"/>	<input type="text"/>
1.16A Average - Median	17	<input type="text"/>	<input type="text"/>
1.18A Average - Mode	19	<input type="text"/>	<input type="text"/>
1.20A Averages and spread	21	<input type="text"/>	<input type="text"/>
1.22B Interquartile range	23	<input type="text"/>	<input type="text"/>
1.23C Applying interquartile range and spread	24	<input type="text"/>	<input type="text"/>
1.25D Standard deviation	26	<input type="text"/>	<input type="text"/>
1.26A Common formulae	27	<input type="text"/>	<input type="text"/>
1.28B Relationship formulae	29	<input type="text"/>	<input type="text"/>
1.30A Applying Formulae	31	<input type="text"/>	<input type="text"/>
1.32B Developing formulae	33	<input type="text"/>	<input type="text"/>
AT1 Do The Numbers	34	<input type="text"/>	<input type="text"/>
1.35 Numerical Language	36	<input type="text"/>	<input type="text"/>

Comments:

1.01 Introduction

Numeracy Senior

Welcome to **Numeracy Senior** at this, your final stage, of your secondary schooling. This resource has been developed to assist you to build numerical skills that will enable you to make more informed decisions for your personal, social and professional wellbeing for this year and beyond.

The learning material is organised into units 1&2

Unit 1 features eight sections focusing on:

1. **Doing the Numbers** - Numerical Skills and Processes (**LO1** and applied)
2. **Seeing The Numbers** - Numerical Skills and Processes (**LO1** and applied)
3. **Dealing with Money** - Financial Literacy (**LO2**)
4. **Money Management** - Financial Literacy (**LO2**)
5. **Showing The Way** - Planning and Organising (**LO3**)
6. **Got The Time** - Planning and Organising (**LO3**)
7. **Measure By Measure** - Measurement - Representations and Design (**LO4**)
8. **Representation & Design** - Measurement Representation and Design (**LO4**)

Unit 2 features six sections focusing on:

9. **Applied Numeracy Project** (**U2 LO1**)
10. **Numeracy-Based Project Plan** (**U2 LO1**)
11. **Industry Stages - Inputs** (**U2 LO 1-3**)
12. **Industry Stages - Processing** (**U2 LO 1-3**)
13. **Industry Stages - Outputs** (**U2 LO 1-3**)
14. **Reporting** (**U2 LO4**)

Many of the tasks have been designed for you to apply your numerical learning to real decisions that impact on your personal, social, educational and work-related decisions. You are also invited to collect images on numeracy in action and interview key stakeholders related to these topics. These tasks, and the **glossary** activities, will assist you to develop an applied **technical** or **professional numerical vocabulary** related to work-related situations and industries within which you are interested. This will also help you to build your professional network.

Sections 1-8 contain many skills-building and applied activities that can form a portfolio of tasks that you might be required to complete as part of an assessment portfolio. Each section also has an assessment task designed to support completion of relevant learning outcomes. There is a pro-forma to record your progress at the end of this book. Your teacher will inform you of your requirements for assessment.



Use online sources to research relevant numerical data or information.



The use of a spreadsheet could or must be used to complete this task.



Oral Communication builds applied skills. Might suit Oral Communication outcomes.

WRS

This task might support and integrate with Work-Related Skills activities.

PDS

This task might support and integrate with Personal Development Skills activities.

LIT

This task might support and integrate with Literacy Skills activities.

Estimating

- ⇒ Estimating involves initial planning based on a person's knowledge, skills and past experience.
- ⇒ Estimating might be supported by quick sketches, job quotes and general calculations.
- ⇒ Estimating size, cost, time, distance and shape can determine a 'ball park' figure.

e.g. A tradie will assess a potential job and predict the amount of materials needed, as well as the likely labour time involved.

Predicting

- ⇒ Prediction uses past knowledge of events as well as an understanding of probability, sequences and patterns, to predict what is most likely to happen next.
- ⇒ Predicting involves determining relationships between cause and effect and applying these relationships to future situations.

e.g. Looking at seasonal variations in sales data and predicting sales levels that are likely to happen on an ongoing basis.

Calculating

- ⇒ Calculating involves using the skills of mathematics to properly carry out calculations!
- ⇒ This includes simple functions, such as addition, subtraction, multiplication and division, from to more sophisticated methods. It also relies on knowing the correct order of operations.
- ⇒ Calculating might also require the development and use of formulae.

e.g. A caterer might have to calculate the food and beverage requirements, within budget, for an event such as a wedding.

Interpreting

- ⇒ Numerical interpretation involves looking at our personal, educational and work-related activities and recognising, understanding, explaining numerical situations and patterns in everyday lives.
 - ⇒ Interpretation is a vital skill in making sense of numerical information.
 - ⇒ All information and data needs to serve a purpose. People then interpret data to support their decision-making.
- e.g. You need to interpret financial information when making quotes, processing customer orders or working in business.*

Analysing

- ⇒ Analysing is a key skill as it involves using numerical information to make decisions.
- ⇒ All data needs to have a purpose. Analysing numerical information and data allows us to make sense of our world and make informed decisions.
- ⇒ A true and accurate analysis of the 'numbers' will guide us to take the most appropriate course of action.

e.g. You might analyse your income and spending patterns as part of developing a personal financial plan; and then determine areas of strength and areas of concern.

Problem-solving

- ⇒ Problem-solving uses numerical and mathematical calculations, processes, formulae and equations to develop answers to questions and make decisions.
- ⇒ It might involve each, or indeed all, of the other skills as well as comparing, scheduling, financing, designing, evaluating, assessing, inspecting or even assembling.

e.g. You are faced with many decisions as you finish Year 12 and problem-solving using numerical information will help guide you towards the right courses of action.

Preview
Sample:
Do Not
Copy

1.03 Doing the Numbers

Calculations

By now you are probably familiar with the different types of calculations required to develop, use and apply numeracy skills.

First off you have the basic **addition**, **subtraction**, **multiplication** and **division** functions. You need to be able to do some of these in your head. More complex problems will require you to set the calculations out on paper and/or use a calculator. For many applied situations calculations can involve a combination of different functions. This is governed by **order of operations** and the use of **brackets**.

One of the most important skills when performing calculations is to know that your answer is correct. This requires you to be able to carry out **estimates** and **rounding** in your head. By doing this you can tell if your exact answer is close to your estimated amount. This skill is important when you are on the go, such as when shopping, working with materials, processing customer orders or even providing quotes.

When estimating or calculating you need to be able to work with small and large whole **numbers** (both positive and negative), **fractions**, **decimals** and **percentages**. You also need to be able to **convert** between different **units**, such as when dealing with **quantities** expressed in millimetres, grams, metres, kilograms and so on.

You should also have a understanding of how to calculate **rate ratios**, whereby one quantity is expressed in the terms of another, such as kilometres per hour. You also need to understand varied **scale ratios** that are used in maps, diagrams and shopping.

Preview
Sample
Do Not
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When performing a calculation the order of operation is as follows.

Firstly, you must always **evaluate any brackets** before doing anything else:

⇒ $5 + (10 \times 6) = 5 + 60 = 65$ (and not 90!!!)

Secondly you **move from left to right** performing any **multiplication or division**. It doesn't matter which of these you do first as long as you move from left to right. Tip: You can show this as a bracket 'x'.

⇒ $6 \times 5 + 3 \times 13 =$
 $(6 \times 5) + (3 \times 13) =$
 $30 + 39 = 69$ (and not 429, 624 or 1,170!!)

Finally you move from left to right performing any addition or subtraction. (Once again it doesn't matter which of these you do first as long as you move from left to right.)

For example:

$$3 + 9 \times 7 = ??$$

$$3 + (9 \times 7) = 66$$

do this 1st

$$3 + 63 = 66$$

And another:

$$6 \times 9 - 9 \div 3 = ??$$

$$(6 \times 9) - (9 \div 3) = ??$$

do this 1st do this 2nd

$$54 - 3 = 51$$

And one more:

$$17 - (15 \div 3) + 5 \times 25 = ??$$

do this 1st

$$17 - 5 + (5 \times 25) = ??$$

do this 2nd

$$12 + 125 = 137$$

NUM
SUPER
SKILLS

Had a long summer? Complete the following calculations to revise and refresh your numerical skills. We'll start easy and then build up. Try these first without a calculator.

a. $2 + 2.5 =$ (expressed as fraction)	b. $3 + 7 + 3 \times 7 =$
c. $25\% \text{ of } 250 =$	d. $1,000 - 17\% + 50 =$
e. $46 \times 72 + 12.5 =$	f. $2,000 \div 40 \div 5 =$
g. Change from \$100 for purchases of 1 @ \$12.50 and 2 @ \$15.00	h. Purchases of 4 @ \$16.00 and 3 @ \$19.95 less 10% total discount =
i. $\frac{1}{2} \times \frac{4}{2} =$	j. $\frac{3}{4} + \frac{2}{8} + \frac{5}{16} =$
k. Worked 24 hours at \$12.75 =	l. Worked 16 hours at \$18 and 4 more hours overtime at time and a half =
m. Filled up a 70 litre tank and paid \$105. How much was the petrol per litre?	n. Drove 500 km on the full tank before it was empty. Tank capacity was 70 litres. How many litres per km?
o. Drove 500 km in 6 hours. What was the average speed?	p. $2x + y = 20$ If $y = 10$, how much is x ?
q. A box has dimensions of 10cm x 40cm x 20cm. What is its volume?	r. Using a ratio of 4:1, will the drawing be bigger or smaller, than its actual size?

Preview
Sample:
Do Not
Copy

2. Your studies of numeracy are about skills development and using and applying these skills. So in your workbooks, outline an example of how you applied numeracy skills during your holiday break for each of these areas.

- | | | |
|--------------------------------------|---|---|
| <input type="checkbox"/> calculating | <input type="checkbox"/> budgeting | <input type="checkbox"/> measuring |
| <input type="checkbox"/> estimating | <input type="checkbox"/> mapping/locating | <input type="checkbox"/> designing and/or |
| <input type="checkbox"/> using money | <input type="checkbox"/> planning time | drawing |

1.05 Doing the Numbers

Solving problems

At times life requires dealing with problems. Money problems, time problems, people problems, work problems, customer problems, work/life balance problems and many more problems. And that's where well-developed applied numeracy skills come in.

Senior Numeracy is aimed at you developing and using skills to deal with problems. But 'doing the numbers' is not the problem. 'Doing the numbers' allows you to use data and information to make more informed decisions, so that you can deal with problems in a better way.

Some problem-solving numeracy skills you can apply include the following.

- ⇒ **Collecting**, collating, interpreting and analysing data and information, such as transport schedules and travel times.
- ⇒ Using **measurements** and **formulae** to calculate area and other amounts, such as the number of tiles needed for a kitchen floor.
- ⇒ Applying or changing **formulae** when cooking, such as working out the amount of time needed to cook a heavier cut of meat than given in a **recipe**.
- ⇒ Setting up **spreadsheets** and other tools to organise and interpret information, such as a personal budget.
- ⇒ Calculating **averages** use on various data sets, such as patterns, such as daily sales.
- ⇒ Developing **flowcharts** and **diagrams** to represent sequences.
- ⇒ Creating **sketches** and **plans** to represent objects to scale.

Looks a bit raw! Perhaps Ivan should've tripled the cooking time!



Image: LisaA85/Depositphotos.com

Consider this example:

Marnie has just started working in an advertising firm after getting her degree in public relations last year. But she finds that she is always broke by the end of the week. Being cool and hooked-in digitally, Marnie uses PayWave, direct debits, apps and online purchases for most everything she buys. But she doesn't know where the money goes! Marnie says that her problem is that she has gone broke. But is that the problem?

What do you think?

Marnie's friend Lucinda completed VCAL a few years back and is good with practical numbers. Lucinda shows Marnie how to do a budget to track her spending. Lucinda puts all Marnie's income and spending from when she started working into a spreadsheet, and organises the information by various categories.

Marnie sees that each week she is spending, on average, 20% of her income on Uber Eats and Deliveroo, 15% on Uber and 15% on mobile, internet and online subscriptions. That's half her take home pay - gone! She is also spending about 30% a week going out and socialising. So it's lucky she still lives at home!

- 🧠 So what is the problem? Is it the numbers that are the problem? Or are the actions and behaviours that have led to the numbers, 'the problem'? What do you think?

Solving problems B

Solve these problems first by estimating (where appropriate) and then researching relevant information to make accurate calculations. (More space? = use workbooks!)

a. How much would a fish and chip dinner cost for your family?

b. What would you buy to cook a dinner for you and 3 friends for only 10 bucks?

c. How long would it take you to save up for a car? What changes would you need to make?

d. If you had a job with 4-hour shifts per week, where would you find the time? What days and times would you prefer and why?

e. How long would it take you to walk 10kms? In what circumstances would you do this?

f. If you had to use a spreadsheet to calculate a budget, when would be the formulae for an average and for totals? When would the formulae be used in a budget?

g. If you are going for your driving license test what is the sequence of actions you need to do right from the beginning until you drive off? Develop a diagram or flowchart.

h. You have to cut a length of timber to join a totally straight upright of 1.5m all the way out to the edge of the roof 2m away. What shape would this make and what length would you need?

Preview
Sample:
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1.07 Powers and Roots

Powers

A number expressed with a power is a simpler way of writing a number that is multiplied by itself a certain number of times.

We see 'powers' when numbers are expressed like this: 4^2 or 10^3 or 7^7 . In others words, 4 x 4, or 10 x 10 x 10, or 7 x 7 x 7 x 7 x 7 x 7 x 7.

The number to be multiplied is called the **base**. The number of times it is to be multiplied is called the **exponent**, or more commonly the **power**. Powers are commonly used in measuring, e.g. area: units squared or ² and volume: units cubed or ³. Powers are used in computing, e.g. for file and drive sizes, in science, finance and many other fields, especially where big numbers need to be simplified.

[illegible]

Do you know the name of this number? It can be written more simply as 10^{100} .

e.g. For the first example above

The base is 4 and the power (or the exponent) is 2.

So: 4 to the power of 2

or: $4^2 = 4 \times 4 = 16$

or: 4 squared equals 4 times 4

or: Four is multiplied twice.

🗣️ Say these out loud and you'll feel it in your pocket. Which way of expressing these do you prefer? And what about an object that measures success. What might that be?

Preview

for example, 4^2 over
 the power of 4 and the power (of the exponent) = 2.
 the power of 2
 $4 \times 4 = 16$
 squared equals 4 times 4
 is multiplied twice.

Sample:

Power calculations

Don't

Multiplication and division

If the **base number** is the same, simply add or subtract the powers.

e.g. $3^2 \times 3^3 = 3^5$ i.e: $(3 \times 3) \times (3 \times 3 \times 3) = 9 \times 27 = 243$ which equals the same as 3^5 .

e.g. $4^5 / 4^2 = 4^3$ i.e: $(4 \times 4 \times 4 \times 4 \times 4) / (4 \times 4) = 1024 / 16 = 64$ which equals the same as 4^3 .

If the **base numbers** are not the same then one way is to work out each power then do the calculation. But your teacher might show you easier ways.

It is important to note that this rule is only relevant to multiplication and to division (which is the opposite of multiplication). This is because a base with a positive power is how many times you multiply a number (the base) by itself. So these types of calculations using powers (or exponentials) are one particular numeracy train of action. If we want to deal with adding and subtracting with numbers with powers then we need to catch a different train!

Addition and subtraction

To work this out you have to solve for the powers first, because you always do multiplication (and/or division) before adding and subtracting. So after you have 'done the powers' you then add or subtract the numbers as required using basic maths. It makes sense if you stop and think about it!

e.g. $3^2 + 3^3 = ?$ i.e: $(3 \times 3) + (3 \times 3 \times 3) = 9 + 27 = 36$

e.g. $4^5 - 4^2 = ?$ i.e. $(4 \times 4 \times 4 \times 4 \times 4) - (4 \times 4) = 1,024 - 16 = 1,008$

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Roots

A root is the opposite to a power. A root is shown by the symbol $\sqrt{\quad}$ so $\sqrt{25} = 5$ (or the square root of $25 = 5$). A perfect square is a number whereby the square root is a whole number and not a fraction, i.e. it does not have any decimals after it.

Perfect square roots											
1	4	9	16	25	36	49	64	81	100	121	144
1	2	3	4	5	6	7	8	9	10	11	12
169	196	225	256	289	324	361	400	441	484	529	576
13	14	15	16	17	18	19	20	21	22	23	24

Some imperfect square roots											
2	3	5	6	7	8	10	20	50	200	500	1,000
1.41	1.73	2.24	2.45	2.65	2.83	3.16	4.47	7.07	14.14	22.36	31.62

Pythagoras' Theorem

The ability to calculate a square root is not very useful when working with right-angled triangles. You might have heard of Pythagoras before, even the Pythagoras' Theorem allows you to calculate the length of the longest side of a triangle. This is really useful in construction, tiling, design and when working with areas.

For a right-angled triangle the length of the longest side (the hypotenuse) will always equal the square root of the sum of the squares of the lengths of the other 2 sides.

It is easier to show this as: $a^2 + b^2 = c^2$

For example

$$3^2 + 4^2 = ?^2$$

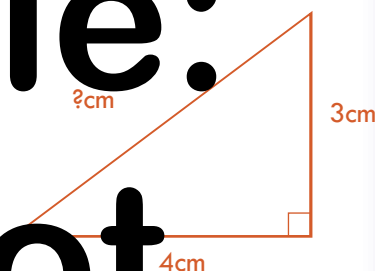
$$9 + 16 = 25$$

The square root ($\sqrt{\quad}$) of $25 = 5$, so:

$$3^2 + 4^2 = 5^2$$

The length of the longest side is 5cm.

Try it by measuring and see for yourself. It always works, always!



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Powers and roots A

1. In your workbooks, calculate the following:

3^2	10^2	50^2	2.5^2	$3^2 \times 3^2$	$4^2 \div 4^3$	$5^2 \times 2^2$	$6^4 \div 6^2$	$2^2 \div 3^4$	$2^2 + 3^4$	$3^4 - 2^2$	$10^9 - 10^5$
-------	--------	--------	---------	------------------	----------------	------------------	----------------	----------------	-------------	-------------	---------------

2. Calculate the square root of these numbers. (Not all will be perfect squares.)

4	400	4,000	10	100	1,000	5	500	5,000	4.8	10,000	1m
---	-----	-------	----	-----	-------	---	-----	-------	-----	--------	----

3. Draw these right-angled triangles and calculate the length of the longest side.

i. 30mm and 40mm	ii. 12cm and 15cm	iii. 20cm and 10cm	iv. 64mm and 100mm
------------------	-------------------	--------------------	--------------------

4. Jum is an apprentice cabinet-maker. His boss is on-site and texts Jum saying to cut 4 doors for a kitchen instal. The message says that one door needs to be 2,500cm square, the next is 1,600cm square, the third is 1,200cm square and the last one is a right-angled triangle that has a height of 50cm and a width of 35cm.

Draw sketches to help Jum out; and calculate and show the dimensions of the doors.

1.09 Chance and Probability

Chance vs probability

Probability refers to the likelihood of something occurring. It is measured as a ratio, or as a percentage, related to the chance of something (an outcome) happening. So **probability** measures **chance** (but not really luck - **luck** is a totally different thing altogether).

For example:

- ⇒ The probability of rolling the number 4 using a fair die is a 1 in 6 chance (1/6) or 16.67%.
- ⇒ The probability of drawing an ace from a standard playing deck of cards is 4 out of 52 (1/13) or 7.7%.

So let's take a look at the common example of tossing a coin and hoping for tails.

Essentially each time you toss a coin there is a 1 in 2 chance of it landing tails (if you remove the minuscule chance it will land on its edge). So that fifty-fifty outcome can be described as a 50/50 probability.

And of course if you toss the coin again the chance that you will get tails this time is still 50/50. The coin has no memory of what it did the first time, and it also has no interest in establishing a pattern (unlike humans).

Another toss hoping for tails? Again a 50/50 chance. Each toss of the coin resets the probability because each toss is a new situation.

What about one more time? Feeling lucky about tails? Or will it now change to heads because, as you know so very well, heads is bound to come up? What would you do?

Give this a try now using a 20c coin (that's if you still carry money!). And yes, there are apps that can do this - but people don't trust technology thinking it may be rigged. Yet they will pour money intookies and other luck based gambling; which of course have to be 'rigged', otherwise casinos or betting agencies could go out of business on its first day!

Compound probability

A compound probability refers to the likelihood of 2 or more independent outcomes occurring.

If we again use coins as an example, what is the probability of spinning 2 heads in a row?

The probability of this is 1/2 times 1/2 which equals 1/4 (or 25%).

We can say that over 2 spins there are 4 possible outcomes.

- ⇒ Head then head, or
- ⇒ head then tail, or
- ⇒ tail then tail, or
- ⇒ tail then head.

Each of these 4 outcomes has a 25% chance of occurring. And the 4 probabilities add up to 100% (which they must)! So as you can see, the probability of 2 heads in a row is 1 in 4 (or 25%), which is what we calculated right at the beginning.

Image: vichie81/
Depositphotos.com



Tree diagram

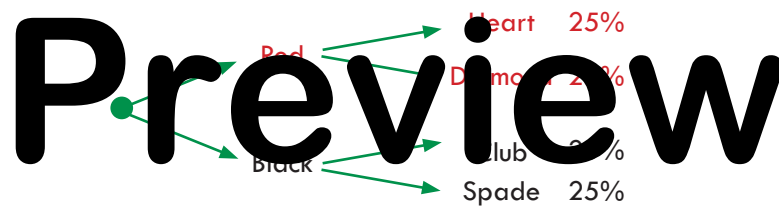
A tree diagram is a visual tool to display all the possible outcomes of an event.

You can use the tree diagram to calculate the probability of all the possible outcomes, because each branch in the tree diagram represents a possible outcome.

In a tree diagram all the possibilities must add up to 100% - naturally! But of course some outcomes may have a lower probability of occurring, whereas some might have a higher probability.

For example, the chance of drawing a red card from a standard 52-card deck is 1 in 2, or 50%. The chance of drawing a heart is 1 in 4, or 25%. The chance of drawing an Ace is 1 in 13, or 7.7%, and the chance of drawing the Ace of Hearts is 1 in 52 or 1.9%!

e.g. Probability of drawing a particular suit from a deck of playing cards.



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Sample:

Probability A

Have you ever played the game heads or tails? And if so, did you win?

How does it work? Is it all luck, or is there a strategy?

Your teacher will explain the game to you.

Have a round of the game as a class now. How many rounds did it take to get a winner?

Draw a tree diagram to work out the probability of lasting 6 rounds. How many players might be needed to ensure a game will last 6 rounds?

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1.11 Chance and Probability

Life could be a dream?

What would you do if you won a million dollars in Tattslotto? I have heard people (and even supposedly even-tempered teachers who are apparently satisfied with their job) say they would march into their boss's office and tell him/her to "stick it". I don't know why suddenly coming into money makes 'normal' people become aggressive and offensive. Well I have never met anyone who has won Tattslotto, have you? Why not? But I have met some people who are already millionaires and many more who will retire as millionaires. And then there's you!



Image: jukai5/
Depositphotos.com

B Dream on

1. What would you do if you won Tattslotto? What is the likelihood of this happening?

Preview

2. Outline 6 important pieces of advice that you have learned from the article, 'Life could be a dream'. Add 2 supplementary pieces of advice for someone hoping to get rich playing lotto. Do some research online and discuss your findings.

Sample:

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3. Some years ago the Tattslotto draw changed from 40 balls to 45 balls. The operators said that they changed this so as to increase the potential Division 1 prize. In your workbooks complete the following tasks.
 - a. Calculate the odds of winning a 6 from 40 lotto draw.
 - b. Calculate the odds of getting 4 and 5 numbers.
 - c. Calculate how many years it would take to win the prize, assuming playing 50 games per week.
 - d. How might the change from 40 to 45 balls increase the prize pool?
 - e. In reality, did it get any 'harder' for a person to win the Division 1 prize in their lifetime?

Life could be a dream

Maureen has her heart set on winning Tattslotto. She believes that if she continues to spend her \$35.50 a week on a 50 game coupon then one day she will strike it rich. Good luck to her, I hope she wins. I really do! But it is not very likely. Rule 1: 'Return = Risk'. How do I know? Well here's how.

What are the odds?

The odds of winning Tattslotto are 1 in 8,145,060 or about 8.15 million to 1.

This means that if you play 1 game every week then it will take you 8,145,060 weeks to win.

That's only 156,657.6 years!

You can calculate the odds like this:

- ⇒ You have a 6 from 45 chance of getting the first number correct.
So your odds of getting 1 number are 7.5:1.
- ⇒ You then have a 5 from 44 chance of getting the second number correct.
So your odds of getting this 2nd number are 8.8:1; and your odds of getting both numbers are $7.5 \times 8.8 = 66:1$.
- ⇒ You have a 4 from 43 chance of getting the third number correct.
So your odds of getting this 3rd number are 10.75:1. Your odds of getting all 3 numbers so far are $66 \times 10.75 = 709.5:1$.
- ⇒ You have a 3 from 42 chance of getting the fourth number correct.
So your odds of getting this 4th number are 14:1. Your odds of getting all 4 numbers are $709.5 \times 14 = 9,933:1$.
- ⇒ You have a 2 from 41 chance of getting the fifth number correct.
So your odds of getting this 5th number are 20.5:1. Your odds of getting all 5 numbers correct are $9,933 \times 20.5 = 203,626.5:1$.
- ⇒ You have a 1 from 40 chance of getting the sixth number correct.
So your odds of getting this 6th number are 40:1. Your odds of getting all 6 are $203,626.5 \times 40 = 8,145,060:1$.

Again: odds of getting all 6 numbers = $7.5 \times 8.8 \times 10.75 \times 14 \times 20.5 \times 40 = 8,145,060$
{Odds of winning 6 from 45 = $(45!/39!)/6!$ Ask your teacher to explain this formula}.

So is it worth it?

However, people play more than just 1 game and Maureen plays 50 games a week, so she has increased her chances of winning to 50 in 8,145,060.

This means that if she plays 50 games a week, every week, then it will now only take her 162,901.2 weeks or 3,132.7 years before she should win. That's a lot better!

In order to win she will have to spend at least \$5,722,950 (assuming the ticket price doesn't increase over those 3,132.7 years... not likely!)

And the average prize for 6 numbers is about \$500,000* (since you didn't increase the ticket price you can't increase the average prize). Of course she might pick up some smaller prize on the way to the year 5,151). Good luck to her, she does! Or she could always try Powerball - the prizes are bigger!

However, what could've happened for Maureen if she had used her money in a different way?
Perhaps a financial adviser, the benefits of compound interest, or a coach could instruct her more wisely.

(*Note: It is not easy to find out the average Division 1 prize. This figure is based on an estimate from an older statistic. See if you can find a newer more accurate figure yourself)



21

1

7

5

16

30

1.13 Average - Mean

Different averages

Not all averages are created equal! Some averages are more equal than others.

Three of the most common types of averages are **mean**, **median** and **mode**. They all measure the same thing - an 'average' of a set of ungrouped data. However, each of these three measures might yield quite different results. Therefore particular measures of averages are more suitable, and therefore more useful, than others.

And just like the proper use of statistics, this usefulness is dependent upon the type of data that has been collected, and the nature of the statistics being measured.

Mean

When we hear the word 'average' we usually think of the 'mean'. So if you were to calculate an 'average', most of you will simply add up the total and divide by the number of items that you add up.

For example, calculate the average price of these shopping items:

- ⇒ \$20, \$16, \$12, \$11, \$9, \$6, \$3.
- ⇒ Total price (sum) (sum of all prices)
- ⇒ Total number of items = 7
- ⇒ Average = $\frac{77}{7} = \$11$.

See simple isn't it! This calculation is sometimes called the **simple average** or arithmetic mean.

The mean is the total of all values divided by the number of all values.

Chickens don't lay eggs exactly to size. Eggs are sold based on an average (mean) weight, which is close to their designated weight in grams.

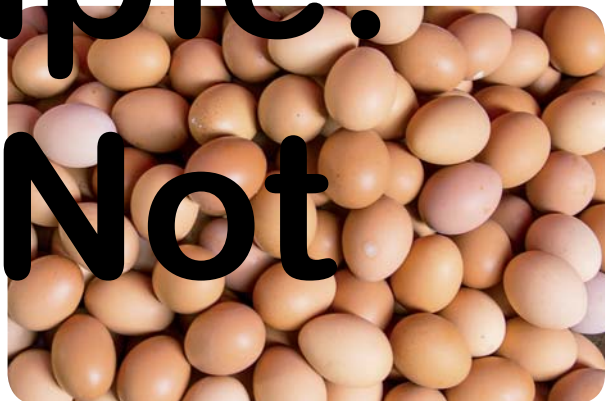


Image: RuddyH/Stock/Thinkstock

Preview
Sample:
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- ⇒ The mean average is called the simple average.
- ⇒ It is calculated by adding the sum of the total values divided by the number of values.

$$\text{mean} = \frac{\text{total of values (sum)}}{\text{number of values (n)}}$$

$$\bar{X} = \frac{\sum X}{X}$$

e.g. Bruce earned \$1,200, \$700, \$350, \$210 and \$450 over each of the last 5 weeks.

$$\text{mean} = \frac{(\text{sum}) \$1,200 + \$700 + \$350 + \$210 + \$450}{n}$$

$$\text{mean} = \frac{\$2,910}{5}$$

$$\text{mean} = \$582 \text{ (earned per week by Bruce over the last 5 weeks.)}$$

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Part A:

The table has data that represents how much each class member of a 20 student VCAL class earned last week from paid employment (rounded to nearest dollar).

1. Calculate the mean income earned from paid employment for the entire class.
2. Calculate the mean income earned from paid employment for all those who worked last week.

20% of the class do not have jobs.

3. Calculate the mean income earned from paid employment for all those employed students who worked last week.
4. Calculate the mean income earned from paid employment for all the students in the class who are employed.

Class members income last week			
\$73	\$45	\$0	\$37
\$124	\$0	\$0	\$76
\$450	\$0	\$0	\$45
\$11	\$9	\$54	\$0
\$0	\$5	\$118	\$175

Preview

Sample: Do Not Copy

Part B:

Collect data from your classmates for their income earned last week and for the last month (4 weeks). In your workbooks complete questions 1-4 above for this data.

5. Describe the income earning patterns of your class.
6. Is there any data that distorts the figures? Explain carefully.
7. You could repeat these tasks for average hours worked per week, and per month.



1.15 Average - Median

Median

Sometimes a simple average might not be the best measure. This could be because of **outliers** (really high or low numbers) that distort the simple (mean) average, especially in small data sets.

Another measure of average is to find out the value that sits in the middle of a set of data. This will give you an idea of where a value sits in a line-up. Just like the class lining from shortest to tallest on school photo day! In this case there will be the same amount of values above and below the median.

So for the example of \$3, \$6, \$9, \$11, \$12, \$16, \$20 the value in the middle is \$11.

⇒ The median price is \$11. (And for this example the median value just happens to be the same as the mean.)

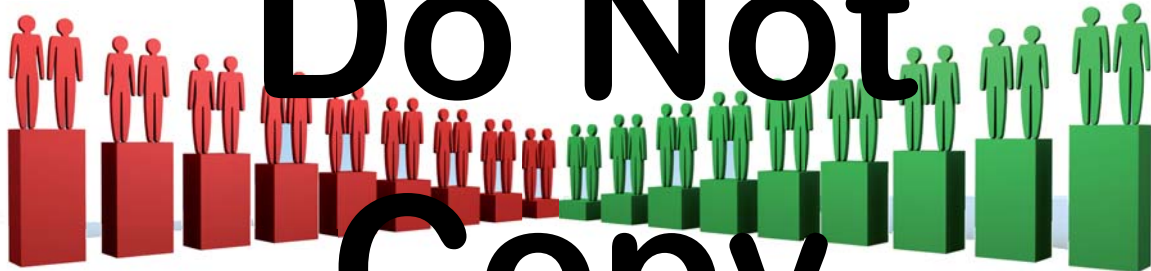
The median is the **midpoint** of a set of values. Median prices are used a lot in real estate, and median is a good measure to find an 'average' when dealing with populations, such as finding median height and weight, median income, and median wealth. Consider these examples.

⇒ The median full-time adult average weekly ordinary time earnings as at June 2018 was \$1,585. This is the figure that sits right in the middle of all 'adult' workers. This is the median average. (ABS, 6244.0).

⇒ The median house price in Melbourne metropolitan area for the June 2018 quarter was \$812,000. (REIV, June 2018).

⇒ The median house price in Victorian regional centres for the June 2018 quarter was \$419,500. (REIV, June 2018).

Image: Stian Iversen/
iStock/Thinkstock



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- ⇒ The median average is used to find the midpoint in a set of data.
- ⇒ The median is the figure that sits exactly in the middle. If the data set is an even number of values, then the median is the simple average of the 2 middle values.
- ⇒ Arrange the data from lowest to highest.
- ⇒ If a data set has 19 values, then the median will be the amount of the 10th value.
- ⇒ If the data set has 20 values, then the median will be the simple average of the amounts for data numbers 10 & 11.

e.g. Bruce earned \$1,200, \$700, \$350, \$210 & \$450 over each of the last 5 weeks.

data = \$210, \$350, \$450, \$700, \$1,200

median = \$450 (Bruce's median income over the last 5 weeks was \$450.)

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Part A:

Rewrite the student income data from the table on p.15 from lowest to highest (ascending order).

Class members income last week									

1. Calculate the median income earned from paid employment for the entire class.
2. Calculate the median income earned from paid employment for all those who worked last week.
- 20% of the class do not have jobs.
3. Calculate the median income earned from paid employment for all those employed students who worked last week.
4. Calculate the median income earned from paid employment for all the students in the class who are employed.

Preview

Sample:

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Part B:

Collect data from your classmates for their income earned last week, and for the last month (4 weeks).

In your workbooks complete questions 1-4 above for this data.

5. Describe the income earning patterns of your class using median.
6. Is there any data that distorts the figures? Explain carefully.
7. You could repeat these tasks for average hours worked per week, and per month.



1.17 Average - Mode

Mode

The mode is the count of the most frequent value. It is useful for finding the value that is occurring most often. As such it is useful for sales and purchasing data, observational data on what types of occurrences are happening; and it can assist in problem-solving (such as the 80-20 rule).

Consider this example.

You want to find out the most likely price you will pay when buying items. If you buy 7 objects priced at \$14, \$14, \$14, \$14, \$14, \$16, and \$111 then the simple mean is \$28.14. (i.e. $\$197/7$).

However, the mode is a measure of the most frequently occurring value. In this example, \$14 comes up five times so the modal average is \$14.

We can say that although the 'average' price is \$28.14 (the mean) the most likely price you will pay is \$14 (the mode). As a simple example this might be the difference between ordering a taxi, as opposed to using Uber, during surge pricing situations, such as on New Year's Eve! Discuss this

Preview

Which colour represents the modal average from these jelly beans?

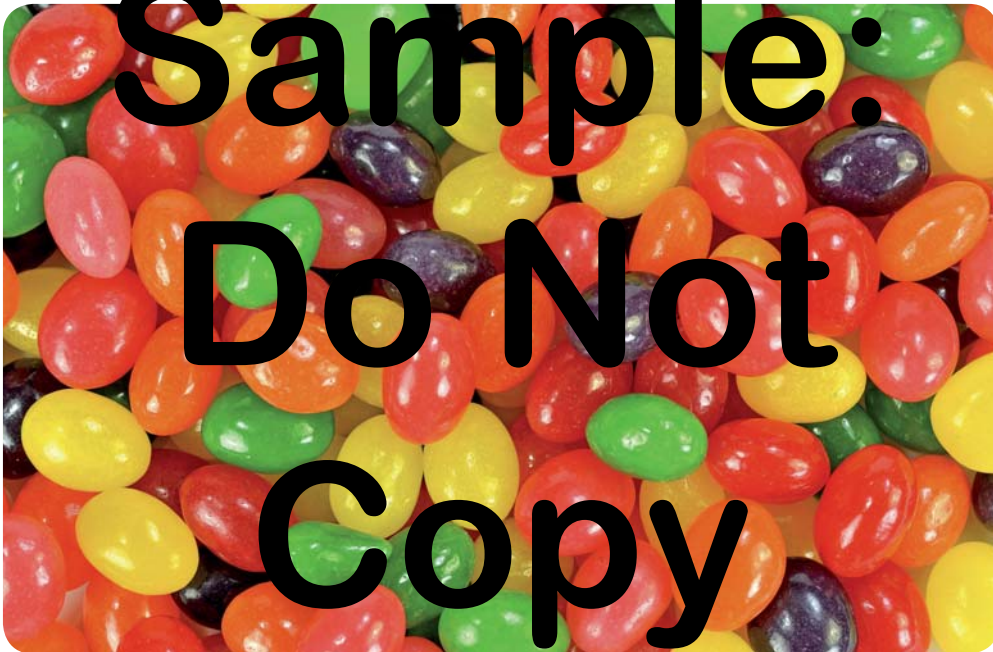


Image:
crispix/
iStock/
Thinkstock

Mode

- ⇒ The modal average is simply the most commonly occurring data value.
- ⇒ To find out the mode you calculate which value occurs most often.
- ⇒ Mode is useful when the spread of numbers is not very high, e.g. student marks on a test out of 20, or average teenage wage/per hour rounded to whole dollars.
- ⇒ Mode is not so useful if the data set is huge and/or so are the amount of possible data values. e.g. Australian households.
- ⇒ However, mode can be good for averages related to action and achievement, such as the modal average of goals Tom Hawkins kicks in a match.

NUM
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Part A:

Rewrite the student income data from the table on p.15 based on a count of the number of times a particular value occurs.

Class members income last week						
/	/	/	/	/	/	/
/	/	/	/	/	/	/

1. Calculate the mode income earned from paid employment for the entire class.
2. Calculate the mode income earned from paid employment for all those who worked last week.

20% of the class do not have jobs.

3. Calculate the mode income earned from paid employment for all those employed students who worked last week.
4. Calculate the mode income earned from paid employment for all the students in the class who are employed.
5. How useful is the modal average measure across these different situations? Explain carefully using evidence.

Preview
Sample:
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Part B:

Collect data from your classmates for their income earned last week and for the last month (4 weeks).

In your workbooks complete questions 1-5 above for this data.

6. Describe the income earning patterns of your class using mode.
7. How useful is mode as an average for these types of measures?
8. You could repeat these tasks for average hours worked per week, and per month.



1.19 Spread and Deviation

Deviation

An average is a good way to get an overall view of a sample of data. But we have to treat some averages with a bit of care in how we apply these to real-life situations.

Some data in the sample might vary widely from the average. So the average is not really indicative of that data. For example:

Wealth of each household on Easy Street							
House 1	House 2	House 3	House 4	House 5	House 6	House 7	House 8
\$ 1.5m	\$2.6m	\$4.5m	\$2.7m	\$0.1m	\$10m	\$1.2m	\$1.4m
Mean average household wealth = $\$24\text{m}/8 = \3m Median average = $\$2.05\text{m}$							

So if we measure the average wealth of each household on Easy Street we can see that only 2 households are above the mean, and 6 are below, with 4 of these well below. So does the mean average show a true picture in this case? And this data also includes one very high outlier and one very low outlier, and these outliers have distorted the mean average.

And you might also find that not one single item of data in the sample equals the average. In fact there might be considerable variation in the actual data from the average. You can see this in the Easy Street example. So the average might not be as representative of a sample as you would expect.

Let's try another example looking at the types of averages and see what we get?

Do you think any of these averages are indicative of the real patterns of the class members?

Distance jogged by class members last 7 days											
Tim	Tom	Jim	Sam	Cat	Nat	Pat	Yat	Rik	Bik	Vik	Zed
2.1km	0	0	7.8km	1.5km	2.5km	0	7.5km	0	0.1km	4.4km	0
Mean distance jogged = $20/12 = 1.67\text{km}$ Median distance jogged = 1.1km Modal average = 0											

Let's take a look at one last set of data. This data set is based on a survey of Year 12 students who are working, reporting the amount of hours they worked in the previous week. Students were asked to use whole numbers only (i.e. to round up or down so as not worry about exact minutes). As this data set is quite large, the results will be more reliable. One other improvement to the data involves excluding students who are not working, as all those zeros could 'skew' the data averages.

Year 12 students hours worked in the previous week											
4	8	5	8	12	16	4	8	6	12	10	4
8	28	8	9	8	4	12	16	18	23	8	8
12	8	12	16	4	9	7	8	9	12	2	5
4	8	12	16	15	11	8	9	20	16	15	8
8	12	10	11	7	6	15	8	9	14	9	18
n = 60 Mean = 10.3 hours Median = 9 hours Mode = 8 hours											

Averages and spread A

1. Use the examples on p.20 to answer these questions



a. Easy Street Mean?	b. Easy Street Median?	c. Easy Street High outlier?	d. Easy Street Low outlier?
e. Explain how useful you think the mean average is for this data set.		f. Explain how useful you think the median average is for this data set.	
g. Take out the outliers from this data set and then calculate the new mean and median averages. Do you think these averages now better represent this data set? Why/why not?			
h. Distance jogged Median?	i. Distance jogged Mode?	j. Distance jogged Outlier?	k. Distance jogged Outliers?
l. Which is a more useful measure of average for this data set, mean median or mode? Why?		m. What is the problem with this data set? How could it be improved to give a better indication of average?	
n. Take out the zeros (non-joggers) and recalculate the new mean and median averages. Do you think these averages now better represent this data set? Why/why not?			
o. Hours worked Mean?	p. Hours worked Median?	q. Hours worked Mode?	r. Hours worked Outliers?
s. Each of the averages give different results. Which would you choose to report on the data? Why so?		t. There are 60 items of data in this data set. Why does that make the averages more useful?	

Preview
Sample:
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1.21 Spread and Deviation

Interquartile range

As you've just learned, at times an average really doesn't give a good indication of the data it measures, especially for data sets with fewer values (i.e. if you're just surveying your class), or for data with wide variation. So we can apply some statistical tools to improve our interpretation of data, especially in relation to **spread** and **deviation**.

The interquartile range is a measure of variability or spread. The interquartile range is used to divide a rank-ordered data set into four equal parts called **quartiles**. A quartile is a **percentile** measure that divides a total of 100% into four equal parts, which of course are 25%, 50%, 75% and 100% (i.e. the data set is quartered!).

For example, a data set of 20 would have 5 items of data in quartile, a data set of 100 would have 25 in each quartile, and a data set of 244 would have 61 items of data in each quartile. Other similar terms include quintile (5 equal sets) and decile (10 equal sets).

Each quartile is the mark (or joining border) between two quarters. Therefore Q_1 occurs at the 25% mark, Q_2 represents the 50% mark, Q_3 is the 75% mark and Q_4 is 100% (all the data). The correct name for the mark (or joining border) is a percentile, i.e. the 25th percentile, the 50th percentile and the 75th percentile.

The **interquartile range** is calculated by taking away the average of all those values that are below the median from the average of all the values that are above the median.

Of course there will be the same number of values both below and above the median for the whole data set. However, the values might have quite a spread or range from that overall median.



$$\text{Interquartile range} = Q_3 - Q_1$$

B Interquartile range



1. Answer the following questions

a. What is a quartile?		b. How many quartiles in a data set 'population'?	
c. At what percentile is Q_1 ?	d. At what percentile is Q_2 ?	e. At what percentile is Q_3 ?	
f. How is the interquartile range calculated?		g. Calculate the interquartile range if: $Q_1 = 17$ $Q_3 = 46$	



2. Each of these statements is likely to be true. Why so?

a. You are likely to be in the lowest quartile in Australia based on income earned.	b. You are likely to be in the highest or 2nd-highest quartile based on time spent using social media.	c. You are likely to be in the second lowest quartile based on hours spent driving.
---	--	---

Vertical jump test														
Abe	Bek	Cec	Dot	Eff	Flo	Gaz	Huw	Ike	Jan	Kha	Laz	Moh		
17cm	35cm	65cm	44cm	55mm	62mm	46cm	59cm	48cm	31cm	61cm	52cm	57cm		
n = 13, mean = 48.6														
Arrange the data in order from lowest to highest														
17	31	35	44	46	48	52	55	57	59	61	62	65		
Find the median (midpoint) = 52 and then split the data into 2 equal sets.														
17	31	35	44	46	48	52	55	57	59	61	62	65		
Calculate the median (midpoint of each of these).														
17	31	35	44	46	48		55	57	59	61	62	65		
(35 + 44) / 2 = 39.5						(59 + 61) / 2 = 60								
Now we can just focus in on the 4 quartile marks, or points.														
17	31	35		44	46	48		55	57	59		61	62	65
<div><div>39.5</div><div>52</div><div>60</div></div>														
<div><div>Q₁</div><div>Q₂</div><div>Q₃</div></div>														
Q ₁ median (midpoint) = 39.5 Overall median = 52 Q ₃ median (midpoint) = 60														
So now instead of just one midpoint average for the entire data set we now have an average Q ₁ for all those values below the median (midpoint) as well as an average Q ₃ for all those values above the median (midpoint).														
The interquartile range is the difference between the median for the third quartile and the median for the first quartile. (Q ₃ - Q ₁) = 60 - 39.5 = 20.5														
So we now have some 'mid' median and then spread' that is under consideration. We have a 'low-end' median of 39.5, a 'high-end' median of 60, and a range of 20.5 between them. We can see that the Q ₃ median is closer to the Q ₂ median than the Q ₁ is. This means that 'higher-end' results show less spread than the 'lower-end' results. Would you expect that on a jump test?														

Preview

Sample.

Do Not

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Applying interquartile spreads

1. In your own words, explain interquartile range.
2. What can interquartile range indicate about a set of data? Use an example.
3. Record a vertical jump test for the class. Work out the median and the interquartile range. What do your results show about the performance of your class?
4. Use a different 'measure' that is not based on physical abilities, such as income earned by students in your class. Would you expect a large or small interquartile range? Why so? Explain why your results show...

Applied

Your mate Poindexter is a bit of a maths wizard (he doesn't do VCAL). He has just started coaching an Under 14 basketball team, the Even Stevens. He has calculated the interquartile range for the team's vertical jump test and is happy that there isn't much spread. He's confident of a good season because he reckons this shows that the team is a pretty even bunch. Do you agree? Why/why not?

The first game against the Lofty Longshanks sees his team get hammered 112 to 34. The next game against the Quanto Quadblasters results in another drubbing. Poindexter is quickly losing his faith in maths. Help him out by explaining that it is not the maths that is the problem, but rather how he is applying the maths; and that perhaps he is 'focusing' on the wrong measure anyway!

1.23 Spread and Deviation

Standard deviation

Another measure of the usefulness of an average calculation is standard deviation. Have a think about the word 'deviation'. Deviation often refers to moving away from something, i.e. deviating off the road when driving.

Standard deviation simply measures how far away from the mean the values in a data set are. If the values are closer to the mean then the average calculation is more valid (or more **robust**). Therefore that mean is a more useful measure because it is more representative of the values in the data set. However, if the values in the data set vary significantly from the mean, then that average is really not that indicative of the values it is supposed to represent.

🧠 As an example, think back to the Easy Street data. Was that mean average really all that indicative of the values it measured?

Wealth of each household on Easy Street							
House 1	House 2	House 3	House 4	House 5	House 6	House 7	House 8
1.5m	\$2.6m	\$4.5m	\$2.7m	\$0.1m	\$10m	\$1.2m	\$1.4m
Mean average household wealth = 3.4m = 3.4							
Calculate standard deviation - Step 1: Subtract the mean from each value and square the result.							
1.5	2.6	4.5	2.7	0.1	10	1.2	1.4
- 3.0	- 3.0	- 3.0	- 3.0	- 3.0	- 3.0	- 3.0	- 3.0
-1.5	- 4	1.5	-0.3	-2.9	7.0	-1.8	-1.6
2.25	0.1	2.25	0.09	8.41	49	3.24	2.56
Calculate standard deviation - Step 2: Calculate the mean of these amounts.							
Mean = 67.76/8 = 8.495 (this is called the variance)							
Calculate standard deviation - Step 3: Take the square root of this number.							
Square root of 8.495 = 2.91							
The standard deviation for this data set (population) is 2.91. This shows us that the values in this data set are quite spread out from the average (mean), because the standard deviation figure is high; and in fact it is quite close to the mean, so the average wealth that was calculated for the households in this data set is not really indicative of each household's wealth. There's a lot of variation.							
e.g. Wealth of each household on Breazy Street							
House 1	House 2	House 3	House 4	House 5	House 6	House 7	House 8
2.5m	\$2.6m	\$4.5m	\$2.7m	\$3.6m	\$4.0m	\$1.7m	\$2.4m
Mean average household wealth = 3.4m = 3.4							
Calculate standard deviation - Step 1: Subtract the mean from each value and square the result.							
2.5	2.6	4.5	2.7	3.6	4	1.7	2.4
-	-	-	-	-	-	-	-
Calculate standard deviation - Step 2: Calculate the mean of these amounts.							
Mean = /8 = 8. (This is called the variance)							
Calculate standard deviation - Step 3: Take the square root of this number.							
Square root of =							
The standard deviation for this data set (population) is This shows us that the values in this data set are...							

Normal distribution

Standard deviation may often be quite high in small data sets (or populations) unless your data values are close to one another. However, as your data set gets larger, standard deviation becomes a more useful tool to measure the accuracy of your median average.

Normal distribution is a measure that shows the distribution of values and the amount of **spread** or '**deviation**' from the **mean**. Normal distribution is particularly useful for large data sets (**populations**) because these will often resemble a 'normal' spread pattern.

Normal distribution can be shown on a histogram plotting all the values to create a curve. On a graph (**bell curve**) showing normal distribution, most values will occur close to the mean. These give the bell its height. Some of the values will of course deviate from the mean. These give the curve its spread.

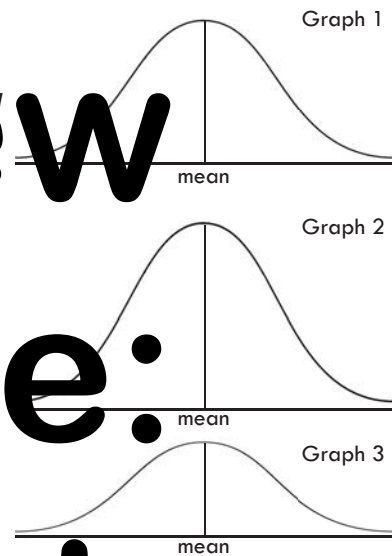
For example, Graph 1 shows this by having most values bunched at the mean and then having fewer values as you get further away from the mean on each side (both lower and higher). This bell curve might represent data values for the height of a population. Most people will be close to the mean with fewer and fewer people as you move further away from the mean on each side.

A normal distribution with a tall curve at the middle (Graph 2) indicates that lots of values are close to the mean and that standard deviation should be relatively small.

A normal distribution with a flatter curve at the middle (Graph 3) indicates that values are more spread out and that standard deviation is likely to be larger.

Normal distribution is good for data related to performance (such as test results and physical achievement), natural characteristics (such as human height) and economic data (such as average income and wealth).

Your teacher will explain more about normal distribution and how this can be applied to spread and deviation.



Standard deviation D

1. Estimate the average height of students in your class. Measure and calculate the mean and median average heights. Based on the data, would you expect a high, moderate or low standard deviation?
2. Calculate the standard deviation. What does this figure indicate about the 'spread' of the results?
3. Repeat this process for the heights of students when sitting down. Would you expect the standard deviation to be higher or lower than their standing heights? Do the calculations and then comment on your results.

Extension

Work with other schools to form a larger (more robust) population and work out the mean and standard deviation of hours worked, and income earned per week, for working VCAL students, and for the student population as a whole.

1.25 Using Formulae

What does X =?

In this section you will investigate the use of formulae to assist you to deal with numerical information and help solve numerical problems.

Now before you go running for the hills and screaming that you don't know how to use formulae, it is good to reflect on the fact that just about every numerical problem that you have solved in your past Numeracy studies is based on the use of formulae. You have successfully completed these tasks using formulaic principles and numerical skills that you have developed over time, and also by using other skills that you naturally possess. It's just that you did this without even realising your strengths in these areas.

We naturally use formulaic principles when we cook, budget, measure objects, run our vehicles, build things, analyse sporting performances and many other tasks.

The Super Skills below will give you an insight into formulae and how you are going to apply these principles.



This image includes a simple formula.
Help Janice out by giving her the answer.



Image: Monkey Business Images/Monkey Business/ Thinkstock

Sample:

Formula for success

- ⇒ Formula = one (singular) whereas formulae (or formulas) = more than one (plural).
- ⇒ A formula expresses a mathematical problem or a relationship.
- ⇒ A formula might use algebraic expressions, symbols, such as X, in place of words or variables. Symbols can confuse and confound, but really all they represent is a short way of writing the variables. E.g. 'Amount of fuel needed to get to Geelong' could be just written as 'F'; for fuel (and not Freddie!).
- ⇒ In computing, such as when using a spreadsheet, formulae can do all the adding, subtracting, averaging and other more complex work for us.
- ⇒ When following recipes for cooking, or mixing chemicals, or brewing beverages we naturally use formula to apply ideal ratios of ingredients or constituents.

So let's have a go.

- ⇒ Remember calculating the mean or simple average? You simply added up all the total values (sum of values) and then divided this by the number (n) of values.

So for a data set of \$3, \$7, \$11, \$12 & \$17 you would add the 5 data values, which equals \$50, and then divide by the number of data values (which is 5) to get an answer of \$10. ($\$50/5 = \10).

mean = sum of values/n

- ⇒ Remember calculating median where the population number was an even number? You had to add the two central values and divide by 2. This would give you a number exactly half way between the two of these. Well the formula for this is:

median = (the middle value before + the middle value after) ÷ 2

- ⇒ So for a data set of 10, you would add the values of data numbers 5 & 6, and then divide by 2, to yield your result.

NUM
SUPER
SKILLS

1. Find out the formulae to calculate each of the following. Some might surprise you.
2. Use appropriate formula to undertake a calculation for each situation. You supply the variables based on realistic situations.



Situation	Formula	Apply the formula
Simple interest rate		
Compound interest rate		
GST to add to a price		
GST already in a price		
Male shoe size based on foot length		
Female shoe size based on foot length		
Fuel economy of a vehicle - city driving		
Fuel economy of a vehicle - country driving		
BMI - Normal person		
BMI - Muscular athlete		
Cat years in 'equivalent' human years		
Dog years in 'equivalent' human years		
Labour participation rate		
Unemployment rate		
Your choice		
Your choice		

Preview
Sample:
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1.27 Using Formulae

Establishing a relationship

Formulae are useful because they allow you to express relationships that show ideal ratios. Once developed we can apply this formula over and over again!

For example, a recipe might call for 3 eggs, 2kg of sugar for every 3 eggs, and 500 grams of butter for every 2 kilos of sugar. So we could express this as follows.

- ⇒ *Recipe = 3 eggs + 2kg sugar + 500g butter (in plain English)*
- ⇒ *or $R = 3E + 2S + 0.5B$ (in simple notation)*
- ⇒ *or $A = 3X + 2Y + 0.5Z$ (in algebraic expressions).*

Which of these notations do you better understand?

(Note: It is important that the person following the recipe knows that the whole numbers for sugar and butter represent 1 kilo!)

So although this formula relates to a recipe we can also use it to plan our shopping budget. For example, (and I'm going to pick the most abstract version):

- ⇒ $A = 3X + 2Y + 0.5Z$
- ⇒ $A = 3(\$1.45c) + 2(\$1.85) + 0.5(\$4.50)$
- ⇒ $A = \$1.35 + \$3.70 + \$2.40$
- ⇒ $A = \$7.45$

⚡ So what is A? What was X? What was Y? And what was Z? Pretty straightforward really!

However, if we go shopping to buy only the ingredients we need and that our total spend looks something more like this:

- ⇒ $A = \$3.30 + \$3.70 + \$2.75$
- ⇒ $A = \$9.75$

⚡ Why is this amount higher? Where is the variation?

Well we had to buy 6 eggs, but we had worked out 45c per egg based on the price of a 12-pack and each egg was actually 55c in a 6 pack. Sugar was right-on for a 1kg bag (\$1.85), but we bought 500g of butter which is dearer per gram than buying a kilo. So how much would the recipe cost now?

- ⇒ $A = \$1.65 + \$3.70 + \$2.75$
- ⇒ $A = \$8.10$
- ⇒ *Recipe = \$1.65 of eggs + \$3.70 of sugar + \$2.75 of butter*

We have 3 eggs left over (which cost 55c each for a total of \$1.65). And this \$1.65 represents the difference between the shopping and the recipe cost.

⚡ And just as a matter of interest what do you think about a recipe that uses 3 eggs, 2kg of sugar and half a kilo of butter? What other ingredients might be needed?



Image: /Thinkstock

Relationship formulae B

1. Calculate using the following formulae. For each try and suggest what the variables might represent.

i. $3X + 2Y$ $X = 2, Y = 4$		
ii. $6X + 6Y + 5Z$ $X = 5, Y = 12, Z = 20$		
iii. $10X + 4Y - 5Z$ $X = 10, Y = 20, Z = 25$		
iv. $3X + 3Y + 5Z + 2X$ $X = 2, Y = 4, Z = 11$		
v. $9X - Y^2 + 4Z + 2Y$ $X = 100, Y = 8, Z = 400$		

2. Develop relationship formulae for the following situations.

3 eggs, 1 kg flour, 1 tbl salt, 300 ml milk.	
4 parts bleach to 1 part water.	
2 cups water for 1st cup of rice, 1.5 cups for each cup of rice thereafter.	
4 screws, 2 brackets, 1 shelf for every timber beam. Required 20 lengths.	
Meal requirement: 40% kj from protein, 40% from carbs and 20% from fats.	
Parking: \$7 per hour first hour, \$5/hour thereafter for 8 hours in total.	

3. Develop appropriate formulae for the following situations.

1 litre fruit smoothie.	1 litre protein shake.
Fruit salad for 8 people.	Scrambled eggs (or tofu) for family of 4.

1.29 Applying Formulae

Solving for X?

Formulae are also very useful problem-solving tools because they can assist you to find out a missing value, variable or quantity. Being able to solve for a missing quantity by transposing a formula based on known variables, can assist you to deal with, and solve, personal and work-related problems much more easily.

- 🧠 For example, Harriut went shopping with \$300 in her pocket. She has come home with \$56.50. How much did she spend? Some of you will work this out straight away using simple subtraction, and say that she must have spent \$243.50. Here's the formula.

$$\Rightarrow X = Y - Z$$

$$\Rightarrow \$ \text{ total spent} = \$ \text{ in pocket at start of shopping} - \$ \text{ in pocket at end of shopping}$$

$$\Rightarrow X = \$300 - \$56.50$$

$$\Rightarrow X = \$243.50$$

That was very easy, so let's step this up a little.

Harriut has the receipt from the supermarket which reads \$122.75 and a receipt from Blandbags which shows \$69.95. She bought a \$30 download card from Insanity Tunes. She also bought some lunch and coffees but she is not sure how much she spent on these. So let's try again.

$$\Rightarrow S = X - (A + B + C)$$

$$\Rightarrow \$ \text{ spent on lunch \& coffee \& download card} = (\$ \text{ total of supermarket receipt} + \$ \text{ total of Blandbags} + \$ \text{ total of Insanity Tunes download})$$

$$\Rightarrow S = \$243.50 - (\$122.75 + \$69.95 + \$30)$$

$$\Rightarrow S = \$243.50 - \$222.70$$

$$\Rightarrow S = \$20.80$$

- 🧠 So Harriut spent \$20.80 on food and drink out of \$243.50. How much is this as a percentage? Is it too much? This example notice how we kept X as the notation because we had worked that out earlier. We then used different letters for the other variables because they are new to the calculation. But we could have just used words or even single letters. Whatever works for you.

Harriut's friend Lombago also likes some retail therapy. But he's a bit OCD and only buys things ending in even amounts. So Lombago bought 4 items at \$10, 6 items at \$20, 3 items at \$30 and 2 items at \$40. He has offered you his formula for his own total spend.

$$\Rightarrow X = 4A + 6B + 3C + 2D$$

$$\Rightarrow X = 4(10) + 6(20) + 3(30) + 2(40)$$

$$\Rightarrow X = \$40 + \$120 + \$90 + \$80$$

$$\Rightarrow X = \$330$$

So Lombago's total spend, that is, his 'X', was \$330.

Because Lombago likes patterns, next week he goes out and buys items of exactly the same dollar amount, but in different quantities.

- 🧠 He presents you this formula: $X = 2A + 12B + 4C + 1D$. Did he spend more or less than last week? And given that he has bought items of the same price (which means the variables are the same, even though the quantity has changed) are you permitted to add the formulae together to get his total fortnight spend?

1. Calculate using the following formulae. For each try and suggest what the variables might represent.

i. $X = 24 + 47 + 123$

ii. $X = 10 + 4 - 2 \times 5$

iii. $X = 76 - 4^2 \times 10$

iv. $X = 27 + 32 + 2Y$
whereby $Y = 2$

2. Develop appropriate formulae for the following situations.

Weekly shopping budget = \$200.
Groceries = \$120, cleaners & toiletries = \$25, fruit & veg = \$55.

Compare timber and change of energy flow rate of \$25 or \$1.50 per minute.
Average car takes 15 minutes.

Describe proportional car running cost per year using at least 3 categories of variables.

Describe the ideal concrete mix for driveway paving. Work out the \$ cost of the concrete based on a 1m² slab.

Jock mows lawns. For a standard lawn he charges a flat rate of \$10 plus either \$25/hour for regulars or \$15/hour for pensioners. Also provide Jock with Excel formulae for his spreadsheet.

If they laid all the hotdogs sold at the AFL Grand Final end-to-end would that stretch to the moon? (Assume they sell 40,000.)

Preview
Sample:
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1.31 Applying Formulae

Shifting things around

Sometimes you might have to shift things around in an equation (based on a formula) in order to find out what you really want to know. This shifting about is called **transposition**.

For example, your friend Rhikkie is a nice guy but he has a funny way with language. But that's no problem, you're used to how he talks. You ask him how he went at cricket last night and he tells you that he scored:

$$\Rightarrow X - 15 = 43$$

So how did he go? While you congratulate him, your other friend Blurtos hasn't got a clue! So we better set him straight.

When solving for 'X' or any other unknown, but that unknown isn't isolated on its own, we have to **transpose** the formula to get it on its own. The rules for transposition are simple. Equations have two sides. What we do to one side we have to do to the other. It's a very even-handed approach. So we want to get the 'X' on its own, that represents Rhikkie's score.

$$\Rightarrow X - 15 = 43$$

$$\Rightarrow X - 15 + 15 = 43 + 15 \text{ (we add 15 to both sides. That'll leave the X on its own on the LHS) which is what we want to do.}$$

$$\Rightarrow X = 58$$

Rhikkie made a half century which is pretty good.

Now Blurtos thinks he has got the hang of this and asks Rhikkie how this score compares to last week. He probably should have done this more carefully, because Rhikkie responds with:

$$\Rightarrow X = 2Y + 18$$

Once again Blurtos is stumped and turns to you for help! Well you know X (it's 58):

$$\Rightarrow 58 = 2Y + 18$$

You can do some transposition to get last week's score, 'Y', on its own:

$$\Rightarrow 58 - 18 = 2Y + 18 - 18 \text{ (this time we have to take 18 away from both sides to get the variables on their own)}$$

$$\Rightarrow 40 = 2Y \text{ (but we are not done yet as we are actually solving for 'Y' this time, which is last week's score)}$$

$$\Rightarrow \frac{40}{2} = \frac{2Y}{2} \text{ (we have to divide both sides by 2 to isolate Y on its own)}$$

$$\Rightarrow 20 = Y$$

So last week he made 20. Would have been easy if he just said that, but in life problems don't solve themselves, that's why you have to do the thinking most of the time!

Blurtos thinks this is all a bit too complex so he goes for a final 'easy' question. "Well Rhikkie what is your lowest score this season. Rhikkie of course, replies obtusely and says:

$$\Rightarrow Z = X^0 - Y^0$$

"Oh well", replies Blurtos "me too, you can't win them all!" So what was Rhikkie's lowest score for the season?



Image: STYLEPICS/
Depositphotos.com

1. Transpose then calculate using the following formulae. For each try and suggest what the variables might represent.

i. $X + 15 = 100$ Solve for X		
ii. $X - 15 = 100$ Solve for X		
iii. $X \times 15 = 150$ Solve for X		
iv. $X / 15 = 15$ Solve for X		
v. $X = 3Y + 20$ $X = 50$, solve for Y		
vi. $2X = 2Y - (50)$ $Y = 275$, solve for X		
vii. $X = 3Y - 3(50)$ $X = 900$, solve for Y		
viii. $X - Y = 2Y + 10,000$ $Y = 20,000$, solve for X		

2. A good way to calculate whether it is worth your while working, based on a particular hourly wage amount, is to use estimation, calculation, comparison and analysis.

e.g. Wage = \$30 (per hour)

Estimate a weekly amount using 40 hours = \$1,200 (per week).

Calculate an annual estimate using 50 weeks = $\$1,200 \times 50 = \$60,000$ (per year).

Compare to average weekly earnings (Australia 2018) about \$82,400 full/time). So $\$60,000 / \$82,400 \times 100\% = 73\%$ of average income.

Analyse this. I'd say that's a pretty good hourly wage. It is about 3/4s of the annual income (wages and salaries) of all full-time workers. This is especially good if you are a young worker receiving \$30/hour.

What about \$10 per hour?	
What about \$40 per hour?	
What about your average wage?	

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Sample:
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1.33 Assessment Task

AT1 Do The Numbers

This task focuses on collecting, analysing and communicating data and information related to the number of hours that each student in your Year 12 cohort worked in the previous week.

However, your teacher might get you to investigate a different data set.

This assessment task has 3 parts. You must complete all of the tasks in each part.

Part A: Collecting, analysing and communicating data

Part B: Communicating data and information

Part C: Dealing with probabilities

Part A: Collecting data

You are required to collect data from your Year 12 cohort about the number of hours each student has worked in the previous week.

Note: If your school is very small then extend this to students from other year levels that are working.

Using this data, you are required to calculate the following:

- ☐ mean
- ☐ median
- ☐ mode
- ☐ interquartile range
- ☐ standard deviation.

Part B: Analysing and communicating data

Use the data you have collected and your calculations, to develop 8-10 clear statements, that use numerical information to analyse this data.

Consider information related to:

- ☐ overall results
 - ☐ patterns
 - ☐ range, average and rate
 - ☐ spread and deviation
 - ☐ possible reasons
 - ☐ possible implications.
- Develop at least 2 graphics to communicate this data (e.g. graphs or diagrams).



Part C: Dealing with probabilities

Based on the data you collected for Part A, calculate the following probabilities. The probability of:

- ☐ a student being employed
- ☐ an employed student getting 'shift'
- ☐ a student working less than 10 hours per week
- ☐ a student working 10 -19 hours/week
- ☐ a student working 20+ hours /week
- ☐ a VCAL student being employed
- ☐ a non-VCAL student being employed.

All of these probabilities need to be expressed in decimals, percentages, fractions and the language of probability, (e.g. 2 in 3 students were employed).

You also need to show at least 2 tree diagrams.

Name:		Project dates:			
Topic:					
Tasks - AT1: Do The Numbers		Re- quired	Due by	Done	Teacher initials
Part A: Collecting data					
Negotiate your topic with your teacher.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Collect your data.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
i. Calculate mean, median and mode.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
ii. Calculate interquartile range	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
iii. Calculate standard deviation	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Part B: Analysing and communicating data					
i. Analyse the data.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
ii. Develop 8+ statements to communicate information.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
iii. Develop 2+ graphs to communicate information.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Part C: Dealing with probabilities					
i. Calculate probabilities.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
ii. Express probabilities in different forms.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
iii. Develop 2+ tree diagrams.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Prepare and present a report					
⇒ Prepare your report.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
⇒ Obtain and respond to feedback. 	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
⇒ Present your report. (If required) 	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Additional information:

Signed: _____

Date: _____

1.35 Numerical Language

When dealing with numerical situations related to **numerical skills and process (S1&2)**, there are key terms and phrases that you are expected to know. List key terms/phrases, provide a definition, and outline how each relates to **personal** and **work-related situations**.

Term/phrase	Definition	Personal application	Work-related application
<p>Preview</p> <p>Sample:</p> <p>Do Not</p> <p>Copy</p>			

Seeing The Numbers 2

Contents

2.01 Data and Information.....	38	2.19 Pie Charts.....	56
2.07 Checksheets.....	44	2.23 Infographics.....	60
2.09 Graphs.....	46	2.25 Data and Graphs in Action.....	62
2.11 Line Graphs.....	48	2.27 Assessment Task.....	64
2.15 Bar Graphs.....	52	2.29 Self-Reflection.....	66

Activities 2: Seeing The Numbers	p.	Due date/Done?	Comment
2.01A Me and data	38	<input type="checkbox"/>	
2.02B Data and information	39	<input type="checkbox"/>	
2.03C Organising data	40-41	<input type="checkbox"/>	
2.05D Grouped data	42	<input type="checkbox"/>	
2.06E Frequency	43	<input type="checkbox"/>	
2.06A Checksheets	45	<input type="checkbox"/>	
2.10A Which graphs	47	<input type="checkbox"/>	
2.12A Line graphs	49-50	<input type="checkbox"/>	
2.14B Line graphs in action	51	<input type="checkbox"/>	
2.16A Bar graphs	53-54	<input type="checkbox"/>	
2.18B Bar graphs in action	55	<input type="checkbox"/>	
2.20A Pie charts	57-58	<input type="checkbox"/>	
2.22B Pie charts in action	59	<input type="checkbox"/>	
2.24A Infographics	61	<input type="checkbox"/>	
2.25A Get up and be active	62	<input type="checkbox"/>	
2.26B Language of data	63	<input type="checkbox"/>	
AT2 Communicating Information	64-65	<input type="checkbox"/>	
2.29 Self-Reflection	66	<input type="checkbox"/>	

Comments:

2.01 Data and Information

Data makes the world go around

We live in a world governed by data. **Data** can be described as all of the measurements, observational records, facts, recordings and other information that can be expressed in numerical or written form and communicated by varied means and media.

Much of our life is governed by digital methods of data collection, sharing and analysis, such as our mobile phone usage data and billing, our banking and financial information, and our **socio-demographic** data, including our personal details, income levels and taxation requirements.

It is important that you are able to understand how data is collected, organised, collated and analysed. Much data is compiled into statistical reports that make it easier to understand, analyse and act upon.

However, not all data is 'digital'. Straightforward uses of data might involve measuring a room to determine the amount of carpet needed, listening to the sound of an engine to pick-up misfires and timing issues, and calculating how much petrol you might use to travel for a person on holiday.

In essence, data is just a set of numbers, or a set of words, or a set of words and numbers that means nothing until a human interprets that data. Otherwise it's just computers and devices exchanging digital binaries with each other, because to a computer, data is just a series of '0's and 1's'.



Image: pinginz/iStock/Thinkstock

A Me and data

Complete the table by giving brief descriptions of the types of data and information you rely on in your personal life and for your work-related responsibilities.

Data/information	Personal examples	Work-related examples
i.		
ii.		
iii.		
iv.		
v.		
vi.		

Consider the 6 sets of data listed in the table below.

1. What is the sample size in each data set?

2. The numbers are right-justified. Why is that important?

3. What do you notice about how each set of data is organised? Are there any patterns?

Data set 1	Data set 2	Data set 3	Data set 4	Data set 5	Data set 6
12	3	8	1	56	85
27	12	8	1	46	98
56	17	56	19	3	56
46	19	46	12	98	27
19	27	32	98	17	17
85	32	27	32	85	3
2	46	3	1	19	46
7	56	17	3	32	32
8	85	12	1	27	12
2	98	3	46	12	19

There are no headings, descriptions nor other information given to accompany the data. Just 6 data sets each with 10 numbers. Data means nothing until we know what the data refers to. This reference must be given in a heading or description.

4. Match these headings to each set of data. Are they all plausible?

- ☐ Student test marks out of 100, listed alphabetically.
- ☐ Number of errors per worker over a month ranked best to worst.
- ☐ Number of cola beverages (375ml) consumed in a month.
- ☐ The age at which people first travelled overseas.
- ☐ Volume of sales of different products per day.
- ☐ Text messages sent by people per day.

2.03 Data and Information

Data

The proper collection, collation and analysis of data is vital in all business-related activities. **Databases** store customer and client information, account transaction histories, as well as many more kinds of data, including **biodata**. A database can be integrated with **spreadsheets** that are set up using **formulae** to help analyse the data. However, data only ever exists for a 'human' to use in some way. This means the data must be organised so that it is easy to read, as well as useful and timely for the purpose for which it was intended.

You may have to organise data for work-related purposes. You might also have to analyse the data to determine what patterns might exist. And of course you might also be called upon to identify potential errors in data entry. The database and the spreadsheet will only function based on the information that they have been set up to collect; or the information that you or someone else, has entered. If there is an error, then once again, a 'human' will have to find it!



You might not believe it, but it wasn't too long ago that most business information and data was captured, processed and stored manually.

Image: Michael Blann/
Digital Vision/Thinkstock

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C Organising data

You are helping out a relative's business and they want you to sort out some of their customer data (p.41). But it's really quite intriguing what data can show you!

Complete the following questions giving evidence to support your answer.



1. Rewrite the customer data in the correct order. How do you decide this?
2. What does 'Days', 'DK' and 'EK' mean?
3. How does the presentation of this information help you analyse it easily?
4. Who is the biggest customer?
5. Which customer is owed money? Why might this be the case?
6. Which customer has had 2 email orders this quarter?
7. Which customers appear to regularly order exactly the same amount?
8. Which customer owes 10% of their annual orders?
9. Which customer still owes money from last quarter and how much?
10. Which are likely to be the oldest and the newest customers?
11. You have a message from a customer's accounts payable clerk saying that their account might be in error and can you check. But no details are given! What might be the error, and which customer are you most likely to call back?
12. Calculate averages for the relevant columns.



Extension: Spreadsheet

Set up a spreadsheet to show this data. Use formulae to calculate averages.

Name	Customer Number	This month \$	This qtr \$	Year-to-date \$	Balance \$	Days
Stoltenberg Inc	145	4,520	4,520	4,520	0	0
Stewart Co.	7	0	0	1,550	0 DR	0
John Stuart	36	1,520	1,760	2,545	1,950 DR	96
Stuart Johns	71	2,000	578	3,650	365 DR	23
Sturat & Johns p/l	14	57	150	3,111	93 CR	14
Stuart, Stewart & John	25	278	556	1,668	278 DR	4
Stotts, S. J.	48	11,250	37,250	45,250	5,625 DR	21
Stew Slotz	103	78	780	7,800	870 DR	86

Name	Customer Number	Last month \$	Last qtr \$	Year-to-date \$	Balance \$	Days
Averages						

1.	
3.	4.
5.	6.
7.	8.
9.	10.
11.	12.

2.05 Data and Information

Data

A lot of data that you, or some other person, organisation or agency collects, arrives as unorganised or ungrouped data. Consider **ungrouped data** as the raw (or primary) information, facts and figures about something.

For example:

- ⇒ a family shopping list and sales receipt (docket)
- ⇒ the weights of players on a football team
- ⇒ customer responses to a satisfaction survey
- ⇒ a record of your times running 5km over an extended period of time.



Image: bloomua/
Depositphotos.com

But in order to make data more useful we often have to organise and collate data so that it can be interpreted and analysed. We can also show organised and collated (i.e. **grouped**) data quite effectively on different graphs, tables, spreadsheets and in other numerical visual formats. Once we organise and collate data then we are more likely to be able to make informed decisions about what to do based on what the data is showing us.

For example:

- ⇒ the shopping list and sales receipt organised into different types of purchases and then collated on week-by-week basis and shown in a spreadsheet
- ⇒ the weights of players can be grouped into a kg range (and shown on a bar graph)
- ⇒ the customer responses to a satisfaction survey being collated and then organised into 'favourable', 'neutral' and 'unfavourable' responses, and then displayed in a pie chart
- ⇒ the record of your times running 5 km sorted into duration brackets with 15 second intervals, with the results being plotted on a line graph over time

Note: Your teacher might use the term 'grouped' data or they might not. But it is important to know the term because you might come across it for descriptions of data in applied or online situations. Either way, we are talking about primary data that has been organised and collated.

D Collating data



Get a hold of your family's most recent shopping receipt from the supermarket.

1. Develop 2 series of categories that you can use to collate (group) the data. These could be type of item, \$ amount, or other categories of your choice.
2. Collate and organise the data into 2 tables so that it is grouped appropriately.
3. Draw 2 pie charts to show the data. Comment on what the data is showing.
4. Use multimedia, or a spreadsheet and computer chart (graph), to organise 1 set of this collated data, and create an appropriate pie chart.
5. Discuss which of the methods for creating the table and pie chart was easier to do - by hand or using multimedia/computer? Which table and chart looked better? Why? Which format was easier to read/interpret? Why?

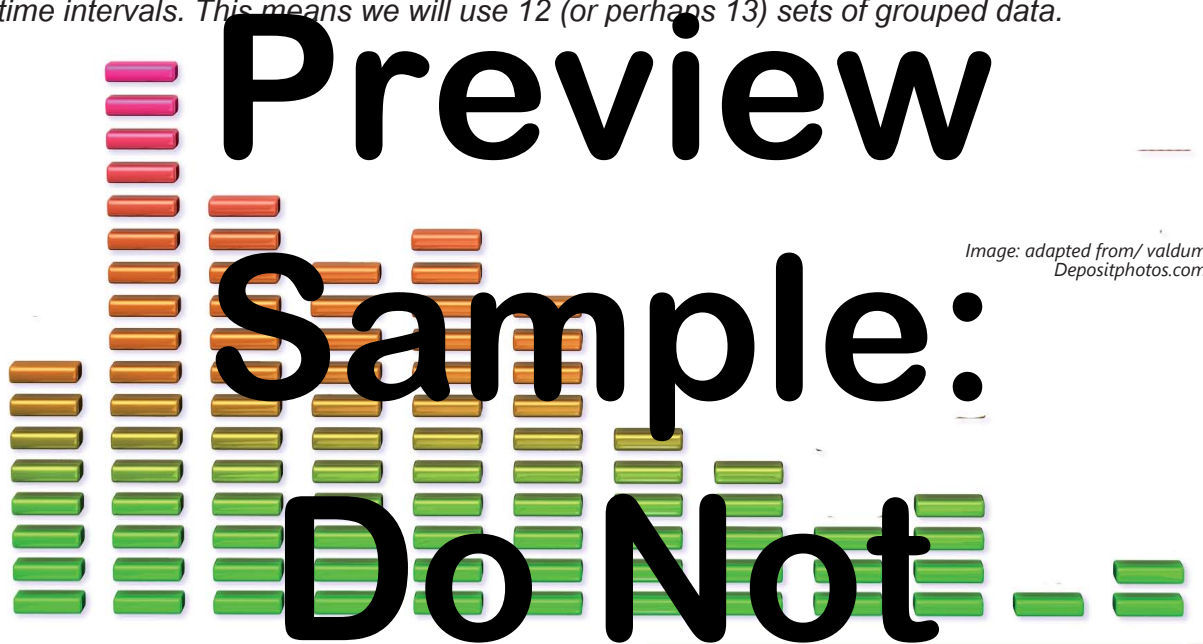


Frequency

One of the advantages of grouping data is that it allows you to collate, organise, display, interpret and analyse the frequency of data. **Frequency** refers to how often something has happened, or how many times a particular data value occurs. Appropriate use of frequency normally requires the collation of data according to a pre-determined range.

For example, if we investigated how long it takes students to travel to school we might get 100s or even 1,000s of data results, each with slightly different values; such as a range from 1 minute 17 seconds for Aaran who lives across the road; all the way up to 1 hour and 53 minutes 23 seconds for Zultina who walks 12 km to school.

So in this situation it might be much more useful to organise the data into 10 minute time intervals. This means we will use 12 (or perhaps 13) sets of grouped data.



Frequency

E

1. Survey your classmates about how long it takes them to get to school. (You'll have to use their estimates)
2. Develop a way to record the data in a table.
3. Develop a method of organising (or grouping) the data (i.e. by time range).
4. Show the grouped data on a properly labelled, hand-drawn bar graph.
5. Comment on the results.

Extension

Use multimedia, or a spreadsheet and computer chart (graph), to organise your collated data, and to create an appropriate bar graph.

Discuss which of the method for creating the table and bar graph was easier to do - by hand or using multimedia/computer? Which table and graph looked better? Why? Which format was easier to read/interpret? Why?

2.07 Checksheets

Checksheets

Checksheets are useful in many personal, work-related and professional situations. For example, checksheets might be used to record:

- ✓ reasons for students coming late to class
- ✓ the number of customers at different times of the day
- ✓ the type of product ordered
- ✓ the reasons for a customer complaint
- ✓ the cause of a technological breakdown
- ✓ the types of motor vehicles using a section of a road
- ✓ the number of public transport passengers alighting at a particular destination
- ✓ the type of meal most ordered.



Image: Daniel Ernst/
iStock/Thinkstock

Preview Sample:

- ⇒ Modern ICT infrastructure collects a lot of data automatically which, means it does the hard work related to information gathering for us.
- ⇒ It then presents this data for the user to interpret.
- ⇒ A manual method of data collection can be done by using checksheets.
- ⇒ A checksheet is a tool that can be used to collect and record observational information.
- ⇒ In order to support effective data collection, recording and then collation, checksheets must be pre-prepared so that they can be quickly and easily used to record information.

Effective checksheets

- ⇒ A space to describe the work task or activity being monitored.
- ⇒ A list of pre-prepared major reasons expected to occur.
- ⇒ A space to record an 'other' and 'all others'. ('All others' should only be a minor component.)
- ⇒ A system for recording occurrences, e.g. a tick.
- ⇒ Columns to show time duration, such as days of the week, or hours of the day.
- ⇒ Columns and rows for easy adding of data and calculation of %'s.
- ⇒ Space to note the person recording the information, the day and date.
- ⇒ Space to record and note any other information that might be important.

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Checksheets							
Work task/activity: Cars parked illegally at Westlakes Primary School							
Other information: none							
Completed by: Aaron Tonto Day: Mon - Fri Dates: 17-21 Aug, 2019							
Reason/factor	Mon	Tue	Wed	Thu	Fri	Total	%
double-parked	17 17	16 16	13 13	18 18	20 20	84	34
cars blocking me	17 17	16 16	13 13	18 18	20 20	57	23
parking in no standing zone	6 6	6 6	6 6	6 6	6 6	30	12
parking in front of driveways	3 3	3 3	2 2	3 3	2 2	13	5
parking too close to corner	4 4	4 4	4 4	3 3	2 2	17	7
other (describe) parking in bus zone	6 6	6 6	6 6	6 6	7 7	31	13
all others together (all different)	4 4	3 3	3 3	3 3	3 3	16	6
Total	50	58	39	46	55	248	100
%	20	23	16	19	22	100	
Information to consider: Someone else is calculating total cars parking.							



You are required to use a checksheet to record some observational data, such as reasons why students arrive late to school, or cars parked illegally at the local primary school pick-up and/or drop-off, or some other relevant topic negotiated with your teacher. You can report your findings to the key stakeholders.

Checksheet										
Task/activity: _____										
Other information: _____										
Completed by: _____ Day: _____ Date: _____										
Time period for each day (duration in hours, etc)										
Reason/factor									Total	%
other (describe)										
all others together										
Total										
%										
Information to consider:										

Preview
Sample:
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2.09 Graphs

Graphs

Graphs are a way of organising and communicating data in a visual form that enables a viewer to more easily interpret and understand the results.

If we have a lot of data covering varied and/or disparate variables then displaying this data in visual form makes it easier to follow. It certainly makes it easier than long lists of numbers in a table, or detailed lists of summary statements using numbers and statistics.

There are many different types of graphs, but the three you are going to focus on are:

- ⇒ line graphs
- ⇒ bar graphs
- ⇒ pie charts.

Preview Sample: Do Not Copy



Image: whilerests/
iStock/Thinkstock

Which graphs A

- Working in pairs, research online and try to identify each of the graphs shown opposite.
- What type of data and information might be best suited to each graph?
- Which of the graphs do you find visually appealing. Why so?



i. _____ b. c.	ii. _____ b. c.	iii. _____ b. c.
vi. _____ b. c.	iv. _____ b. c.	iv. _____ b. c.
vii. _____ b. c.	v. _____ b. c.	ix. _____ b. c.
x. _____ b. c.	xi. _____ b. c.	xii. _____ b. c.

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2.11 Line Graphs

Line graphs

One of the most common ways of representing connected data and numerical information in a visual form is to use a line graph.

Line graphs are generally used to display data that is connected over a particular period of time. Spacing the data along the horizontal axis using a scale establishes the duration of each data point. It also indicates the total **time series** that is being measured.

Plotting the data on the vertical axis using dot points establishes the height of the various measures. This indicates how much was recorded at that point in time.

Joining the dots gives us an easy to read lineal representation of the data.

Line graphs are commonly used to represent:

- ⇒ natural phenomena such as the weather
- ⇒ sales, revenue, expenses and profit amounts over time
- ⇒ records of achievements, such as fitness data, weight gain or loss, strength increases, and other associated measures
- ⇒ patterns in income, savings and wealth levels
- ⇒ comparisons of data (by using more than one line on a graph).



A line graph represents a variable over an extended period of time (time series). It allows for a visual representation of data and can also be used to compare different variables on the same chart. The components of a line graph are:

Horizontal axis (x): Plots the time series

Vertical axis (y): Plots the variable over time

Heading and data labels: Tells the reader what is indicated by the graph

Data line: Shows the data plotted on each point

e.g. Lerry has just started working as a casual in March and plots his bank balance monthly as he is saving for his first car.

By the start of April he had saved \$112, by May \$256, by June \$300, the balance dropped to \$275 in July, but rose to \$425 by August.



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Line graphs A

Effie and Jay started an online business J&F Beauty Emporium 2 years ago selling hair straighteners and other haircare accessories which they import. They sell across platforms, such as eBay, Shopify, through a Facebook shop and also through their own website. Shown opposite are their sales for the last calendar year. They want to expand their business and get a bank overdraft, but their bank manager wants them to supply a graph of their recent sales.

Month	Sales \$
Jan	8,000
Feb	14,000
Mar	7,500
Apr	16,500
May	14,500
Jun	2,500
Jul	5,000
Aug	7,500
Sep	9,500
Oct	12,000
Nov	16,000
Dec	19,500

1. On the next page (or in your workbooks) prepare a properly labelled line graph that shows their sales for the previous calendar year.
2. Describe the line for the graph.

3. Prepare another line graph of the same data showing their average sales on a quarterly basis.
4. Use a computer or tablet to plot the graphs, adding visual effects and print these out. Which was easier to construct? Which format was better? Why?

5. Their bank manager asks them why there is such a discrepancy in their sales levels both on a monthly and quarterly basis. Why do you think this is the case? What could you advise them to help deal with this discrepancy?



2.13 Line Graphs

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sales \$	8,000	14,000	7,500	16,500	14,500	2,500	5,000	7,500	9,500	12,000	16,000	19,500

Preview
Sample:
Do Not
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1. Choose which graph you would most prefer for each of these situations, briefly stating why.
2. Now consider the same graphs, but for a different set of scenarios related to personal financial outcomes.

2. A graph over 5 months of:	Colour	Why so?
Bank balance		Do Not
Income earned		
Total expenditure		
Credit card balance		

3. In your workbooks, or using multimedia, construct a properly labelled time series line graph to illustrate something related to your own personal or financial situation. You might use months, weeks or even days. But you must have at least 12 points to plot.
4. Describe the trend shown by the line. How are you doing; improving or not?

[illegible]

2.15 Bar Graphs

Bar graphs

A common way of representing comparative numerical information in a visual form is through the use of a bar graph.

Bar graphs are generally used to display relative data for a category of different incidence. Plotting the different categories along the horizontal axis using equal spaces allows a comparison to be set out. Bar graphs commonly use different coloured bars to represent each category and use spacing between each bar.

Plotting the height of the data on the vertical axis using a scale establishes the relative size of the data in each category. The height of the bars gives a simple visual comparison of the amount of each data. However, bar graphs can be plotted horizontally, especially if there are a lot of categories to be included on the chart.

Bar graphs are commonly used to represent:

- ⇒ preferences between people, such as the car they drive, or their preferred brand of breakfast cereal
- ⇒ records of incidence, such as reasons for customers complaints, or causes of road accidents
- ⇒ differences between continuous data, such as sales per quarter. (This type of bar graph is actually a histogram and usually no space is left between the bars).

Preview
Sample:
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A bar graph represents a comparison between various categories.

It allows for a visual representation of data and can also be used to compare different variables on the same chart. The components of a bar graph are:

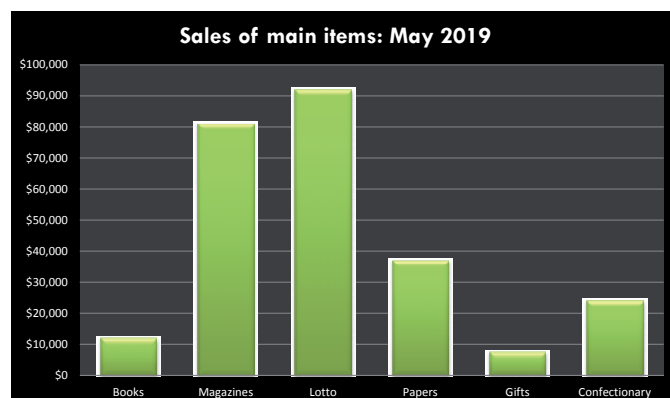
Horizontal axis (x): Plots the categories, usually with spaces between

Vertical axis (y): Plots the incidence, i.e. the count or amount

Heading and data labels: Tell the reader what is indicated by the graph

Bars: Indicate the amount and can be shown using the same, or different, colours.

e.g. The bar graph opposite shows the sales in dollars of the six main items for a newsagency for the month of May 2019.



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Effie and Jay want to focus in on their best performing models so they need to see how sales of their various units are going. They have extracted the information about last year's sales of various models from their spreadsheet.

1. On the next page (or in your workbooks) prepare a properly labelled bar graph that illustrates unit sales for their 6 models of hair straighteners.
2. Describe what the graph indicates.

Model	Units
Flat Chat	11
Bambilino	9
Kurl-Begone	36
Friz-Killer	85
Fuzz-No-More	125
Porta-Delux	72

Preview

3. Use a computer or tablet to plot the graph, adding visual effects, and print these out. Which was easier to construct? Which format was better? Why?



Sample:

4. After looking at the graph Jay explains to the bank manager that they are going to focus marketing efforts into Fuzz-No-More and Friz-Killer. Why might this be a good course of action?

Do Not

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5. The bank manager agrees, "That might be a good start, but we need more information before making the decision." Effie says that she thinks they should focus on Porta-Delux and Kurl-Begone. Explain what type of information the bank manager might want, and also why Effie might (rightly) disagree with Jay.



2.17 Bar Graphs

Model	Units
Flat Chat	11
Bambilino	9
Kurl-Begone	36
Friz-Killer	85
Fuzz-No-More	125
Porta-Delux	72

**Preview
Sample:
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Bar graphs in action B

Glasses filled with liquid are a pretty cool way to construct a 3D bar graph. But once again there are no labels nor a heading. So let's assume the 'bars' correspond to consumption of various items.



Image:
PhotoObjects.net/
PhotoObjects.net/
Thinkstock

1. Choose which 'bar' you would most prefer for each of these situations, briefly stating why. Estimate relative percentages.
2. Now consider the same graph, but for a different set of scenarios related to personal time use.

1. A bar representing weekly: Colour & Volume		
Consumption of fruit juice		
Consumption of water		
Consumption of fizzy drink		
Consumption of tea &/or coffee		

2. A bar representing weekly: Colour & Volume		
Time spent online on screen		
Time spent on school responsibilities		
Time spent working		
Time spent sleeping		

3. In your workbooks, or using multimedia, construct a properly labelled bar graph that accurately represents your use of time (in various categories) over a normal school week. Do the same for your use of time on a 'school holiday' week. They could even be plotted on the same set of axes.
4. Describe the patterns shown by the graph(s). How well are you spending your time?

2.19 Pie Charts

Pie charts

Pie charts are a very effective way of visually showing numerical information that represents relative proportions of a whole.

Essentially the pie represents the whole and each segment or slice of the pie represents a part of that pie. Segments will usually be different sizes, unless the data is exact for each proportion. The size of the segment will correspond to the proportion (the % of the total). Segments will also be coloured which helps the viewer to easily identify each segment.

Pie charts are useful to show survey information based on closed questions and preferential ranking questions (such as 'very high', 'high', etc.).

When constructing a pie chart it is important not to have too many segments, otherwise it will be hard to make sense of the data. This might mean you will need an 'other' category to 'catch' all the smaller or less frequent amounts.

Pie charts might work in conjunction with bar graphs. The bar graph shows the incidence, i.e. how many, whereas the pie segments indicate the relative proportion. Both visuals might suit different users.

Pie charts are commonly used to represent:

- ⇒ proportional spending patterns of an individual (or a group as a whole)
- ⇒ sources of income for an individual (or a group as a whole)
- ⇒ allocation of time between various tasks
- ⇒ preferences, likes or dislikes for a group, such as the football team they support
- ⇒ demographic information, such as country of birth, or type of residence/dwelling, or participation in recreational activities.



Image: vetkit/istockphoto

Pie charts

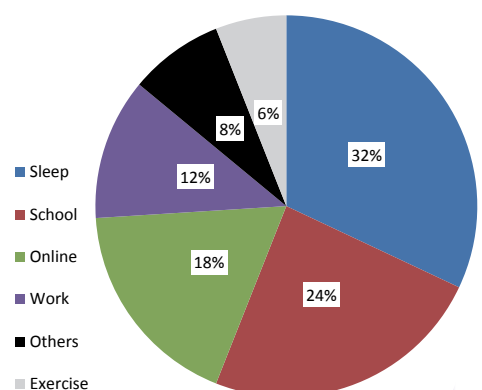
Time spent weekly on different activities

A pie chart is a graphical representation of the relative size of different factors shown by pie segments of a proportional size.

We can quickly see the difference between variables shown by the size (or area) of the pie segments.

The chart should include the segments, a legend, data values (or %'s) and a heading.

Shown opposite is a pie chart that shows the proportional time spend on different activities (measured weekly) by a 'fictional' young person.



NUM
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Pie charts A

Effie and Jay have some information from their online analytical data. They have found out about:

- ⇒ gender of visitor
- ⇒ gender of purchasers
- ⇒ age of visitors
- ⇒ age of purchasers.

Visitors		Purchasers	
Female	63	Female	44
Male	26	Male	42
Other	4	Other	3
Neither	7	Neither	11

Visitors		Purchasers	
<18	6	<18	1
18-24	22	18-24	35
25-34	19	25-34	24
35-44	15	35-44	9
45-54	13	45-54	9
55-64	8	55-64	4
65+	5	65+	12
Unknown	12	Unknown	6

- On the next page (or in your workbooks) prepare properly labelled pie charts to illustrate the demographic characteristics of your visitors and purchasers.
- Describe in words what each graph indicates.

- Use a computer or tablet to plot the graphs, adding visual effects, and print these out. Which was easier to construct? Which format was better? Why?
- Effie and Jay are in disagreement about the data. Effie says they should focus on marketing to females because that's who is hitting their sites more often. But Jay says that males are actually doing a lot of buying even though they visit less often. Jay also thinks there might be a big market for older people, potentially males, whereas Effie says that they should really focus more on younger females as that age group results in a lot of sales. What do you think?



2.21 Pie Charts

Preview
Sample:
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Visitors	%
Female	63
Male	26
Other	4
Neither	7

Purchasers	%
Female	44
Male	42
Other	3
Neither	11

Visitors	%
<18	6
18-24	22
25-34	19
35-44	15
45-54	13
55-64	8
65+	5
Unknown	12

Purchasers	%
<18	1
18-24	35
25-34	24
35-44	9
45-54	9
55-64	4
65+	12
Unknown	6

Pie charts in action B

3D pie charts look pretty effective, just like this one. But once again there are no labels nor a heading! So let's assume that the pie corresponds to daily dietary preferences.



Image: scanrail/iStock/Thinkstock

1. Choose which segment you would most prefer for each of these situations, briefly stating why. Estimate relative percentages.
2. Now consider the same graph, but for a scenario related to the relative proportion of the methods that you use to 'contact' your friends outside of school hours.

Preview
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1. A segment representing	Colour & %	Why so?
Daily proportion of meat, eggs, tofu and meat substitute servings		
Daily proportion of fruit servings		
Daily proportion of vegetable and legume/bean servings		
Daily proportion of bread and grain servings		
Daily proportion of dairy and dairy alternative servings		

2. A segment representing	Colour & %	Why so?
SMS & MMS text messaging		
Phone calls		
Social media PMs and online chat platforms		
Social media public posts		
Face-to-face		

3. In your workbooks, or using multimedia, construct a properly labelled pie chart that accurately represents your weekly consumption of the 5 food groups.
4. Describe your eating pattern as represented by the pie segments. How well are you doing compared to Australian recommended dietary guidelines?



PDS



2.23 Infographics

Infographics

An infographic is a pictorial way of representing data and information using a combination of:

- ⇒ words (describing the data and information)
- ⇒ numbers and percentages (presenting the statistics or observational data), and
- ⇒ images (pictures, symbols and pictograms presenting the information, the data or a combination of both).

Infographics are usually prepared using digital design software and specialised apps. The aim of an infographic is to use design elements to communicate both linked and varied numerical data and information.

Infographics present well as posters or digital pages, hence they are increasingly being used to communicate information across digital platforms.

Infographics draw heavily on the use of pictograms, which have been around since pre-historic times.

Essentially **pictograms** are just common symbols that we can easily and readily associate with an object or concept, such as a human form, male and female gendered figures, representation of common objects or items, and other signs and symbols.



Image: Askold Pankov / iStockphoto

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- ⇒ In the 'old days' numerical information could be communicated using simple 2D graphs with clear headings, labels and data shown in visual form. The graph might have been supported with a few simple text statements to emphasise the key points.
- ⇒ Nowadays we see the growing use of infographics incorporating pictograms developed by graphic and digital designers using specialised software, apps and even animation programs.
- ⇒ Although infographics take longer to 'build' they do present numerical data and information in a way that is visually stimulating, by using representational images (pictograms) and relevant text.
- ⇒ Because infographics engage the viewer they are designed to be read on digital devices and can incorporate animation and break-out boxes.
- ⇒ So which do you prefer, old-style 'straightforward' graphs, or new-style 'digitally-designed' infographics using pictograms?

Complete the table below based on each example of information.

1. Reflect on how you might illustrate this information in an infographic.
2. Draw or source images that might suit an infographic. In your workbooks or using multimedia, develop brief infographic elements to represent each of the examples of information. Research infographics online for examples and models.
3. Research how accurate these examples are. Are they made up, or do they seem plausible, or even quite valid?
4. Do you prefer infographics as communication tool? Why/why not?

Imagery: Use of pictograms, symbols and signs to substitute and/or reinforce 'text'.		
e.g. 7 out of 10 adults who participate in the labour force. McDonald's operates in 119 countries worldwide. The environment, health care and education are reported as being 3 key areas of concern that influence...	What symbols would you use/why?	Graphical example(s)
Scale: Use of multiple and repeated symbols, scaled-size symbols and 'volume' symbols.		
e.g. Australian families have average of 2.6 children An African elephant is approximately 50% larger than an Asiatic elephant. A person's average annual consumption of refined sugar would fill 7.5 wheelbarrows.	What symbols would you use/why?	Graphical example(s)
Ratios: Use of figures as images to represent, compare and contrast information.		
e.g. 70% of people prefer Pepsi Max over Coke Zero. 9 out of 10 Honda Jazz owners are female. 14 out of every 100 young people aged 15-24 are officially designated as being unemployed.	What symbols would you use/why?	Graphical example(s)

Preview
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2.25 Data and Graphs in Action

C Get up and be active



Our culture, our lifestyle, our work patterns and the types of jobs we do are encouraging more of a sedentary lifestyle. Quite simply, we don't move enough! This is leading to reduced fitness levels, personal and work-related weight gain and obesity, and other health risks.

1. Calculate your travel kms per day for each of these four modes of transport.

Mode	Your calculation	What does that indicate?
Your travel kms daily: Private transport.		
Your travel kms daily: Public transport.		
Your travel kms daily: Walking (or wheeling).		
Your travel kms daily: Self-propelled vehicles e.g. bike, skating, rowing.		

A strategy to counter this problem is to try and walk 10,000 steps throughout a day. But how much is that in distance and in time? And how many kilocalories would that burn? And do you do enough?

2. Calculate your average stride length and then estimate the distance that 10,000 steps would be? How long would that take (i.e. what is your average walking pace?). How much energy would that burn?

Stop it right there!

An average sized person has a stride of about 70cm. Tall or shorter people, those with longer or shorter legs and others with mobility issues will vary from this. People tend to take longer strides when walking faster. People take smaller strides if there is more human traffic to deal with.

A brisk walk is 5-7kmh. A stroll is about 3-4kmh (i.e. the phone walk). Young people doing the 'Year 12 Shuffle' rarely stride out and often walk really slowly!



3. A very popular device on the market aimed at helping us improve our fitness and health is a fit tracker. As a class discuss the costs and benefits of this device.

Language of data B

When dealing with numerical skills related to **data** and **graphs** there are a number of key terms and phrases that you might hear and be expected to know. Provide a definition for each and briefly outline why you need to know this or how this could relate to **personal situations**, and how you might be expected to know or use this term in **work-related examples**. Add 3 terms of your own.

Term/phrase	Definition	Personal application	Work-related application
data			
collation			
alphabetise			
tabulate			
graph			
axis			
plot point			
time series			
data line			
proportional			
pictogram			

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2.27 Assessment Task

AT2 Communicating Information

Overview

You are required to research, analyse and communicate data and numerical information based on a topic negotiated with your teacher. This topic might be something you have investigated for Literacy (a social issue), PDS (e.g. health and wellbeing), or even WRS (industry trends). Alternatively, it might be something you have already investigated in this unit (such as for **AT1**). You can choose from 2 alternative types of tasks.



LIT
PDS
WRS

- ☐ Draft, design and develop an **infographic** based on a topic or issue negotiated with your teacher. Present your information to your class.
- ☐ Develop a **summary report** using explanations, numbers, graphs, statistics and other relevant numerical data and information based on a topic or issue negotiated with your teacher. Present your information to your class.

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Infographic

Develop an infographic based on a topic or issue negotiated with your teacher.

The infographic should include:

- ☐ words (used sparingly)
- ☐ pictures (used appropriately)
- ☐ symbols (used representationaly)
- ☐ numbers (used accurately)
- ☐ statistics (if/where relevant)
- ☐ graphs (at least 2 different)
- ☐ your sources of information.

You should use ICT and multimedia to construct this unless you have good design and drafting skills yourself.

You will then be required to present your infographic to the class, along with an explanation of the information that it depicts.

Your classmates will give you feedback on how well you did at communicating numerical data and information.

Summary report

Develop a report that summarises numerical data and information based on a topic or issue negotiated with your teacher.

- The report must include:
- ☐ summary text
 - ☐ numbers (used accurately)
 - ☐ statistics (if/where relevant)

graphs (at least 2 different)

your sources of information.

You should strongly consider using ICT and multimedia to construct your report for final submission.

You will then be required to present your report to the class, along with an explanation of the information that it includes.

Your classmates will give you feedback on how well you did at communicating numerical data and information.

Topic ideas and other information, notes, key dates, etc..

Name:	Project dates:			
Topic:				
Tasks - AT2: Communicating Information	Re- quired	Due by	Done	Teacher initials
Stage 1: Drafting and design				
i. Negotiate your topic.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
ii. Collect relevant information.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
iii. Determine suitable picture, symbols and images.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
iv. Determine appropriate graphs.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
⇒ Meet with teacher to discuss progress and drafts.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Stage 2: Preparing your infographic or report				
i. Collate and organise your information and statistics.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
ii. Prepare suitable graphs.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
iii. Analyse your statistics and information.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
iv. Summarise your statistics and information.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
v. Draft your infographic or report.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
⇒ Meet with teacher to discuss progress and drafts	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Stage 3: Prepare and present a report.				
⇒ Prepare your report.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
⇒ Present your report.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
⇒ Obtain and respond to feedback.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Additional information:				
Signed: _____		Date: _____		

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2.29 Self-Reflection

Self-Reflection Pro-Forma

Which numeracy skills did I develop during this unit?

→ _____

→ _____

→ _____

How have the skills of numeracy helped improve my personal life?

→ _____

→ _____

How have the skills of numeracy helped my development of work-related skills?

→ _____

→ _____

How would I rate my performance (use a circle) in developing my numeracy skills this unit?

0 not shown	1 low	2 reasonable	3 good	4 very good	5 excellent
----------------	----------	-----------------	-----------	----------------	----------------

What were my strongest areas of performance and what should I work on improving?

My strongest topics/skills were	But need to improve my skills in:

Signed: _____ Date: _____

Teacher initials: _____ Date: _____

Dealing With Money 3

Contents

3.01 Working With Money	68	3.13 Comparing Prices	80
3.05 Fractions, Decimals & Ratios ..	72	3.17 Converting Currencies	84
3.09 Discounts	76	3.21 Assessment Task.....	88
3.11 Calculating Change	78		

Activities 3: Dealing With Money	p.	Due date/Done?	Comment
3.01A Money and me	68		
3.02B Working with money	69		
3.03D Percentage	70		
3.04D Percentage change	71		
3.05A Fractions and decimals	72		
3.06B Calculating fractions & decimals	73		
3.08C Ratios	75		
3.10A Discounts	77		
3.11A Making change	78		
3.12B Making change II	79		
3.14A Compare the basket	81		
3.16B Basket case	83		
3.19A Converting currency	86-87		
AT3 Dealing With Money	88		
3.23 Numerical Language	90		

Comments:

3.01 Working With Money

Calculating with money

One of the most important suites of applied numerical skills you need is to be able to perform calculations involving money.

Effective **money management** is vital for your personal life. This involves buying goods and services, budgeting, comparing discounts, evaluating different purchasing options, saving for your future, analysing varied credit options, and many other money management tasks.

As your **personal life** crosses over into your **work life**, money management requires you to interpret timesheets, pay slips, bank statements and other financial documents including bills, bills and more bills!

You will also be required to apply these skills directly in **work-related situations** as part of your **job**, whether that be in retail, trades, community services, manufacturing, personal services, or hundreds of other delivery industry settings and demanding work roles.

So be ready to **apply** the varied skills that you developed in Sections 1&2, as well as those you have picked up through your **educational** and **work experience** to improve your own money management skills.



Preview
Sample:

Image: rukanoga/
Fotostripphotos.com

"It's not hammers I worry about anymore,
instead it's those too-easy scanners
and tech scammers."

A Money and me



Briefly describe situations when you have to perform each of these types of numerical calculations involving money.

a. Adding	b. Subtracting
c. Multiplying	d. Dividing
e. Estimating	f. Budgeting
g. Calculating percentages	h. Discounting

1. Complete these calculations based on money in your head or on paper. Then check your answers using a calculator.

a. $\$5.50 + \$7.95 + \$27.95 =$	b. $\$18.50 - \$9.99 + \$49.95 =$	c. $\$7.50 \times 500 =$
d. $\$20 \times 45 - \$150 =$	e. $\$750 - \$7 \times \$42 =$	f. $\$2,500 / 15 + 10\% =$
g. half a dollar $\times 2,950 =$	h. $-\$1.50 \times 1,000 =$	i. $10\% \times 100 \text{ less } 15\% \text{ tax} =$
j. $\$65\text{m} \times \$7\text{m} - \$42\text{m} =$	k. $\$7.8 \times 100 \text{ plus } \$100\text{m} =$	l. $\$10 \text{ a week averaged over } 4 \text{ years.}$

2. Describe money situations you have to deal with in your personal or work-related activities by writing these in short numerical form (with just a few words for description). Complete any appropriate calculation for them.

e.g. Wages earned last week $\$12 \times 15 = \180	e.g. Spending on each day of week $\$5.70 + \$7 + \$7.50 + \$6 + \$15 = \41.20	e.g. My mobile bill/week & pa. $\$40 \div 4 = \10 $\$10 \times 52 = \520
a.	b.	c.
d.	e.	f.
g.	h.	i.

3.03 Working With Money

Percentages

One of the most common types of calculations you are likely to have to do with money is to calculate a percentage. Remember that a percentage is just another way of representing a **proportion** (half) or a **fraction** ($\frac{1}{2}$) of something. Our monetary system is based on a decimal currency. 100 cents = \$1. This means that proportional amounts of money are very easily converted into percentages, (i.e. 'a half' or ' $\frac{1}{2}$ ' is '50%'. So half a dollar = 50%, which is of course is 50c).

At this level of your studies you are expected to be able to do more complex percentage calculations that are likely to involve a number of steps. These could relate to retail discounts, margins (or mark-ups), trade (wholesale pricing), income amounts, bank interest rates, interest rates on credit products (such as credit cards and personal loans), calculation of rates and ratios (such as fuel costs), and many more personal and work situations.

Image:
Vasyl Yakobchuk/
Thinkstock



Preview

Estimating percentages

- ⇒ There is a quick and easy way to estimate percentages. This is good if you have to think quickly 'on your feet'. Use the 10% rule.
- ⇒ What's 10% of 100? 10% of \$286? 10% of 7,500? Not too hard.
- ⇒ Now if you have to work out 5% then halve your 10s answer. 20% then double your 10s answer? 30% then triple your 10s answer. Or 75% then $\frac{3}{4}$ of your 10s answer.
- ⇒ So the trick is to work out the easy percentage - which is 10% - and then double, or halve or use whatever ratio you need to estimate the percentage you are after.
- ⇒ Have a go: 5% of 1,000, 20% of 75, 30% of 1,200 and 2.5% of 160?

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C Percentages

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Calculate these amounts in your head or on paper. Check answers with a calculator.

a. 75% of \$500 =	b. \$10,000 x 25% =	c. \$40,000 - 25% =
d. $10 \times \$50 + 20\% \text{ of } \$150 =$	e. $\$6,000 - 50\% + 22.5\% \text{ of } \$1,000 =$	f. $250 \times 10\% + 1,500 \times 15\% \times (40/10) =$
g. $\$75 \times 15\% \times 25 =$	h. $\$190 - 40\% \times \$500 - (5\%) =$	i. $\$64,000 \div 20 \times 20\% - \$50 =$
j. $\$100 - 100\% =$	k. $\$100 + 100\% =$	l. $\$100 \times 100\% =$
		m. $\$1000 / 100\% =$

Percentage change

Percentage change is one of the common and useful calculations you might need to do when dealing with money in personal or work-related stations.

Percentage change allows us to measure whether quantities or amounts are growing or reducing. By using a percentage change calculation we can make better comparisons between amounts of different sizes.

For example:

Gronk has been lifting weights for many years. Over the last 3 months he has increased his best squat by 30kg from 100kg to 130kg.

Myron is quite new to working out. In the last 3 months he has increased his best squat by 15kg from 30kg to 45kg.

Gronk says that he has made better strength gains, twice as good, than Myron. But Myron doesn't necessarily agree. What do you think?



Preview Sample: Do Not Copy

- Percentage change measures how much a quantity or number has grown or reduced over a given period of time.
- It is calculated by finding out how much the amount has changed by, and then comparing this to the original amount. The answer is then multiplied by 100% to express the answer in % terms to enable better comparisons.

$$\% \text{ change} = \frac{\text{end value} - \text{start value}}{\text{start value}} \times 100\%$$

e.g. Based on Gronk and Myron's best squat gain, Gronk's best squat 3 months ago was 100kg and Myron's best 3 months ago was 30kg.

$$\begin{aligned} \text{Gronk's \% change} &= \frac{130\text{kg} - 100\text{kg}}{100\text{kg}} \times 100\% \\ &= \frac{30}{100} \times 100\% \\ &= 30\% \end{aligned} \quad \begin{aligned} \text{Myron's \% change} &= \frac{45\text{kg} - 30\text{kg}}{30\text{kg}} \times 100\% \\ &= \frac{15}{30} \times 100\% \\ &= 50\% \end{aligned}$$

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Percentage change D

Calculate the % change for each of these situations.

a. Sales Year 1 = \$40,000 Sales Year 2 = \$60,000	b. 2018 wage: \$18/hr 2017 wage: \$12/hr	c. Height age 12: 140cm Height age 18: 200cm
d. Profit 2020: \$125,000 Profit 2019: \$105,000	e. House value 2018: \$850,000 House value 2020: \$775,000	f. 2,000m time trial March: 9:57 2,000m time trial June: 9:32

3.05 Fractions, Decimals & Ratios

Fractions

You already know that a fraction represents a part or a portion of a whole number. Essentially a fraction divides the top number (**numerator**) by the bottom number (the **denominator**).

For example:

⇒ A cake cut equally in two portions = $\frac{1}{2}$ a cake + $\frac{1}{2}$ a cake.

If you eat one of these portions you have eaten $\frac{1}{2}$ of the cake. And 1 divided by 2 = $\frac{1}{2}$. (Or, "how many 2s go into 1: a half!") Then if you cut the other half equally you have 2 quarters. Eat one of those and you have now consumed $\frac{3}{4}$ s and have $\frac{1}{4}$ left.

⇒ 75 cents = 3 quarters of a dollar or $\frac{3}{4}$.

⇒ A pizza sliced into 8 portions = $8 \times \frac{1}{8}$. Each slice is $\frac{1}{8}$.

A **proper fraction** is one where the number on top (**numerator**) is less than the number on the bottom (**denominator**). This means that the number represented by the fraction will always be less than 1. (e.g. $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{5}$, $\frac{1}{3}$, $\frac{5}{6}$, $\frac{7}{10}$, $\frac{19}{20}$ and so on. In money terms this can be related to how many cents in a dollar ($50c = \frac{1}{2}$ of dollar); which is of course 50%!

An **improper fraction** is one where the number on top (**numerator**) is more than the number on the bottom (**denominator**). This means that the number represented by the fraction will always be more than 1. (e.g. $\frac{3}{2}$, $\frac{4}{3}$, $\frac{5}{4}$, $\frac{7}{2}$, $\frac{11}{3}$, $\frac{27}{4}$ and so on. In money terms this relates to converting cents into dollars ($150c = \frac{3}{2}$ of dollar). This can also be used for rounding and for comparing big numbers, such as \$1,487,000m, which is 1 and $\frac{1}{2}$ million (after rounding).

Decimals

A decimal is another way of representing a fraction. Decimals are based on our number system which uses the powers of 10s (i.e. 1, 10, 100, 1,000, 0.1, 0.001, 0.0001).

Some numbers include a decimal point. These represent a whole number, such as 9, plus a fraction of a whole number, such as 0.95. Written together this will be 9.95 (or 9 and nineteen twentieths).

For really accurate numbers (such as in medicine, pharmacy and other technical and scientific areas, decimals might go up to the hundred (i.e. 2 numbers after the decimal point; 0.01); or even to the thousandth (i.e. 3 numbers after the decimal point 0.001). Numbers to 2 decimal points are important when dealing with money (i.e. dollars and cents); and when converting measurements, such as m, cm, mm, tonne, kg and grams.



Image: ArturVerkhovetskiy
Depositphotos.com

Preview
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A Fractions and decimals

Calculate to express each of these fractions as a decimal or vice versa.

$\frac{1}{4}$	$\frac{11}{3}$		$\frac{9}{10}$		$\frac{3}{2}$	$\frac{2}{3}$		$\frac{7}{2}$	$\frac{27}{4}$		$\frac{5}{7}$		$\frac{7}{10}$	
0.25		2.50		0.50			1.33			0.60		1.25		0.95

Fractions: Addition and subtraction

If the fractions have the same bottom number (**denominator**) then simply add or subtract the top numbers (**numerator**).

e.g. $\frac{1}{5} + \frac{3}{5} = \frac{4}{5} = 0.8$ e.g. $\frac{5}{8} - \frac{3}{8} = \frac{2}{8} = \frac{1}{4}$ e.g. $\frac{9}{2} + \frac{6}{2} - \frac{3}{2} = \frac{15}{2} - \frac{3}{2} = \frac{12}{2} = 6$

But, if the fractions have the different bottom numbers (**denominators**) then you will have to find the lowest common **denominator** (or lowest common multiple). After this you can then add or subtract the top numbers.

e.g. $\frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$ e.g. $\frac{3}{2} + \frac{2}{4} - \frac{1}{8} = \frac{6}{4} + \frac{2}{4} - \frac{1}{8}$
 $= \frac{12}{8} + \frac{4}{8} - \frac{1}{8}$
 $= \frac{15}{8} = 1 \frac{7}{8} \text{ or } 1.875$

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Fraction Multiplication and division

Multiplication

1. Multiply the top numbers (numerators).
2. Multiply the bottom numbers (denominators).
3. Then if possible, simplify the fraction.

e.g. $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$ e.g. $\frac{4}{5} \times \frac{3}{2} = \frac{12}{10} = \frac{6}{5} = 1 \frac{1}{5}$ e.g. $\frac{1}{5} \times \frac{3}{2} = \frac{3}{10}$
 $\frac{2}{10} = 2 \frac{1}{10}$

Division

Now this is a bit trickier, but follow these steps.

1. Invert all the fractions to the right of the first fraction (or whole number).
2. Then multiply (yes multiply) the top numbers (numerators).
3. Then multiply (yes multiply) the bottom numbers (denominators).
4. Then if possible, simplify the fraction.

$\frac{4}{5} \div \frac{2}{5} = \frac{4}{5} \times \frac{5}{2} = \frac{20}{10} = \frac{4}{2} = 2$

Step

Steps 2 & 3

Step 4

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Calculating fractions & decimals B

In your workbooks complete the following calculations showing your workings.

a. $1/2 + 0.5 + 50\% =$	b. $3/7 \times 9/7 =$	c. $0.25 \times 3/2 =$	d. $1/4 \times 0.75 =$
e. $4/5 \div 5/4 =$	f. one 8th of a billion =	g. $46.5 \times 7/4 - 20/2 =$	h. $0.5 \div 1.5 \times 5/2 =$

3.07 Fractions, Decimals & Ratios

Proportions and ratios

A **proportion** refers to an amount of something as compared to the total amount. Proportions are often measured in percentages, decimals or fractions.

e.g. What proportion of her weekly pay did Vonda spend? She spent \$233 out of \$466, which is $\frac{1}{2}$ or 0.50 or 50%. That's not too bad really, Vonda has shown some financial discipline and can save her money for the future. Her mate Benny spent all of his \$66 pay. That's 100%.

Proportions can also be expressed as ratios. A ratio shows one quantity as expressed in relation to another.

e.g. A cake you are baking requires 0.25 kg of sugar for every kg of flour. So the weight ratio of sugar to flour 1:4; and the weight ratio of flour to sugar is 4:1.

Vonda's savings to spending ratio is 1:1 (i.e. for every dollar she spends she also saves a dollar).

Her spending to earnings ratio is 1:2 (she spends 1 out of every \$2). Alternatively her earnings to spending ratio is 2:1 (for every 2 dollars she earns she spends 1 dollar; or for every \$1 she spends 50c).

Proportion and ratios are important for measurements, scale and for dealing with physical quantities. People doing practical, manual, design and technical tasks in their professional and personal life rely on the use of proportions and ratios; and they often estimate these using their own experience, to provide a good understanding of practical numeracy. Proportion and ratios are also used to express financial information and statistics in simple sentences.

Consider this applied example and work out the proportions.



Sami makes and sells gourmet pies from a food trolley.

He sells the Mini pie for \$2 and the Maxi pie for \$5. The 200g mini has 150 grams of meat and gravy. The 500g maxi has 300 grams of meat and gravy.

Each 50 grams of meat and gravy costs Sami 40c to make.

So what are the 'meat/gravy weight to total weight' ratios for each of the pies?

What are the 'meat/gravy cost to selling price' ratios for each pie?

Which pie is better for Sami to make and sell - is there other information you need to know before you determine this?

Mini or maxi?



*Image: Dpimborough/
Depositphotos.com*

Rates

A rate is another type of ratio; but a rate combines 2 items or amounts expressed in different units. Rates show how much of one quantity is required, or used up, or spent, or even earned, in relation to another. i.e. Something per something else. Got it?

The most common rates you experience use distance and time. e.g. 100 km per hour (100kmh). And then there's petrol consumption, consider 5 litres per km - very economical! Wages \$15/hour, salary \$29,640 per annum - not bad if you're young, but not if you have a family! Dinner cost? \$10 per kg of chicken - not too expensive! What about a shower? 30 litres of water per minute - now that's a waste, should switch to a low-flow shower head. Got it now?

1. Write these money amounts in words, and also say and write these as fraction ratios (e.g. 2 and a half million dollars).

a. \$7 1/2 million	b. \$250,000	c. \$125,000
d. \$10,250	e. \$875	f. \$750m

2. Write these ratios numerically, then convert to percentages.

a. A 10th of every dollar.	b. One in four dollars.	c. \$7 out of every \$20.
d. 25c in every dollar.	e. A price marked up or double.	f. A price reduction of a sixth.

3. Calculate these time-based rates using appropriate units.

a. Travelled 100km at average of 50kmh.	b. Travelled 60km at average of 90kmh.	c. Travelled 10km at average of 4kmh.
d. Cooked 5kg of beef over 5 hours.	e. Sold 712 hot dogs over 16 hours of trading.	f. Made 54 coffees over 150 minutes of trading.
g. Ran a half marathon in 3 hrs 32 minutes.	h. Lost \$100 at the pokies in 12 minutes.	i. Saved \$1m in superannuation over 45 years of working.

Applied

Investigate rates that apply for your own personal and work situations. Consider travel, cooking, work productivity and so on. Describe these application of these rates as clear statements featuring numerical information.

3.09 Discounts

Discounts

As you know a discount is an amount that is deducted from the normal price or cost of an item. And you already are aware that not all discounts represent a 'smart' purchase!

Price (or retail) discounts are generally used by businesses to encourage **consumers** either; to buy more from them, to switch their business to them, or to remain loyal to them.

Some discounts are good because as a buyer you purchase items at a reduced price. However, other discounts are used to entice or encourage you to purchase something that you don't want, or to try to get you to buy more of an item than you actually need.

Cost (or trade) discounts are used by businesses to encourage other businesses to purchase from them. These discounts occur on the **wholesale** side (or supply side) of business transactions. Cost discounts (or **trade** or wholesale discounts) can include volume discounts, wholesale trade discounts, bulk purchase discounts, early payment discounts and other **business-to-business (B2B)** discounts.

A seller might offer retail discounts to new customers, to regular customers and/or for early payment of an account.

So there are many instances when you might have to estimate or calculate if a discount is indeed a 'good bargain' or just a waste of money if you are a consumer. And as a seller you need to factor in appropriate **sales margins** when selling B2B, as well as in retail situations based on retail margins.

Image: focusandblur/
Depositphotos.com

Are you drawn in by discount sales?



Preview
Sample:
Do Not
Copy

Discounts

Discounts are normally applied as a % reduction to a retail or wholesale price.

Most (but not all) discounts are calculated using percentages.

e.g. i: End of season clearance on jackets - save 40%!

e.g. ii: Buy 2 and save 25% off both.

i. 40% off

ii. 25% off for 2

Normal price = \$100

Discount = \$100 x 40% = \$40

New price = \$100 - \$40 = \$60

Normal price = \$40 and \$40

Discount = (\$40 + \$40) x 25%

Discount \$ = \$80 x 25% = \$20

New total = \$80 - \$20 = \$60

e.g. iii: Buy two pizzas get a third for free! (Offer applies to lowest priced item).

iii. Buy two pizzas get a third free.

Normal price = \$16, \$14 and \$10 = \$40

Total price paid = (\$30 + \$0)

Discount \$ = \$40 - \$30 = \$10 (normal price less price after discount)

Discount % = \$10/\$40 x 100%



= 25% (So what is the after discount average price of each pizza?)

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1. In your workbooks calculate the discount amount and the new price(s) on each of these consumer transactions. How much was the total discount %?

a. Buy 3 items at \$30 each and get a 10% discount in total.	b. Buy 5 items at \$25 each and get a 20% discount in total.	c. Buy 3 items at \$30, \$40 and \$50 each and get the lowest at a discount of 50%.
d. Order 3 pizzas and 4th is free. (Offer applies to lowest price). Prices: \$16, \$12, \$14 & \$17.	e. Loyalty discount: For every 10th coffee (\$5) get one free.	f. 5th diner eats free! Meals were \$22, \$27.50, \$23, \$16, \$22.50.

2. In your workbooks calculate the **discount amount(s)**, the **new cost(s)**, the **cost per item** (unit costs) and **total discount savings amount** and %'s on these B2B transactions.

a. Order 100 units @ \$3.75 = \$375.00. Receive 10% discount on the total cost.	b. Order 200 units @ \$10 with a trade discount of 20%. A repeat order within 30 days will get a discount of twice this amount.
c. Buy bakery ingredients from a wholesaler of 10 @ \$100, 50 @ \$50, 120 @ \$10 and 500 @ \$5. Trade discount is 10%. Receive a further 5% off any item subtotal that exceeds \$1,000.	d. Order 5,000 units @ \$6.50. Trade discount = 30%. Long-term client discount of 2.5%. Early payment discount = 1.25%.

3. Find examples of these types of discounts in retail or B2B situations. Add other types of discounts that may exist. Discuss your examples as a class.

sales discount	volume discount	buy one get one free	end of season discount	loyalty discount	for cash discounts
wholesale trade discount	bulk purchase discount	pensioner discounts			



3.11 Calculating Change

Working with cash

When you are buying using cash, the transaction will often involve change. The change amount is the difference between the **purchase price** and the **money tendered**. As a **purchaser** it is important to know that you are being given the correct amount of change to avoid being **short-changed**. If you are the worker then you must be able to **calculate** and **make change** accurately, as many transactions (depending on the types of customers, industry and location) will still be conducted using cash. And these are also likely to be speedy transactions as well.

If you use an electronic point of sale register that tells you how much change to give, you will also have to manually 'make' the correct change using notes and coins.

But is the age of cash over? Australian surveys conducted in 2017 and in 2018 found that for direct (i.e. face-to-face) transactions, cashless payment methods via cards and devices now accounted for just over 50% of all transactions; whereas cash-based transactions were used just under 50% of the time. However, cash was still favoured by older people over 65, and for most transactions under \$10. The trend is likely to sharpen as the teenagers of the digital age emerge with full pockets as they start earning more money. But those pockets will be bulging with cards, and more likely devices, rather than currency.

But in reality, as more and more everyday purchases are transacted using e-payment devices and apps, it actually becomes more vital that you develop your own applied numerical skills to be able to calculate and make change. Why do you think this might be the case? Think of the new convention being born - *evolution* - or in other words;

“use it or lose it”.

A Making change

Complete the following transactions in your head or on paper. Calculate the amounts and list the notes and coins you would provide. (Don't forget about rounding!)

a. Purchase of 10 cans of Popsi Dax @ \$1.75c. Handed a \$20 note.

b. Purchase of 3 sundaes @ \$2, 4 burgers @ \$3, 4 fries @ \$3, and 2 shakes @ \$2.75. Handed 9 \$2 coins and heaps of \$1 coins.

c. Order of 4 pieces of flake, 7 potato cakes, 4 fried dim sims, family chips, a pumpkin fritter and a 2 litre bottle of Sarsaparilla. What's left from a \$50?

d. Purchase of jeans @ \$89.99, top @ \$40, shoes @ \$149.99 and a beanie @ \$25. (Beanie is free with sales over \$300). Handed a \$100 and four \$50s.

Making change II B

Indicate the correct combination of notes and coins needed to make change for each of these transactions. Try to use the least number of currency units.

<p>i. Processing a \$39.95 sale. Given \$100.</p>	<div> <div>\$100 \$50 \$20 \$10 \$5</div> <div> x _____ x _____ x _____ x _____ x _____ </div> <div> <div>\$2 \$1 50c 20c 10c 5c</div> <div> x _____ x _____ x _____ x _____ x _____ x _____ </div> </div> </div>
<p>ii. Purchase of 3 items at \$57.50 each. Given 3 x \$50 a \$20 and a \$10.</p>	<div> <div>\$100 \$50 \$20 \$10 \$5</div> <div> x _____ x _____ x _____ x _____ x _____ </div> <div> <div>\$2 \$1 50c 20c 10c 5c</div> <div> x _____ x _____ x _____ x _____ x _____ x _____ </div> </div> </div>
<p>iii. Purchase of 3 items for \$175 and a different item at \$44.99. Given 6 x \$100 notes.</p>	<div> <div>\$100 \$50 \$20 \$10 \$5</div> <div> x _____ x _____ x _____ x _____ x _____ </div> <div> <div>\$2 \$1 50c 20c 10c 5c</div> <div> x _____ x _____ x _____ x _____ x _____ x _____ </div> </div> </div>
<p>iv. Total sales = \$73.11. PayWave of \$40 then given 2 x \$20s.</p>	<div> <div>\$100 \$50 \$20 \$10 \$5</div> <div> x _____ x _____ x _____ x _____ x _____ </div> <div> <div>\$2 \$1 50c 20c 10c 5c</div> <div> x _____ x _____ x _____ x _____ x _____ x _____ </div> </div> </div>
<p>v. Purchase of 7 @ \$1.50 and 20 @ \$2.20 Given a \$100.</p>	<div> <div>\$100 \$50 \$20 \$10 \$5</div> <div> x _____ x _____ x _____ x _____ x _____ </div> <div> <div>\$2 \$1 50c 20c 10c 5c</div> <div> x _____ x _____ x _____ x _____ x _____ x _____ </div> </div> </div>
<p>vi. Purchase of 3 x \$2.50, 2 x \$9.75 and 2 x \$15.10. Given a \$20, a \$10, 6 x \$5 and a 10c.</p>	<div> <div>\$100 \$50 \$20 \$10 \$5</div> <div> x _____ x _____ x _____ x _____ x _____ </div> <div> <div>\$2 \$1 50c 20c 10c 5c</div> <div> x _____ x _____ x _____ x _____ x _____ x _____ </div> </div> </div>
<p>vii. Purchase of \$89.95 and \$94.95. Given 9 x \$20s.</p>	<div> <div>\$100 \$50 \$20 \$10 \$5</div> <div> x _____ x _____ x _____ x _____ x _____ </div> <div> <div>\$2 \$1 50c 20c 10c 5c</div> <div> x _____ x _____ x _____ x _____ x _____ x _____ </div> </div> </div>

Preview
Sample:
Do Not
Copy

3.13 Comparing Prices

Who is cheapest?

One of the most useful ways that you can apply your numeracy skills is to compare the prices of different goods and services offered for sale from different sellers.

People have been naturally doing this for thousands of years by picking and choosing who to buy from and trying to manage their budget to get better value. That is how the concept of the 'market' began.

In our more recent times people might compare prices at Woolworths, Coles, Aldi, IGA, NQR, Costco, 7-Eleven, the local market, Crazy Cracka's discount store, Nick's friendly grocers, the milk bar around the corner, or even the nearest servo, just to find out who has the cheapest milk!

But in the contemporary world, **e-commerce** and **online shopping** have become a natural part of many people's lives. Thus, introducing the battle of 'bricks vs clicks'. So one of the most common price comparisons people might make nowadays is between items available from traditional retail outlets, i.e. 'bricks', and those offered for sale online, i.e. 'clicks'.

Digital shopping

According to the Australia Bureau of Statistics, online shopping in Australia accounted for 5.2% of total retail sales for 2017/18, up from 4% in 2016-17.

The total online retail spend in 2017/18 was \$15.7b, an increase from \$11.4b for the previous year. Traditional retail sales accounted for just over \$300b for 2017/18.

So although online retail sales is still a small proportion of total retail sales, it is growing significantly and will likely to be \$20b before 2020 and then continue to grow much faster.

In addition, people are increasingly buying online from overseas suppliers (these sales are not included in the Australian statistics shown above). In fact, in the early waves of online digital shopping, overseas sales accounted for the largest proportion of digital sales. So what do you think about Nigel's approach to shopping (below).

Why digital?

Some shoppers hunt many digital sites trying to find bargains on the types of goods they buy regularly (i.e. **household staples**). This helps them to spread their money further as part of their weekly shop.

Other people shop online because they like to hunt for the best bargains on **occasional** or **luxury purchases**; and they might source these items (such as a dress or a camera) either



Image: JohanH / Depositphotos.com

Preview
Sample:
Do Not
Copy

Good coffee and banie from the US and its like five dollars cheap. Good one Nige! This means I can use the money I have to get another single-blend Soy latte."



Image: gpointstudio / iStock/Thinkstock

Comparing Prices 3.14

domestically or from overseas. You might see them ‘**showrooming**’ at Chaddy on a Sunday, trying on different outfits, taking a quick selfie (loaded to Insta of course!), and then heading home to see if they can save \$5 online.

An increasing number of shoppers opt for the **convenience** of online shopping and use **home delivery** services. This saves them time so that they can sit at home and track their Uber Eats delivery.

And of course many online shoppers do so because of their geographical **location** or **isolation**. For them it is better to get items delivered because they can't easily source these products locally, or local prices are too high. This can also extend to shoppers searching for goods online that they cannot track down in retail stores. The online shopping experience is **faster** for them, and in fact, this may be the only way that they can source a particular product.

Image: mipan/
Depositphotos.com

Is this the future. What do you think?



Preview

Sample:

Do Not

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One way to compare different prices is to select a basket of staple goods that you purchase regularly and record the prices of these from different sellers. Using the data you collected you can set up a table and calculate the \$ differences and/or percentage differences in the price of particular goods, as well as the differences in the entire basket of goods. You can also show your results on a bar graph.

Jodie has collected some data from retail stores and online retailers. Do the calculations to complete the table, compare the total price of the basketed goods. What would you recommend Jodie do? What else might Jodie need to take into account before choosing where, or how, to buy?

Item	Boles	Boles Online	Baldi	IPA	www.ome shop'n 2 u!
Bread	\$3.50	\$3.00	\$2.75	\$4.15	\$4.50
Milk	\$1	\$1	\$1	\$1.50	\$2
Shampoo	\$7.99* (on special)	\$9.50	\$3.50	\$4.75* (on special)	\$2
Chicken thighs	\$12.99	\$12.99	\$9.99	\$15.99	na
Chocolate	\$3.75	\$3.75	\$2.50	\$2.50* (on special)	\$4.75
Toilet paper	\$9.50	\$9.50	\$7.99	\$12.50	\$6.99
Totals					



3.15 Comparing Prices



Spreadsheets

One of the best ways to compare prices or other data is to use a spreadsheet. With spreadsheets you can enter formulae into cells to make quick and accurate calculations. In an Excel spreadsheet you use an "=" to denote a formula or calculation.

For example (and there are thousands):

=5*10 will perform the calculation and yield the answer of 50

=A3 + 26 will perform the calculation of adding 26 to whatever is in the cell "A3"

=sum(A1:A10) will add up all the values in the cell range, provided that they are numbers of course!

Have a look at these 2 spreadsheet examples based on the data from activity 3.14A, 'Compare the basket'.

The first spreadsheet shows the headings and the formulae to calculate totals for each column, and the differences in both \$ and % terms of retailers compared to the lowest priced retailer.

The second spreadsheet shows the results of the calculations for the totals after the data has been inputted. Your teacher will explain this to you and get you to set up these examples.

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	A	B	C	D	E	F
1	Price Comparison April 4, 2019					
2	Item	Baldi	Baldi	Baldi	Baldi	Baldi
3	Bread					
4	Milk					
5	Shampoo					
6	Chicken thighs					
7	Chocolate					
8	Toilet paper					
9	Totals	=sum(B2:B8)	=sum(C2:C8)	=sum(D2:D8)	=sum(E2:E8)	=sum(F2:F8)
10	Difference from lowest \$	=B9-D9	=C9-D9	=D9-D9	=E9-D9	na
11	Difference from lowest %	=B10/D9*100	=C10/D9*100	=D10/D9*100	=E10/D9*100	na

	A	B	C	D	E	F
	Price Comparison April 4, 2019					
2	Item	Baldi	Baldi	Baldi	Baldi	Baldi
3	Bread	\$3.50	\$3.50	\$2.79	\$4.15	\$4.50
4	Milk	\$1	\$1	\$1	\$1.50	\$2
5	Shampoo	\$7.99	\$9.50	\$3.50	\$4.75	\$2
6	Chicken thighs	\$12.99	\$12.99	\$9.99	\$15.99	na
7	Chocolate	\$3.75	\$3.75	\$2.50	\$2.50	\$4.75
8	Toilet paper	\$9.50	\$9.50	\$7.99	\$12.50	\$6.99
9	Totals	\$38.73	\$40.24	\$27.77	\$41.39	\$20.24
10	Difference from lowest \$	\$10.96	\$12.47	0	\$13.62	na
11	Difference from lowest %	39%	45%	0	49%	na

Basket case B



You are required to compare the prices of a 'basket' of items that are available from traditional retail outlets (i.e. 'bricks') versus online retailers (i.e. 'clicks').

1. Form into pairs and select 8-10 items to investigate.
Choose physical goods such as household grocery items, or perhaps a clothing outfit ensemble, or a suite of electrical and electronic goods.
2. Research and investigate prices from traditional retailers and online retailers.
3. Record and organise your information in a table, and then transfer the information and data to a spreadsheet to make calculations.

Retailer:	Traditional	Traditional	Traditional	Online	Online	Online
Items:						
Totals						

4. Communicate your findings by creating summary statements that use numerical information. Consider reporting on:
 - ⇒ least and most expensive
 - ⇒ range and availability
 - ⇒ convenience and time
 - ⇒ delivery costs and other charges
 - ⇒ your recommendations.



3.17 Converting Currencies

Go global

The world of commerce has evolved with a significant proportion of shoppers now buying using online purchasing portals.

Many of these transactions involve buying from overseas which means that we have to convert our currency, Australian dollars, into the overseas currency (\$US, Yen or Euro) in order to carry out the transaction. The growth of Amazon, eBay, Etsy, Alibaba, Facebook stores, Shopify and other online platforms has been astounding. This growth will continue as mobile apps continue to dominate consumer's online shopping experiences.



Types of eCommerce

B2C: Business to consumer transactions are concerned with the sale of goods or services to consumers. Electronic sales of goods (i.e. eetailing) involves selling physical items using an online presence. e.g. Buying a box of soap from Once Works locally or buying a hand-crafted leather grooming set from an online store in Denmark.

Electronic sales of services include online banking, online bookings, electronic bill paying, online education, ebooks, digital media content streaming services, information and news, gaming subscriptions and many other products. Many electronic services complete the actual sale of the physical service, such as online booking and payment for an airline flight.

B2B: Business to business involves businesses managing their supply-chain by conducting online wholesale transactions with each other.

C2C: Consumers to consumers or (peer to peer) involves consumers making transactions with each other, such as 'classified' types of ads on Gumtree and auction ads. Online job sites, such as seek.com.au are usually included in this category.

C2B: Consumers to business refers to consumers forming a buying group to deal with businesses as a whole 'community'.

"She's the right mate!"



Image adapted from:
olga.angeloz/
Depositphotos.com

Value of Australian dollar versus...					
Year	\$US	Euro	Yen	GB Pound	
June 30 2016	0.7523	0.6979	75.46	0.5666	
June 30 2017	1.0120	0.8092	80.89	0.6529	
June 30 2014	0.7420	0.6906	95.43	0.5531	
June 30 2016	0.7426	0.6699	76.23	0.5549	
June 30 2018	0.7391	0.6344	81.82	0.5634	
June 30 2019					
June 30 2020					
June 20 2021					
June 30 2022					
Source: RBA, Historical Data, month end					



Converting the Australian dollar

Float like a butterfly...

Australia has what is called, a floating exchange rate. What this means is that the value of the Aussie dollar is determined by the demand for and supply of the dollar.

Different countries of the world have their own currency. When purchasing a good or service from a country you have to pay in their currency.

Generally, if you are buying something from overseas you have to pay in their currency. If you are selling overseas you generally want to be paid in your own currency.

There are some exceptions to this, such as when a very powerful country trades with a weaker country and dictates the currency to be used, or when trading is being undertaken in a very recognisable currency that both parties are happy to trade with.

In order to help international trade run smoothly, international foreign exchange markets buy and sell different currencies. Essentially the value of a currency is determined by the demand for (people wanting it) and the supply of (people offering) a particular currency.

It is not necessarily better to have a high valued currency nor is it necessarily bad to have a low valued currency. In fact sometimes it might be better to have a lower currency.

The exchange rate represents the relative purchasing power of one currency versus another currency at any one particular time. This exchange rate will fluctuate on a daily and hourly basis, and even by the second! But what an exchange rate always represents

is the proportion that one currency can purchase of another.



Image:
SashaGalatchenko/
iStockThinkstock

Who do you barrack for?

When we see a finance update at night we see the value of the Australian dollar reported. Tom Piotrowski might say something like...

"And on global financial markets, the Australian dollar is buying 75.6c US, 89 yen, 61 Euro cents and 0.52 pound sterling." This statement indicates the relative purchasing power of the Australian dollar expressed in terms of other currencies. Sometimes the commentator might say:

"...On the global financial markets the value of the Australian dollar fell over half a cent from 75.5c US to 75.1c US."

The next morning all working people all complain about the weaker Australian dollar and how that hurts Australians. But does it?

Ask yourself the following question.

"Is it better if the value of the Australian dollar increases or decreases?"

Find out what your class members think.

Calculating the value of the dollar

If 1 Australian dollar buys \$US0.75 cents this means that to purchase something priced at \$US7 you have to spend \$100 Australian dollars. Make sense? And the statement again. If 1 Australian dollar can buy \$US0.75c then 100 Australian dollars can buy \$US75. Simple isn't it!

So at this exchange rate, how much Australian currency can one whole \$US dollar buy? It must be more than a dollar in this case!

We can set the equation out like this:

$$1 \text{ AUD} = \$0.75 \text{ US}$$

You need to use some basic transposing to solve this. We need to get the \$US dollar on its own.

To do this we divide both sides by 0.75.

$$\frac{\$0.75}{0.75} = \frac{1 \text{ AUD}}{0.75}$$

so therefore:

$$\$1 \text{ US} = \$1.33 \text{ AUD (i.e. } \$1 / 0.75)$$

It really is that simple and faster than checking on your phone!

3.19 Converting Currencies

A Converting currency



1. Add 2 countries of your own choosing to the table.
2. Find out and list the currencies of each of the countries in the table.
3. Show how much \$1 Australian will purchase of each country's currency.
4. Show how much 1 of each country's currency will purchase of Australian dollars.
(Note: For Japan, think of the yen like a cent. So you will need to show how much 100 yen will purchase in Aussie dollars.)
5. How much of this currency will \$100 Aud buy?

You want to buy a signed soccer jersey as a present for a friend. You can buy it at various auctions on eBay for 75 Euro, \$US110 or 50 UK pound. You can also buy it locally for \$100. Postage and insurance from Europe is 15 Euro, from the US is \$US20 and from the UK is 10 pounds.

4. Calculate how much each transaction will cost in Australian dollars.
5. Which transaction would you recommend and why?
6. What other costs/issues should be considered when buying from online auction sites?
7. Draw a diagram that shows the relative purchasing power of the Australian dollar against 2 other currencies. The size ratio must be exact (Why not base the graphic around the basic currency unit of these countries?)

Country	Currency	Symbol	Value (\$1 Aud buys ..)	Value (1 of this unit buys ? \$Aud)	\$100 Aud will buy?
Australia	dollar	\$	1		\$100
USA					
New Zealand					
Europe					
Japan					
UK					
China					
Canada					
Mexico					
India					
Switzerland					

Stage 2:

1. A farmer wants to buy a new American tractor from a local dealer. The dealer has quoted him \$100,000. What would be the equivalent price of this tractor in US dollars? Assume that \$1 Australian dollar buys \$US0.80. (This is the US sticker price.)

Assume that the US sticker price of this tractor has not changed for some years.

2. Calculate the sticker price of this tractor in Australian dollars as at today and also for June 30, 2018, 2016, 2014, 2012 and 2010 (Remember: Assume that there has been no price changes to this US sticker price.)
3. Draw a line graph to show these prices over time. Remember to label the graph.
4. Copy and complete the statements below to describe the relationship between the value of the Australian dollar and the price of the tractor.
5. As the value of the \$Aud rises against the \$US, the price of an imported tractor goes _____. For example, in _____ when one \$Aud was buying \$US _____ the price of the tractor in Australian dollars was _____.
6. As the value of the \$Aud falls against the \$US, the price of an imported tractor goes _____. For example, in _____ when one \$Aud was buying \$US _____ the price of the tractor in Australian dollars was _____.

Stage 3:

Copy and complete the statements describing the possible relationship between the \$Aud and purchase of imports and exports. Choose the correct alternatives.

1. When the value of the \$Aud rises against overseas currencies, Australian purchasers can buy more / less overseas currency with the same amount of Australian dollars. This means that imports become relatively cheaper / dearer. This is likely to result in Australia importing more / fewer goods and services which may cause direct economic benefit / harm.
2. When the value of the \$Aud falls against overseas currencies, Australian purchasers can buy more / less overseas currency with the same amount of Australian dollars. This means that imports become relatively cheaper / dearer. This is likely to result in Australia importing more / fewer goods and services which may cause direct economic benefit / harm.
3. When the value of the \$Aud rises against overseas currencies, overseas purchasers can buy more / fewer Australian dollars with the same amount of their own currency. This means that exports become relatively cheaper / dearer. This is likely to result in Australia exporting more / fewer goods and services which may cause direct economic benefit / harm.
4. When the value of the \$Aud falls against overseas currencies, overseas purchasers can buy more / fewer Australian dollars with the same amount of their own currency. This means that exports become relatively cheaper / dearer. This is likely to result in Australia exporting more / fewer goods and services which may cause direct economic benefit / harm.
5. Explain how a low dollar might benefit Australian farmers when they sell their produce but harm them when they buy their machinery.
6. Explain with reasons and examples which situation, a lower Aussie dollar or a higher Aussie dollar, is better for you?



3.21 Assessment Task

AT3 Working With Money

Overview

There are 2 parts to this task.

⇒ Part A: Complete a simulated case study.

⇒ Part B: Applied investigation of the examples in the case study.

The different lives of Dot and Dit

Read the case study then complete the tasks that follow. Identify all the examples of 'numerical information' about Dot and Dit by underlining or highlighting these.

Dot and Dit

Twins Dot and Dit have different approaches to money management. Dot is very frugal and careful with money, whereas Dit has a more carefree approach to spending. Indeed, Dot is always telling Dit that, "If you look after the cents then the dollars will look after themselves". Dit usually replies by saying "You're only on this planet once, so you might as well make the most of your time while here."

When the twins are out shopping Dit always uses his phone app to pay. Sometimes he doesn't have enough money in his account and has to make a swift transfer from another account. Dot says to Dit "You should be embarrassed bro!". This becomes a joke between them and a challenge to Dit. Dit finds a 'loophole' and decides he will instead just use his credit on his smartphone.

Dot mainly uses cash when shopping and stops spending when she has run out. In contrast, Dit loves *Get-it-now* the new digital lay-by method of buying. When he gets the bill down the track, Dit just uses his credit card to pay it off anyway. For large purchases, Dot uses her debit card and double checks her balance before flexing it.

Both Dot and Dit work at the Ten Digit Shop. Dit struggles to make change when serving customers and counts on his fingers. One other customer handed him the notes and the cents to get round' change for a payment and Dit couldn't work out how to do it. Dot used to handling cash and quickly calculates change.

Dit loves a discount and is proud when he spots one. He buys up big when the opportunity presents, often from overseas, and shares his savvy on Insta with pics and comments such as "They were almost giving it away!" But Dot points out that sometimes the discounts may work out to be a few per cent, and that he doesn't take into account other charges and costs. But Dit doesn't know how to estimate these.

Every fortnight when they get paid Dit only looks at the gross pay on his pay slip and always complains he is suffering from wage theft from tax and super. Dot sometimes finds mistakes in the hourly rates and number of hours worked and lets the boss know, who fixes it straight away.

Dot and Dit organise a party for their twin friends Ni and Bary. At the market Dit has no idea how to plan what to buy and how much he needs to spend. He buys a box of ripe bananas and some fish because they are being cleared cheaply. In contrast, Dot plans what she needs to get for the party in advance and looks online to see who's got specials on the most expensive and highest quantity items needed. This will help stretch her money further.

In terms of saving, Dot is doing well and is debt-free. Dit has a debt that he finds puzzlingly large (due to interest). Even though they earn the same amount, Dit seems to be far less fortunate than his twin Dot.

So don't be a Dit. When it comes to managing money, join the Dots!

Part A: Tasks

1. Dot and Dit have different approaches to money. Who of Dot or Dit do you more relate to, or agree with? Explain why.
2. Identify all the examples of numerical information from the case study.
3. Explain whether these examples represent 'effective' financial literacy or 'not so effective' financial literacy.
4. Develop short statements as feedback strategies to Dot and Dit about their financial management skills.

Part B: Applied Investigation

You are required to describe real life examples using evidence, related to your own experiences, that match each of the numerical situations from the case study of Dot and Dit.

You need to describe situations involving:

- ☐ Money calculations using both cash and digital transaction methods
- ☐ Estimating, calculating, making and checking change
- ☐ Converting discounts to and from a percentage and percentage
- ☐ Estimating, calculating and evaluating discounts
- ☐ Comparing traditional and digital shopping methods
- ☐ Comparing buying locally to buying from overseas
- ☐ Interpreting pay slips
- ☐ Interpreting varied financial information
- ☐ Saving vs spend
- ☐ Credit use and its relationship with debt
- ☐ Money management and budgeting
- ☐ Other information that your teacher might add.

Topic ideas and other information, notes, key dates, etc..

3.23 Numerical Language

When dealing with numerical situations related to **money (S3)** and **money management (S4)** there are key terms and phrases that you are expected to know. List key terms/phrases, provide a definition, and outline how each relates to **personal** and **work-related situations**.

Term/phrase	Definition	Personal application	Work-related application
<div>Preview Sample: Do Not Copy</div>			

Money Management 4

Contents

4.01 Financial Literacy	92	4.17 Managing Your Spending.....	108
4.03 Personal Budgeting.....	94	4.19 Managing Credit.....	110
4.07 Earning an Income.....	98	4.25 Assessment Task.....	116
4.11 Financial Documents.....	102	4.27 Self- Assessment.....	118

Activities 4: Money Management

	p.	Due date/Done?	Comment
4.02A Financial literacy	91	<input type="checkbox"/>	
4.04A My budget	93	<input type="checkbox"/>	
4.06B My future budget	95	<input type="checkbox"/>	
4.08A Wage rates	97	<input type="checkbox"/>	
4.09B Timesheets	98	<input type="checkbox"/>	
4.10C Pay slips	99	<input type="checkbox"/>	
4.15A Financial documents	103-104	<input type="checkbox"/>	
4.16A Me and money management	103	<input type="checkbox"/>	
4.21A Loan repayments	112	<input type="checkbox"/>	
4.22B Investigating credit	113	<input type="checkbox"/>	
4.23C Credit cards and loans	114-115	<input type="checkbox"/>	
AT4 Financial Literacy	116-117	<input type="checkbox"/>	
4.27 Self-Assessment	118	<input type="checkbox"/>	

Comments:

4.01 Financial Literacy

Financial literacy

Financial literacy refers to the ability of a person to understand, use and apply various numerical and other skills as part of day-to-day personal, social and work-related money management, budgeting and commercial decision-making.

We could say that financial literacy allows you to analyse your personal circumstances in relation to this question.

“Are you in control of your financial situation, or is your financial situation in control of you?”

At this time of your life, when you are soon to transition into post-secondary options, it is even more vital that you are able to build and apply your skills in financial literacy.

As you get older, life becomes more expensive.

Vehicle and transport costs, clothing and work-related costs, TAFE and study costs, the naturally more expensive costs of an adult lifestyle, rent and self-

independence costs, costs of insurances and other obligations - not forgetting relationship and family costs. These can all accumulate very quickly. But what doesn't accumulate nearly as fast is the income you earn.

In Numeracy Intermediate you were introduced to the money management equation. However, it is probably even more relevant to you now, so let's revisit this.

Money management equation

When managing money the equation is: Money out should \leq money in.

- ☹ Too much out (spending far more than income); you go into debt.
- 😊 Less money out or more money in (you start building savings (wealth)).

In theory the money management equation is simple, but managing your money is actually quite hard. Contemporary life is expensive and young people, even if they do have a job, generally don't earn much at all!

It is important to realise that the money-in side of the financial equation is easier to manage than the other.

You can't do much about the money-in side (income) except to try and get a job and build a future career. That takes time, skills, training, experience, commitment and patience!

However, the money-out side (**expenditure**) is the part of the equation you have direct responsibility for. Unfortunately that takes discipline. And **financial discipline** is hard. And it is becoming even harder because people are increasingly using digital payment platforms and purchasing apps when shopping face-to-face, and especially online. This means people are spending too much, spending too quickly, losing track of how much they're spending, and over-using credit, especially through digital spending platforms.

💡 Financial management is about making sacrifices now, so as to create a better longer-term **standard of living**. Can you do that? Well we think you're up for the challenge.

Who is it that really has the control?



Image: den0909/
Depositphotos.com

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1. Discuss the extent to which you agree or disagree with each of these statements.
2. Outline an example related to you that illustrates your view of the statement.
3. What do you think your responses say about your approach to financial literacy?

Statement	My point-of-view	Applied example
1. I need to budget so that I can manage my money.		
2. I'll have my finances under control when I stop paid more.		
3. Cash is old school. I just app or tap.		
4. Before buying I ask myself, "do I really need that?"		
5. I can't wait to start working because there are so many things I need to buy.		
6. If I run out of money there's always credit cards or instant loans available. I'll pay these back easy.		
7. Casual work pays more per hour, so that's the way to go for me.		
8. Saving creates financial discipline which will pay off for me in the long-term.		
9. Starting early on superannuation is the way for me to enjoy a comfortable retirement.		
10. I get more enjoyment from paying for something up front - it means it's really mine because I don't owe anything.		

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4.03 Personal Budgeting

Personal budgets

Many of you were introduced to budgeting in Numeracy Intermediate last year so you might be familiar with the key concepts around budgeting and personal financial management. But we need to reinforce these, as they are an essential component of your life, especially as you transition beyond Year 12 and into your adult lives!

It is essential that you manage your expenditure and minimise the use of credit; especially seemingly easy sources of credit, such as **credit cards**, **'payday'** or **instant loans**, **interest-free** purchase contracts; as well as the growing use of **AfterPay**.

You also need to explore income sources, such as wages and salaries, interest income, and government benefits and assistance.

Additionally, you need to balance your expenditure out with your income in; so as to manage your day-to-day financial obligations, to provide for longer-term spending requirements, to save for assets such as a car, as well as saving for your future.

Budgeting

A budget is a financial management planning tool that lists all of your forecasted revenue and expenses over a period of time. A budget allows you to see if you expect to have more money coming in (a **surplus**) or more money going out (a **deficit**).

A budget can help you plan your spending more responsibly and allow you to take control of your finances. When budgeting it is important to be as accurate as possible and to list all of the expenditure items that you are likely to encounter. You should also budget for 'other' expenses, some of which are unknowns and are likely to crop up unexpectedly.

You need to prepare different budgets depending on your personal circumstances and your goals. This means that your budget will be different this year while you are still in Year 12, compared to next year when you might be working, or studying in post-secondary education.

An important aspect of budget review is to compare your forecasted amounts with the actual amounts to see how much variation has occurred. This will help you plan more accurately in the future.



Image: PeterFZ30/iStock/Thinkstock

Budgeting

Prepare your budget as accurately as possible.

- ⇒ Be realistic.
- ⇒ Plan to the dollar, not to the cent (except for variable costs).
- ⇒ Always underestimate revenue.
- ⇒ Always overestimate expenses.
- ⇒ Calculate forecasted surplus or deficit.
- ⇒ Include amounts and allowances for unknowns and 'other' items.
- ⇒ Use budgeting software, a spreadsheet or an app to manage your budget.

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My budget now A

Use this planner to forecast a monthly budget for yourself based on your current circumstances as a Year 12 student. You need to estimate both revenue (money in) and expenditure (money out).

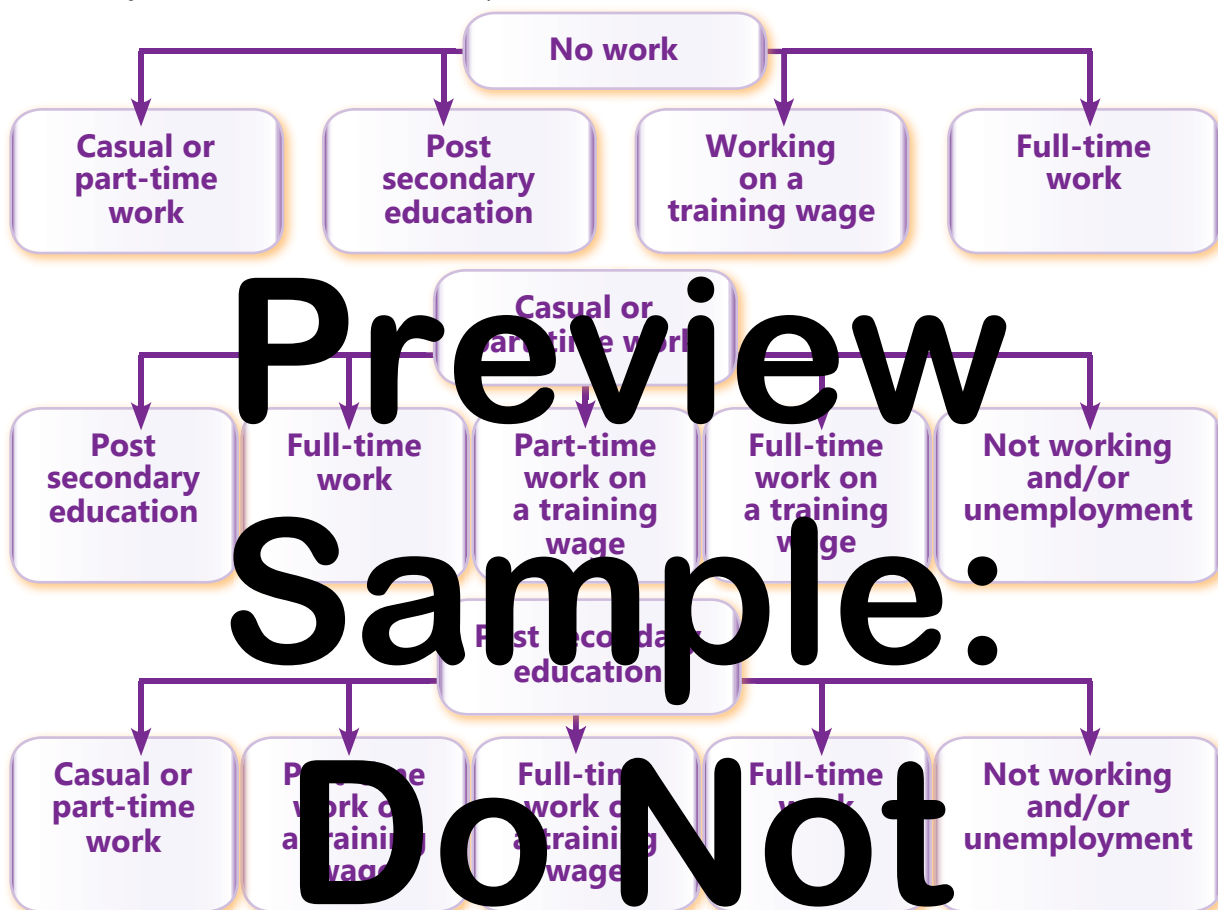


Cash Budget/Financial Planner											
Name(s): _____											
Situation: _____ Date(s): _____											
Revenue items	Forecast \$	Actual \$	Expenditure items	Forecast \$	Actual \$						
Preview Sample: Do Not Copy											
						Total Revenue			Total Expenditure		
Forecasted Surplus			Forecasted Deficit								
Actual Surplus			or	Actual Deficit							

4.05 Personal Budgeting

Changing you

You are in for some changes. Big changes. And these changes will impact on your personal financial circumstances. Some of you will transition into the workforce. This might see you move from no work into paid work, from casual work into full-time work, or even from higher paid casual work into lower-paid entry-level career employment (such as a 1st year Australian Apprentice).



Potential expenditure categories and income sources

Expenses <ul style="list-style-type: none"> ⇒ mortgage or rent ⇒ home insurance ⇒ contents insurance ⇒ rates ⇒ electricity/gas ⇒ water ⇒ repairs/maintenance ⇒ car loan/interest ⇒ petrol ⇒ insurance ⇒ registration ⇒ service and tuning ⇒ maintenance/repairs ⇒ public transport ⇒ parking ⇒ fines and charges ⇒ sporting/club fees ⇒ health insurance ⇒ gym memberships ⇒ groceries 	<ul style="list-style-type: none"> ⇒ pharmacy, dental ⇒ physio, optical, vet ⇒ and other medicals ⇒ phone ⇒ internet ⇒ video/TV ⇒ subscriptions ⇒ music purchases ⇒ entertainment ⇒ clubs ⇒ toiletries, beauty & health ⇒ household products ⇒ take-away, lunches and meals ⇒ haircuts/grooming ⇒ clothing - personal ⇒ clothing - work ⇒ shoes and footwear ⇒ union fees ⇒ computing 	<ul style="list-style-type: none"> ⇒ electrical ⇒ child-care ⇒ school and education fees, books, etc ⇒ books, magazines, subscriptions ⇒ holidays ⇒ gifts and presents ⇒ donations ⇒ special treats ⇒ credit card repayments ⇒ personal loan repayments ⇒ others & others ⇒ lots of others! 	Income <ul style="list-style-type: none"> ⇒ wages & salaries ⇒ government benefits ⇒ business income (profit) ⇒ interest income ⇒ investment income
---	--	---	---

Image: Violka08/iStock/Thinkstock

My future budget B

Use this planner to forecast a monthly budget for yourself based on your most likely situation next year (work, or study, or a combination of these). Both your income patterns and your expenditure patterns are very likely to change as you transition.



Cash Budget/Financial Planner											
Name: _____											
Situation: _____ Date(s): _____											
Revenue items	Forecast \$	Actual \$	Expenditure items	Forecast \$	Actual \$						
Preview Sample: Do Not Copy											
						Total Revenue			Total Expenditure		
Forecasted Surplus			Forecasted Deficit								
Actual Surplus			or		Actual Deficit						

4.07 Earning an Income

Income

Income is money that any individual or enterprise earns from various sources, such as working, investing or operating a business.

Most people in Australia earn a **wage** or a **salary**; and about 2 million people are **owner/operators** of their own business hoping to earn a **profit**. Many investors receive **dividends** from both private and public (sharemarket) companies. Banks and other financial institutions offer **interest** on savings and investment bonds. Many people also receive **transfer income** from the government through various welfare payments.

As people accumulate **wealth** over the course of their working lives (by spending less than they earn) they might then **invest** in assets to earn investment income, such as:

- ⇒ interest from savings
- ⇒ dividends from owning shares
- ⇒ capital gains from selling assets (shares, property, art, etc.) and
- ⇒ rent from investment properties.



Image:
Jiriyapong Thongsawang/
Shutterstock/Thinkstock

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- Main types of income**
- ⇒ **Wages:** Income amounts paid for an employee's labour and determined on an hourly basis. They are commonly used for trades, para-professional, clerical and service industries.
 - ⇒ **Salaries:** Income amounts paid to professionals and high-skilled employees. Salaries are calculated (but not paid) on a yearly basis.
 - ⇒ **Commission:** A incentive payment usually based on a proportion of sales, fees or revenue. Often used for people in sales roles and real estate.
 - ⇒ **Payment in kind:** Non-monetary payments given in return for labour. For example, a nanny might receive free food and accommodation as part of their employment remuneration in return for a lower income.
 - ⇒ **Piece-rate:** Payment used when a person (often a sub-contractor) is paid depending on the amount of items (or units) they produce. For example, someone sewing garments might receive \$5 per garment, or someone delivering pamphlets might receive \$20 per 1,000.
 - ⇒ **Allowance:** Payments given to offset the cost of work-related necessities, such as uniform cleaning, or for meals associated with travel and overtime shifts. Allowances might also be paid for clothing, tools of the trade or other specific work-related requirements.
 - ⇒ **Superannuation:** Amounts paid under law by employers (9.5% of an employee's income as at 2019/20) that becomes available at retirement.
 - ⇒ **Interest:** Amounts earned on savings and investments.
 - ⇒ **Dividend:** Amounts earned on shares as part of a company's profit (a dividend is paid at a rate per each share held).
 - ⇒ **Profit:** The net result (or gain) of a business after all expenses and costs have been accounted for.

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Wages

Wage-earners are paid for the number of hours that they work. A standard full-time working week is usually considered to be 38 hours. Most jobs that you do as a young person are likely to be paid using wages, and nearly all trades occupations and most other non-professional occupations are also paid using hourly wage rates. This means that you and your employer might have to fill in a

timesheet, or you might have your hours recorded automatically when you sign in and/or clock on and off.

The amount you are paid is your hourly wage rate. Wage rates are determined by one of three work arrangements: **awards, registered agreements or minimum hourly wage rate** (set annually by **The Fair Work Commission**).



Image: vinnstock/iStock/Thinkstock

Wage rates

A timesheet (and payslip) will also include the relevant hourly wage rate for the hours that are worked. This hourly rate might differ depending on various factors.

- ⇒ The award or registered agreement under which the employee is employed (or the minimum wage rate).
- ⇒ The occupational classification of the employee.
- ⇒ The age of the employee (for junior staff under 21 and/or trainees and apprentices).
- ⇒ The time of day worked (penalty rates apply).
- ⇒ The day of the week worked (if weekend penalty rates apply).
- ⇒ Extra hours worked (overtime penalty rates apply).

So how could you actually find out which rates and conditions apply to various jobs, or for your own job? Discuss this with your teacher.

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Wage rates A

1. Research and compare the wage rates for an occupation you are interested in. Find out the hourly pay rate, casual loading and penalty loading that might apply.
2. Calculate the proportional junior rates for different ages.
3. If relevant for this occupation, estimate and/or calculate the proportional pay rates for an apprentice at 1st year, 2nd year, 3rd year and 4th year.

Applied

Check out Fair Work Australia which has an online Pay Calculator tool called PACT. But you'll need to know some key information to use this correctly. Your teacher can help guide you through the PACT tool.

www.calculate.fairwork.gov.au



4.09 Earning an Income

Timesheets

Timesheets are used to record employee working hours, work days, break times, rates of pay, as well as other information relevant to the particular work setting and employee. Timesheets often use a **24-hour clock**. Timesheets are used to calculate weekly (or fortnightly) gross pay amounts.

In some workplaces it might be your responsibility to fill in your own timesheets; and it is definitely your responsibility to check that your timesheets are correct.

Crazy Cracka's Discount p/l: Weekly Timesheet							
Name: Robbi Grenoble		Work period: April 19 - April 25, 2019					
Employee number: 9875698		Classification: Retail Worker Level 2				Age: 18	
	Date	Start	Finish	Break	Hours Worked	Rate	Total
Sunday	20/4	10:00	17:30	10:30-11:30	7.5	\$24	\$180
Monday	21/4	10:00	19:00	13:30-14:30	8.5	\$12	\$96
Tuesday	22/4	10:00	19:00	13:30-14:30	8.5	\$12	\$102
Wednesday	23/4	10:30	20:00	13:00-14:00	8.5	\$12	\$102
Thursday	24/4	12:00	19:30	16:00-17:00	6.5	\$12	\$78
Friday	25/4	12:30	19:00	15:00-16:00	6	\$18	\$108
Totals					45		\$666

B Timesheets

1. Use the sample timesheet above to interpret and communicate 10 clear and concise points of numerical information.
2. Complete a timesheet based on the following information. Make up personal and work-related information as required.

Adult retail employee working a standard, 38-hour week, Monday to Friday.

- ⇒ Sign-on is 08:45 am.
- ⇒ Unpaid lunch break is from 13:00 to 13:45.
- ⇒ The employee is paid \$18.93 hour (as per the *National Minimum Wage* for 2018/19 but you can update this figure with the current amount for this year).
- ⇒ The worker does 2 hours overtime (at time and a half) on Thursday, after a break of 20 minutes. You need to adjust the timesheet's format slightly to show this.

3. Complete a timesheet based on your most likely work situation for next year.
4. Obtain an actual timesheet from a workplace and analyse how it is the same as, and/or different from, the sample shown above.

Pay slip

A pay slip is a hard copy or digital document that must be issued by law for each pay period. Pay slips must include relevant employer and employee details, pay and pay rate information, deduction information and summary information.

A pay slip usually will also include loadings, allowances, bonuses, incentives, penalty rates, other entitlements, leave balances, etc., and other information.

Crazy Cracka's Discount p/l		ABN: 4225 214 4875	Date:	April 27th, 2019
Employee: Robbi Grenoble			Period:	April 19-25, 2019
<u>Entitlements</u>	<u>Total</u>	<u>Total</u>	<u>Deductions</u>	
Ordinary hourly rate:				
\$12	31.5	\$378		
Overtime hourly rate:				
\$18	nil	nil		
Saturday penalty rate:				
\$18	6	\$108		
Sunday penalty rate:				
\$24	7.5	\$180		
Gross entitlement		\$666	Tax deducted:	\$86
Net entitlement		\$580		
Paid into bank account: 046 224360 BSB 092 4245				
Year to date		12	Year to date	\$1808
<u>Employer superannuation contribution</u>				
RESFund		\$63.17	Year to date	\$1115.75

Preview
Sample:

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Pay slip



1. Use the sample pay slip above to interpret and communicate 10 clear and concise points of summary information.
2. Complete a pay slip based on the following information. Make up personal, work-related and other financial information as required.

<p>Employer: Hairex Tensilis</p> <p>ABN: 23 456 987 01</p> <p>Pay period: Sunday-Saturday last week</p> <p>Pay date: This Thursday</p> <p>Hourly rate: \$17.50</p> <p>Hours worked: 20 in total</p> <p>Overtime rate: +25%</p> <p>Overtime hours: 6</p> <p>Tax deducted: 12.5%</p>	<p>Super deducted: no</p> <p>Other information:</p> <p>Employee has been working 3 weeks</p> <p>Week 1: Same ordinary hours, no overtime.</p> <p>Week 2: Identical as week 3 just gone.</p> <p>Tax deducted: 12.5% each week</p> <p><i>Note: No superannuation contributions required as under the 30 hour cut-off for an employee less than 18 years of age.</i></p>
--	---

3. Complete a pay slip based on your most likely work situation for next year.
4. Obtain an actual pay slip from a workplace and analyse how it is the same as, and/or different from, the sample shown above.



4.11 Financial Documents

Financial documents

There are hundreds of different financial documents that you might come into contact with as part of your personal, social or working lives. Some you will encounter as a consumer, i.e. a customer or client. It is important that you can interpret the financial information on these so that you can manage your budget and check that you are being billed and charged correctly.

Many other documents are used internally and externally by enterprises to manage their operations. These documents need to collate and clearly communicate numerical information and must be developed to meet legal guidelines (especially for tax receipts, for banking, and for utilities bills).

Sales receipts

Sales receipts are used to collate and record customer transactions and to process payments. They also provide certain information. The restaurant sales receipt is used to keep track of customer ordering and dining experiences. The order is entered on the point-of-sale system either manually, or digitally through an app (i.e. the server might use a phone or tablet to take the order). The POS system will use a database that stores menu items and prices. And the makeover receipt shows all items and client services details. These sales receipts make it easier for staff to make my life. The customers also get a receipt which meets the legal requirements as a tax invoice.

Sumo Burgers				
7a Station Steet Moonee Junction 3052				
03 992 1520				
www.sumoburgers.com.au				
Table	Diners	Server	Time	Time out
4	2	Sam	12:00pm	1:57pm
Menu Item		Qty	Price	Total
Yokuzuna		1	\$19.95	\$19.95
Ozeki		1	\$15.95	\$15.90
Judo fries		2	\$8.00	\$16.00
Dojo rings		2	\$7.50	\$15.00
Diet Coke		2	\$4.50	\$9.00
Soy shake		1	\$8.00	\$8.00
Corkage		0	nil	nil
GST				\$7.22
Total				\$83.85
Paid by:		Visa	**** 2159	\$83.85
24/4/2019				
Note: All prices are GST Inclusive.				
This receipt acts as a tax invoice.				

Thrunk & Schtenier's Male Makeovers		
Crafting Man from Beast for over 30 years		
Stylist: Man		31/10/2019
Client: Glen Elver		11am-2pm
Treatment: Le...		Fee:
Nail grinding	- Deluxe	\$40
Smile bleaching	- Radiant +4	\$60
Hair straightening	- Flatchat	\$80
Back wax	- Intensive III	\$100
Facial	- Abrayso B	\$70
Spray tan	- Supra	\$100
Consultation:		\$450.00
School formal		\$45.00
teacher discount 10%:		
Total:		\$405.00
GST:		\$40.50
Total with GST:		\$444.50
Paid by cash:		\$444.50
Balance:		\$0
Thrunk & Schtenier's Male Makeovers		
666 Mockingbird Lane, Addamstown, 3159		
0466 266 36666		
www.thrunk&schteniers.com		
This receipt acts as a tax invoice.		

Sales receipts and quotes A

1. Use the sample sales receipts on p.102 to list the main types of numerical and other information that is shown.
2. Obtain 2 sales receipts and assess these for the clarity of information shown.
3. Assume you are running a micro business. Develop a sample sales receipt for a transaction for the types of goods or services that you would be offering.
4. Use the sample quote below to list the main types of numerical and other information that it shows.
5. Obtain a quote and assess this for the clarity of information shown.
6. Assume you are running a micro business. Develop a quote for the types of goods or services that you would be offering.

Preview

Quotes

Many businesses have to prepare quotes, especially those that do practical tasks, i.e. tradies, carpenters, builders, gardeners and other similar services.

Quotes are used to estimate what a job might cost, the materials needed and the time it might take to complete the job (labour time). This gives the potential customer a guide to the estimated, or even actual price.

Becoming good at quoting takes experience.

If a person over-quotes they might not get the 'job'.

And if they under-quote they may not be able to do the job for the amount they promised!

Sometimes quotes might include a % allowance for variation from the original price; due to price changes or other problems occurring.

Vincent's Paintngogh Why despair - expression is our flair. 250 Service Lane, Lower Yirra 3195 0411 026 02636	
Request for Quotation:	82
Date:	April 18 2019
By:	Henry Gorgon
For:	House Renovator
Address:	122 Auburn Way, Moonee Junction, 3125
Clean and strip exterior	\$1400
Prep boards, windows & gutters	\$800
Weatherproof undercoat	\$250
Exterior gully lines - pink	\$600
Exterior metal 1 litres purple	\$200
Wash dis...	\$100
Painting labour & callout 40 hours	\$2000
Note: This quote is valid for 30 days. Price is correct subject to no unreasonable occurrences. Ask us about pensioner discount. A 25% deposit is required on acceptance of this quotation and to be paid by direct debit.	
Total	\$5350
Note: All quoted prices include GST. www.vincentspaintngogh.com	

4.13 Financial Documents

B Purchase orders and invoices

1. What are the differences between purchase orders and invoices; and what is the relationship between these 2 types of financial documents?
2. When might you be likely to come into contact with each of these financial documents? Use examples to explain.
3. Use the sample purchase order and invoice below to list the main types of numerical and other information that is shown.
4. Obtain a purchase order and an invoice (these don't have to be 2 sides of the same transaction) and assess these for the clarity of information shown.
5. Assume you are running a micro business. Develop a sample purchase order and a sample invoice for a transaction for the types of goods or services that you would be offering.

Preview

Purchase order and invoice

A purchase order is a request to buy. These are used a lot for B2B transactions. Many businesses cannot process orders unless an official purchase order is generated. This authorises someone to order or buy goods or services.

A purchase order will include information such as name, address, products, quantities, expected price, GST etc. from the buyer's (purchaser) point-of-view. The seller will generate an invoice to go out with the order. The invoice includes purchaser account details, product information, price, GST etc. and payment terms from the seller's (supplier) point-of-view.

Here is a purchase order from a bakery and the corresponding invoice from the wholesale supplier.

Finnegans Bakery For your daily bread and more 24a Station Avenue, Yinnamoon 3194 M: 0411 0912 89256 ABN: 21 2121 21 236			Ulysses Wholesale Tax Invoice Ulysses Wholesale 1/17 Kent Way Dovetown 3172 ABN: 21 2121 21 236 per: Sam Finnegan del: Shainia Joyce				
Purchase order: PO705 Date: 12 Oct 2019			Invoice: 201486 Date: 13 Oct 2019				
Qty	Item	Total	Qty	Product	Tax	Price	Total
3	x 20 kg flour - White		3	W10k	GST-Free	60	180
1	x 20 kg flour - Wholemeal		1	F12	GST-Free	80	80
10	x 1 doz free range eggs		10	F12	GST-Free	4	40
10	x 2 litre milk		10	MIL 2L	GST-Free	2	20
5	x 10 kg Sugar - white		5	SUG W10k	GST-Free	10	50
5	x 2 kg butter - salted		5	BUT S2k	GST-Free	2	10
			1	Free delivery	na		0
Total approx. \$ 400			PO: PO705 Total \$ 380				
Includes GST of: \$ 0			Includes GST of: \$ 0				
Ordered by : Sam Finnegan (Manager)			From: Ulysses Wholesale 1/17 Kent Way Dovetown 3172 www.ulysseswholesale.com.au orders@ulysseswholesale.com.au p: 03 9523 25416 f: 03 9523 25417				
Delivery instructions: To: Shainia Joyce (Kitchen manager) After 5am. Call kitchen using buzzer at back. www.finnegansbakery.com.au			Salesperson: Ronnie Marker Terms: 30 days				

- | | | |
|--------|-----------------------------|--------|
| Mar 1 | VISA EFTPOS - Coles Mt Liza | 56.00 |
| Mar 2 | VISA EFTPOS - Haggis Hoose | 17.50 |
| Mar 3 | Wacko Taco - Wages | 145.00 |
| Mar 8 | DD 25365964 - HiTunes | 50.00 |
| Mar 9 | VISA EFTPOS - Maisie's Hair | 75.00 |
| Mar 10 | Wacko Taco - Wages | 145.00 |
| Mar 12 | Brayshine ANZ - ATM | 100.00 |
| Mar 14 | VISA EFTPOS - El Munchos | 15.00 |
| Mar 17 | Wacko Taco - Wages | 145.00 |
| Mar 19 | VISA EFTPOS - Scoffburgers | 19.50 |
| Mar 21 | VISA EFTPOS - Pizza Glut | 17.50 |
| Mar 23 | Sunbrook NAB - ATM | 100.00 |
| Mar 24 | Wacko Taco - Wages | 290.00 |
| Mar 26 | VISA EFTPOS - McJaks | 11.00 |
| Mar 28 | DD 2175268 - NetStan | 20.00 |
| Mar 29 | Non-bank ATM 758-259 | 100.00 |
| Mar 29 | Non-bank ATM fee | 3.00 |
| Mar 31 | Wacko Taco - Wages | 222.50 |



Preview

Sample:

Do Not

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31 MAR	ACCOUNT SERVICE FEE	10.00
TOTAL AT END OF PAGE		
TOTALS AT END OF PERIOD		

4.15 Financial Documents

D Account statements and bills

1. What are the most important examples of numerical and other information that a person needs to interpret and analyse on an account statement or bill? Why?
2. Develop 5-8 short sentences that explain the usage costs and patterns shown by the information on the bill below. Use numbers in support.
3. How does this electricity bill summary both resemble, and differ from, your own household's electricity bill. Why so?
4. Electricity bills are one of the major household expenses, and prices and charges keep rising every year.
 - a. Estimate and/or calculate your household's electricity bill as a weekly amount and also a proportion of the household weekly budget.
 - b. Research ways to reduce electricity consumption. Make 3-5 key recommendations about how to achieve this.
 - c. Estimate potential energy savings from reducing electricity consumption.
 - d. Estimate potential money savings from reducing electricity consumption.

Preview

Sample:

Do Not

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ENERGY ON Get it to cash
Inquiries: 13 11 11 Fax: 13 11 11 2
Website: www.energyon.com.au

Lindsay Noone
17 Through Road
Croywood Vic 3546

Your electricity bill
Service address 17 Through Road Croywood Vic 3546

ACCOUNT DETAILS	DUE DATE	AMOUNT DUE
Account Number 222 222 222 Tax invoice 91 93 56 78 Issue date: 12 Apr 20 Total amount due: See Account summary	12 May 20 Direct debit: 12 May 20	\$440.89

ADJUSTMENT	USAGE STATEMENT																	
Direct debit discount (2%)	<table border="0"> <tr> <td>Average cost per day</td> <td>\$4.90</td> <td rowspan="2">19% increase in usage since last year</td> </tr> <tr> <td>Average daily usage</td> <td>14.4 kWh</td> </tr> <tr> <td></td> <td>Same time last year</td> <td>12.1 kWh</td> </tr> <tr> <td></td> <td>Indicative greenhouse gas emissions</td> <td>1.9 tonnes</td> </tr> <tr> <td></td> <td>Same time last year</td> <td>1.1 tonnes</td> </tr> <tr> <td></td> <td>Saved with green power</td> <td>n/a</td> </tr> </table>	Average cost per day	\$4.90	19% increase in usage since last year	Average daily usage	14.4 kWh		Same time last year	12.1 kWh		Indicative greenhouse gas emissions	1.9 tonnes		Same time last year	1.1 tonnes		Saved with green power	n/a
Average cost per day	\$4.90	19% increase in usage since last year																
Average daily usage	14.4 kWh																	
	Same time last year	12.1 kWh																
	Indicative greenhouse gas emissions	1.9 tonnes																
	Same time last year	1.1 tonnes																
	Saved with green power	n/a																

HOW TO PAY

DIRECT DEBIT Details specific to the biller and the account	CREDIT CARD Details specific to the biller and the account	IN PERSON & MAIL Details specific to the biller and the account	TELEPHONE & BPAY Details specific to the biller and the account
--	---	--	--



Investigate 2 different personal financial documents and 2 different work-related financial documents. These can be in hard copy or digital form.

1. Explain the purpose of each financial document and how it is issued and used.
2. Identify, interpret and explain the financial information on each document using clear and concise statements, using numeracy information where appropriate.
3. Discuss the importance of each document for your personal and work-related financial literacy beyond Year 12, and into your future.

Financial document type:	Issued by:	Time period:
Customer/client details:	Business/issuer details:	
Purpose:	Summary description:	
Numerical information:	Importance/action required:	
Numerical information:	Importance/action required:	
Numerical information:	Importance/action required:	
Numerical information:	Importance/action required:	
Numerical information:	Importance/action required:	
Numerical information:	Importance/action required:	
Numerical information:	Importance/action required:	
Other important information/points to consider?		
Evaluate the clarity and usefulness of the information.		

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4.17 Managing Your Spending

Money matters

As you start to move into financial independence you will have to develop tools, strategies and even an action plan to manage your spending.

Of course a budget is a good way to help estimate your planned income and expenditure, but a budget is of limited use if you don't actually stick to it.

When you start working you will earn an income. However, apart from working more hours (and getting overtime if applicable), or getting a higher paid job (which will happen in time over the course of your career), you will find that you can't do much about your income level. That is basically in the hands of someone else.

However, your own personal expenditure is within your **locus of control**. You decide what to spend your money on. Your spending patterns are based on your own decision-making. Of course you know that moving out of home or buying a car are both very costly decisions. And these are decisions that are going to result in you having financial obligations week after week for the remainder of your life. Generally these are financial obligations that must be met before any other spending. And that includes your own discretionary spending on social activities, treats or new clothing!



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- ✗ Don't use plastic for all transactions. It makes it harder to keep track of your spending.
- ✗ Don't overuse credit. You'll be working to pay for what you have already spent!
- ✗ Don't buy expensive items until your employment is secured. If you lose your job, how are you going to pay off the loan for your car!
- ✗ Don't use 'payday' and instant loans. They have fees and costs that mean you're usually paying back almost twice what you borrowed.
- ✗ Don't borrow 'long' to buy 'short'. i.e. Using a personal loan or a rolling credit card for a holiday means that you could be paying for your 2-week suntan for 5 years or more.
- ✗ Don't buy things you don't need. Most people have too much of what they don't need. Ask yourself? "Do I need this and do I need the debt!"
- ✗ Don't gamble to win. Gambling is designed to make you lose. That's how the gaming businesses make their profits - by you losing!
- ✓ Arrange direct debits for essential items, such as loan repayments and bills.
- ✓ Use cash for things for yourself. When you run out of cash, you can't buy any more stuff.
- ✓ Used credit sparingly and only if absolutely necessary.
- ✓ Pay back your credit card and other debts as soon as you can.
- ✓ Always pay back more than your credit card minimum balance (if a minimum is required).
- ✓ Go without luxuries to pay off debt, which reduces interest, and means more luxuries for you a little bit later!
- ✓ Save for expensive items.
- ✓ Go without if you don't need something you can't afford. Who are you trying to impress - or fool?
- ✓ Get financial advice and help. It's often free from government and community agencies. Avoid financial advice from organisations trying to sell you a product.

NUM
SUPER
SKILLS

1. For each of these situations outline honestly how you handle these, or how you are likely to handle these in the near future. Add 2 more of your own.
2. Need to improve? In the final column, explain actions you can take to improve your financial management skills.

Situation	My situation	What can I do about this?
Using credit cards regularly.		
Paying bills by borrowing.		
Paying off credit card debt.		
Having job security and a steady income		
Buying things I don't need.		
Using plastic rather than cash.		
Buying online.		
Spending my pay before I have earned it		
Paying off things I no longer like, use or have		
Borrowing for luxuries and things I don't need.		
Gambling!!!		
Having a budget.		
Accessing free and sound financial advice and support.		

3. Ever watched *Extreme Cheapskates*? If not, you're in for a real treat. Watch some episodes online and discuss how these ultra-misers save money. Is there anything you can learn from their approaches?



4.19 Managing Credit

Credit

Credit can be useful, but credit can be a trap: **because credit = debt**.

Increasingly people are turning to credit to buy the things they can't afford to buy right now. Many of their credit-based purchases are for luxuries or 'wants'.

One of the most shocking emerging socio-economic problems is the amount of debt being accumulated and carried by young people, including university and TAFE fees, personal loans for cars, credit card debt, mobile phone debt, 'interest-free loan' debt and of course 'payday' or instant loan debt.

Credit is often advertised or sold as 'easy money'. Now you can get an instant or **payday loan** approved over the internet in just one hour. And many shoppers are turning to methods, such as AfterPay to buy now and pay later.

But never forget. The other side of credit is debt. And with debt comes interest on that debt. And if you don't reduce your debt then you don't reduce the interest you have to pay. And then you will also pay interest on interest. And then interest on interest on interest. And by then you're really so deep you're going to find yourself in big financial trouble.

So is credit easy money? Read on! There are six main types of personal credit finance available in Australia. You might have investigated these at Intermediate level but now it is time to apply your numeracy and Senior Numeracy skills to better manage credit, and to avoid the pitfalls associated with debt. This type of financial literacy is all about minimising the risks associated with credit!

Image: kostsov/
iStockThinkstock

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- ⇒ People can take out a long-term credit contract called a mortgage or housing loan to buy a house (and land).
- ⇒ The term mortgage refers to the right of the lender to take possession of the property in the case of default. (Some people say that the 'bank' still 'owns' their home until the entire loan is paid off).
- ⇒ Home loan mortgages are normally taken out over 15–30 years. Mortgages are a pretty good use of credit because the value of the house and land will usually go up in the long-term.
- ⇒ Borrowers actually gain utility (by living in the house) while building an investment from the value of the house increasing (but more accurately the value of the land increasing).
- ⇒ Younger people are increasingly over-borrowing using a deposit that is too small, because they are not saving enough for buying. They are buying houses that are too expensive for a first-home buyer, thereby suffering mortgage stress for 25 years or more; or even defaulting on their loan, losing their houses.
- ⇒ With a default, many borrowers find that their house is now actually worth less than when they bought it, especially new house and land packages. So they end up in deeper financial trouble, with debt and without their house.

2. Personal loans

- ⇒ People often use credit contracts, such as personal loans to buy cars, household items, holidays, weddings and big-ticket items. The loan is repaid with regular repayments, including interest, over a period of perhaps 3-5 years.
- ⇒ It is a mistake to use personal loans to buy luxuries that are consumed immediately, such as holidays and electricals that date quickly. e.g. A holiday can = 2 weeks of enjoyment but paid for over 5 years.
- ⇒ It is better to save up for a holiday! (I won't mention that borrowing to buy engagement rings is a pain for a wedding & honeymoon!)

3. Credit cards

- ⇒ People use the flexible credit offered by credit cards to buy groceries, personal items, consumer items, entertainment and gifts. Credit cards can also be used for emergencies, such as car repairs and medical bills.
- ⇒ But using credit cards comes at a high price. Credit cards are handy as long as you pay off your debt before the interest-free period expires. Otherwise you could be up for a BIG interest bill!
- ⇒ Look ahead. If you can't afford to pay for an item within one month then you really must reconsider whether you need to buy. Interest accrues quickly.

Beware. If you are using credit cards to pay bills, then you are already sliding into financial trouble. Seek help immediately.

4. Interest-free purchases

- ⇒ Interest-free purchase periods are often offered by retailers to purchasers of household goods, electricals and other big ticket items.
- ⇒ The buyer usually enters into a finance agreement with a third-party lender and/or receives a 'store credit card'.
- ⇒ If the purchaser pays back the 'loan' within the interest-free period then no interest is charged. However, there is likely to be substantial fees. And many people use their 'card' to buy even more stuff, accumulating even more debt!
- ⇒ However, if the 'loan' is not paid off within the specified time then the purchaser is usually up for very high interest charges.

Beware: The recommended minimum monthly repayment amount is not likely to pay off the purchase price within the specified time.

5. Payday/instant loans

- ⇒ This short-term form of credit is basically a cash advance.
- ⇒ They are advertised as being quick and easy and usually feature 'fun' types of advertising, such as man in a tuxedo saying 'buy a suit or someone borrowing a buy a cup of coffee for a hot date!'
- ⇒ There are government regulations that cap the fees and charges related to these types of loans, but they are still very high.

Beware: If you are considering this type of credit then the best advice is: DON'T. You are already experiencing financial difficulties. Financial help is available free. Cash advances are not!

Image adapted from: ARudolf/iStock/Thinkstock

6. Digital 'lay-by'

- ⇒ This is one of the fastest growing sources of 'credit' for consumers in Australia. Key providers include *AfterPay*, *Zip Pay* and others.
- ⇒ Technically this is not a form of credit; it is an agreement to pay off an item over a number of instalments, ie. buy-now pay-later. You get to use the service, or take the item home straight away. But if you miss your repayments you pay fees!

This source of 'credit' is causing severe financial trouble for people aged 18-35 and for people on low incomes.



Preview
Sample:
Do Not
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4.21 Managing Credit

Principal and interest

All loans have a principal amount and of course an interest amount (and various fees). The principal simply refers to the amount borrowed. For example, for a home loan of \$450,000 the principal is \$450,000. For a personal loan of \$20,000 for a car the principal is \$20,000. And for a credit card purchase of \$800 then that adds \$800 to the 'principal'.

When you borrow you agree to repay the principal over a certain amount of time. For example, 25 years for a home loan, 5 years for a personal loan, or within a certain number of days (say 28) for a credit card. **But note: Credit cards are extremely unlikely to have an interest-free period for cash advances!**

All loans attract an interest charge. This is how banks and financial institutions make some of their money. They don't hand out money willy nilly out of the goodness of their heart and trust you to pay it back when you feel like it!

Loans are structured so that interest is charged on the principal amount that is borrowed, as well as on any interest accumulated on that principal. Loans use compound interest - which can really add up! So over the life of a loan, it is important to try and pay your loan down as quickly as you are able, then use your own interest on interest, as well as interest on the principal. And that's why so many people get into trouble with credit cards. They never pay off their purchases, let alone the interest on these purchases.

Preview Sample:

Loan repayment calculator

The formula to calculate periodic loan repayment amount is:

$$P = \frac{PV \cdot r}{1 - (1 - r)^{-n}}$$

P = Loan repayment period amount you are calculating.

PV = Present value (principal amount).

r = Interest rate per period (i.e. 12% would be 0.1 for monthly repayments).

n = Number of payment periods per unit of time (i.e. monthly would be 12 per year, fortnightly would be 26 per year).

ASIC's online loan calculator is the best calculator tool to use. You don't need any others (especially 'commercially provided' loan calculators).

www.moneysmart.gov.au/tools-and-resources/calculators-and-apps



Do Not Copy

A Loan repayments

Use ASIC's money start calculators for the following situations.

i. Loan \$5,000 15% interest rate Repayments monthly	ii. Loan \$5,000 15% interest rate Repayments fortnightly
iii. Loan \$10,000 20% interest rate Repayments fortnightly	iv. Loan \$10,000 18% interest rate Repayments fortnightly

Investigating credit B

1. Work through the case studies below using the online calculators available at ASIC: www.moneysmart.gov.au

1. Lanny gets a credit card at 18 with a \$2,000 limit (and 18% interest rate). He only wants the card to buy one thing and he goes out that day and buys a new SmartWatch and accessories for \$2000. He has a job and plans to pay this off over time.

On his first statement he receives a notice of his balance, \$2,000 and a request to make a minimum payment of \$40 which he pays within the time period specified.

Lanny is quite financially disciplined and he doesn't use his card again. On his next statement he receives a notice of his balance.

Opening balance \$1,960

Add purchases \$0

Add interest charges \$29.40

Closing balance \$1,979.40

Minimum payment due \$39.59

- What will happen if Lanny continues to only pay the minimum monthly payment due? Use the credit card calculator for this.
- What happens if he increases his minimum monthly payment to \$60?
- What about \$100 and what about \$200?
- What would you recommend?
- Do some research and find alternative sources of finance for Lanny.

2. Tregan 18, rides her scooter (an 18th birthday present) 30 minutes to and from her job as a casual animal attendant. She gets side-swiped, slides on the road and her uninsured scooter is written off. Because she wasn't wearing protective riding gear, she loses a lot of skin and needs to have gravel removed from her wounds. Without private health insurance (but still with a pretty good Medicare system in Australia) she gets treated well but is out of pocket \$800 for various medical expenses and prescriptions.

Tregan sees an ad for a 'Payday lender' online and borrows \$800 over 12 months.

The establishment fee for the loan is \$160 (this is set at 20% of the loan amount).

She will pay monthly 'interest' fees (they are set at 4% of the total loan amount).

- How much will her fortnightly repayments be?
- Calculate the total 'interest' and fee amounts that Tregan will repay over life of the loan. Calculate the % interest and fees on the loan. (Total interest and fees/total loan amount) x 100%.
- Find out what happens if Tregan defaults on her loan.
- Do some research and find alternative sources of finance for Tregan.

- Investigate the costs, terms and conditions associated with an example of each of a personal loan, credit card, 'interest-free' loan and instant loan.
- Use the ASIC calculators to assist you to set up a spreadsheet comparing the costs associated with each type of credit.
- Calculate effective annual interest rates associated with using these types of credit.
- Vary the repayment amounts and repayment times and see the difference that this makes. Show this information in the spreadsheet.
- Develop comparison graphs to illustrate the differences.
- Prepare a report to the class that presents a series of guidelines to assist young people to effectively use credit and minimise debt. You could create an infographic to present your findings.

Extension

AfterPay and other similar digital lay-by methods are the fastest growing types of 'credit' for young people. What are the advantages and disadvantages of these types of 'credit'.

Preview
Sample:
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4.23 Managing Credit

C Credit cards and loans



For this applied task you are required to compare the cost of credit across a range of different borrowing options. It's very likely that this task will also form part of your assessment for this Learning Outcome (LO2). Your teacher might instruct you to complete this investigation in pairs.



Part A: Credit Cards

Research the interest payable, fees and other conditions related to 3 different credit cards from 3 different financial institutions. Choose a card from one of the 'Big 4' banks, a credit card from another financial institution, and a credit card from a financial provider that says it is aimed at younger people.

Set your results up in a table like the one below. Use this table to collect and draft your information. You should also use a spreadsheet to make comparisons. It is a good idea to use a good calculator for the AS, which is to be used.

Card feature	Card 1	Card 2	Card 3
Provided by...			
Name of 'card'			
Annual fee			
Purchase interest rate			
Interest-free period			
Cash advance interest rate			
Other fees			
Spending limits			
Other conditions and information			
Scenario: Total interest? Total amount repaid? Time taken?	Put \$2,000 on your new credit card. Pay back \$100 a month	Put \$2,000 on your new credit card. Pay back \$100 a month	Put \$2,000 on your new credit card. Pay back \$100 a month

Preview
Sample:
Do Not
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Part B: Personal Loans

Research the interest payable, fees and other conditions related to 3 different personal loan options from 3 different financial institutions. Choose a personal loan from one of the 'Big 4' banks, a personal loan from another financial institution, and a personal loan from a financial provider that says it is aimed at younger people.

Set your results up in a table like the one below. Use this table to collect and draft your information. You should also use a spreadsheet to make comparisons. It is a good idea to use the loan calculators on the ASIC website to help you.

Loan feature	Loan 1	Loan 2	Loan 3
<i>Provided by...</i>			
<i>Name of 'loan'</i>			
<i>Loan period</i>			
<i>Interest rate: & fixed or variable?</i>			
<i>Set-up fee</i>			
<i>Ongoing fees</i>			
<i>Other fees</i>			
<i>Security needed?</i>			
<i>Other conditions and information</i>			
<i>Fortnightly repayment?</i>	Borrow \$2,000 over 1 year. Fortnightly repayments.	Borrow \$2,000 over 1 year. Fortnightly repayments.	Borrow \$2,000 over 1 year. Fortnightly repayments.
<i>Total interest?</i>			
<i>Total amount repaid?</i>			
<i>Monthly repayment?</i>	Borrow \$10,000 over 5 years. Monthly repayments.	Borrow \$10,000 over 5 years. Monthly repayments.	Borrow \$10,000 over 5 years. Monthly repayments.
<i>Total interest?</i>			
<i>Total amount repaid?</i>			

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4.25 Assessment Task

AT4 Financial Literacy



Overview

This assessment task has 3 parts and you are required to complete each of these.

Part A: Group Budget

Prepare a detailed budget for a group activity. This might be an activity related to a group PDS or WRS project or activity.

PDS
WRS

Alternatively you might prepare a group budget for a simulated situation, such as managing finances for a sharehouse next year, or going into partnership with a friend to start up a micro business.

1. Identify and calculate your key **income** sources and **expenditure** categories.
2. Prepare a 'before' budget.
3. Prepare an 'after' budget and calculate variations.
4. Make a list of **recommendations** based on the data and numerical information.
5. Prepare and present a report communicating your **budgeting process** and **success in budgeting**.


Part B: Financial Documents

1. Identify and interpret the numerical information from a range of **financial documents** (at least 3) related to your personal life.
2. Interpret and communicate the **key numerical information** using clear, concise statements.
3. Identify and calculate information from **pay slips** and **timesheets**.
4. Summarise the **key numerical information** using clear, concise statements.
5. Prepare and present a report to communicate **key recommendations** to assist young people to use financial documents, pay slips and timesheets more effectively.

Part C: Cost of borrowing

1. Research **interest rates**, fees and other requirements related to **credit cards** and **personal loans**.
2. Compare **interest rates** and **amounts payable** for a **credit card** as compared to a **personal loan** across a number of **different credit providers**.
3. Make a list of **recommendations** based on the data and numerical information.
4. Prepare and present a report to communicate **key recommendations** about the effective use of **credit cards** and **personal loans** for **loan amounts** of \$1,000, \$5,000 and \$10,000.

Add other information, notes, key dates, etc..

Name:		Project dates:			
Topic:					
Tasks - AT4: Financial Literacy	Re-quired	Due by	Done	Teacher initials	
Part A: Group Budget					
Negotiate your budget focus with your teacher.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
1. Identify and calculate income and expenditures.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
2. Prepare 'before' budget.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
3. Prepare 'after' budget, and calculate variations.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
4. Make recommendations based on the information.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
5. Report on your budgeting process and success.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Part B: Financial Documents					
1. Interpret personal financial documents information.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
2. Communicate key numerical information.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
3. Calculate information from pay slips and timesheets.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
4. Summarise key numerical information.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
5. Report to communicate key recommendations.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Part C: Cost of borrowing					
1. Research loan and credit card interest rates and fees.	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
2. Compare interest rates and amounts payable.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
3. Make recommendations using data and numerical info..	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
4. Report to communicate key recommendations.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Prepare and present a report.					
⇒ Prepare your reports using feedback.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
⇒ Present your reports. (If required) 	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	

Additional information:

Signed: _____

Date: _____

4.27 Self-Reflection

Self-Reflection Pro-Forma

Which numeracy skills did I develop during this unit?

→ _____

→ _____

→ _____

How have the skills of numeracy helped improve my personal life?

→ _____

→ _____

How have the skills of numeracy helped my development of work-related skills?

→ _____

→ _____

How would I rate my performance (use a circle) in developing my numeracy skills this unit?

0 not shown	1 low	2 reasonable	3 good	4 very good	5 excellent
----------------	----------	-----------------	-----------	----------------	----------------

What were my strongest areas of performance and what should I work on improving?

My strongest topics/skills were	But need to improve my skills in:

Signed: _____ Date: _____

Teacher initials: _____ Date: _____

Showing The Way

5

Contents

5.01 Using Maps.....	120	5.15 Assessment Task.....	134
5.05 Giving Directions.....	124		
5.11 Apps & Maps.....	130		

Activities 5: Showing The Way	p.	Due date/Done?	Comment
5.01A Maps	120		
5.02B Compass directions	121		
5.03C Coordinate	122		
5.04D Making and using maps	123		
5.05A Giving instructions			
5.07B Drawing directions	126		
5.09C What would you do?	128		
5.11A Apps v Maps	130		
5.12B Old school v Nu skUL	131		
5.13C Get out and fill up	132		
AT5 Old school vs Nu skUL battle	134-135		
5.16 Numeracy language	136		

Comments:

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5.01 Using Maps

Which way do I go?

Do you know where you are going? And more importantly do you know how to get there?

We live in a big complex world and we rely on maps to help us navigate between locations. These maps include macro maps, such as geographical maps, street directories and digital maps, all the way through to more micro maps, such as retail layout maps, seating plans and even circuit diagrams.

The past decade has seen the growing use of apps, satellite navigation systems and GPS to help us navigate the world. But is this really helping us?

🧠 Is it better to work out where to go for yourself, or be told where to go by someone, or increasingly, something else?



Image: s-c-s
iStock/Thinkstock

A Maps

🧠 Describe examples of when you use maps and for what purposes. Also, state the type of maps you use.

Compass directions B

1. Mark the correct points on the compass below and/or identify the correct compass directions.
2. The needle on a compass always points north. But how do you use a compass to navigate? Research this online and summarise in your workbooks.



i. West 	ii. South-East 	iii. North-West
iii. Nor Nor East 	v. SSW 	vi. ENE
vii. _____ 	ii. _____ 	i. _____
x. In degrees _____ 	xi. In degrees _____ 	xii. In degrees _____

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5.03 Using Maps

Mapping features

⇒ **Directions:** North, south, east and west (90°). Or N, NE, E, SE, S, SW, W, NW (45°). Also NNE, NSE, SSW and 13 more (22.5°). Directions may often be arbitrary such as left, right, around the corner, over there, three blocks, after the hill, etc..

⇒ **Scale:** A scale measures a ratio, such as $1\text{cm} = 1\text{km}$ and might be written as $1:100000$ (e.g. $1\text{cm} = 1\text{km}$). Scale shows an allotted distance on a map corresponding with a distance in real life. Scale enables us to make a visual estimate of travel distance and time and to get our spatial bearings. (However, not all maps are to scale).

Scale = $1:100000$

$1\text{ cm} = 1\text{ km}$



⇒ **Pathways:** Include the ways or routes to get from 'point A' to 'point B'. On GPS, street directories and maps, pathways might include roads, streets, highways, freeways and other methods of travel. Pathways might also include public transport routes, pedestrian traffic areas, waterways, terminals and exchanges (e.g. airports) and so on.

⇒ **Features and Landmarks:** On micro maps, features include places of interest, government buildings and services, emergency facilities, gas stations, schools, signs, landmarks and other distinguishing and useful features. Features on micro maps might include specific locations and exact replication to scale.

⇒ **Coordinates:** Maps, especially digital maps, such as Sat Navs, make use of global positioning coordinates (GPS) that are triangulated from satellite systems in space. These coordinates correspond to latitude - horizontal 'bands' around the earth; and longitude - vertical 'lanes' around the earth (because the earth is a globe, spherical).

Geographic coordinates are most often measured in:

□ degrees, minutes and seconds e.g. $37^\circ 49' 4.07''\text{ S } 144^\circ 58' 7.37''\text{ E}$

□ decimal degrees e.g. $37.8180^\circ\text{ S } 144.9691^\circ\text{ E}$

So what is located at these coordinates?

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C Coordinates

1. Find out the coordinates for the following. Add 3 more of your own choosing.

Your home	Your school	Your nearest train station
The MCG	The Sydney Opera House	Disneyland

Applied

Your mate Billy Bignoter is always cracking on about how he much travels the world and posting pictures on Instagram. He just posted a picture of The Eiffel Tower with the caption, "Deal with it plebs, cry me a river if you're stuck at home." However, a mutual friend has commented saying, "Nice 'travel' pic Billy, how's the French Fries at... Melton Maccas. $37.68756\text{ S } 144.56747\text{ E}$!"

So what's going on?

Making and using maps D

1. You are required to create a map from your home to your workplace (or a work location you would like to be employed at).

Create your map 'from your head' without any research. Use large format paper or multimedia. Include:

- ☐ a suitable scale and directional guides
- ☐ 2 different pathways routes
- ☐ key landmarks and features
- ☐ appropriate directions
- ☐ estimated travel distances and times for relevant travel modes (at least 2 different)

Start planning and drawing here

Preview

Sample:

Do Not

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2. When you are finished compare your map to a digital map. Use the digital map to find out:

- ☐ the scale and directional guides
- ☐ 2 different pathways routes
- ☐ key landmarks and features
- ☐ appropriate directions
- ☐ estimated travel distances and times for relevant travel modes.



3. Comment on the similarities and differences between the 2 map formats. Which was better and more useful for the varied features. Explain why.

5.05 Giving Directions

Giving instructions

When someone asks you for directions you are taking responsibility for them arriving at their destination safely and quickly. You have to develop your instructions so that they can easily navigate to their required destination. This means that you have to use language that the traveller is likely to understand.

So consider, do they respond to directions, such as 'North', or 'SSW', or will they prefer 'left' or 'right'? Can they estimate distance, such as '400 metres'? Will they prefer time, 'about 5 minutes', or do they rely on landmarks, such as 'the church on the corner'? Do they think in general directives, such as 'around the corner', 'over there', or a 'little bit further', or do they respond to precise directives, such as 'veer to the left', 'at the 3rd exit', or take a 45° turn? Tough job - that's why people get lost!

Also bear in mind that:

- ⇒ the most direct route might not be the most practical
- ⇒ the most direct route might not be the quickest route
- ⇒ the most direct route might not be the safest route
- ⇒ the most direct route might not be the easiest to communicate, and
- ⇒ the route that is quickest, safest or easiest to communicate might not be the most practical for you, but it might be the most practical for a traveller following instructions.

A Giving instructions



LIT

Task: Record a set of verbal instructions for someone to follow to a place they are not likely to know, but which is familiar to you. Work in pairs.

1. Start at your school or your classroom.
2. Sketch a rough map for your own use. Use the scaled grid opposite.
3. Using this map, develop your instructions in your workbooks.
4. Communicate the instructions verbally to the traveller.
5. The recipient of instructions should listen and plot the route on their own map.
6. The recipient follows your verbal instructions and gives an improvement to their own map.
7. Swap over.
8. Record any issues, areas of improvement, etc..

Advice from teacher and important information including safety.

Name(s): _____

Map of: _____ Date: _____ Scale: 10mm: _____

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5.07 Giving Directions

Drawing maps

So how did you go at the verbal instructions activity? Some of you might have done quite well, especially if you have well-developed communication skills and a preference for an auditory learning style. However, some people will ask for a map to help them out because they would rather negotiate location visually.

Once again it is your responsibility to draw a useful and representative map to guide the traveller safely to their destination. Therefore, you have to design the map with the following practical features in mind.

- ⇒ The traveller needs to be able to read the map quickly and easily.
- ⇒ All key roads, turns and landmarks need to be clearly marked and easy to identify.
- ⇒ You might need two maps, a long-distance map showing the suggested major route, and then a short-distance map with exact directions that show how to get to a specific destination.
- ⇒ Directions need to be clear (N, S, E, W) and/or using left or right.
- ⇒ Long-distance maps should either be close to scale and show this scale; or they should have estimated distances and travel times.
- ⇒ Short-distance maps should be to scale and should show the scale.
- ⇒ A contact phone number can be included on the map to help the traveller.

B Drawing directions



LIT

Task: Work as a group of 4. Each of you will once again draw a map to help guide someone to a place they are not likely to know. Don't show each other!

But this time one of your team members (the speaker) will give verbal directions to someone else (traveller 1) based on your own map.

At the same time the other team member (the traveller 2) will try to get to the destination based just on your map.

1. Once again, start at your school or your classroom. Sketch a rough map for your own use. Use the scaled grid opposite.
2. Using this map, develop your instructions in the workbooks.
3. Give the instructions, but not a map, to the speaker. They'll work with traveller 1.
4. Give the map to traveller 2.
5. See how they go!
6. Swap over. Record any issues, areas of improvement, etc..

Why not strap a Go Pro on each traveller and then watch the outcomes back in class? Not only will it be instructive; it's probably going to be quite funny!

Advice from teacher and important information including safety

Name(s): _____

Map of: _____ Date: _____ Scale: 10mm: _____

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5.09 Giving Directions

C What would you do?



Sometimes we have to give people verbal instructions and directions which can result in a range of communication difficulties. Discuss these case studies and then provide verbal directions for each person. Why not role model these scenarios?

It's 5:30 and you are at work and a visually impaired guy comes into your workplace. Using a cane he approaches you and asks for directions to the nearest post box as his letter has to make the 6pm mail. He says that his phone has run out of charge so he can't get audio instructions.

1. What is the first thing you should ask him?

2. What else could you ask him?

3. List the verbal instructions you would give to help him find the post box in time.

4. How did you decide on what to include in these verbal instructions?

5. Now partner up. Blindfolded, but with someone to accompany you for safety, try these instructions out!

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Soon after, an anxious woman comes in carrying a petrol can and hands you a piece of paper with the nearest petrol station circled. She shrugs her shoulders and points to the paper and makes a please help me sign with her hands.

1. What is the first thing you should ask her?

She doesn't understand your question and replies in a language you don't understand.

2. What would you do next?

3. Draw an instructional map to help this woman find petrol.

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5. How did you decide on what to include in the visual map?

6. How would you communicate if you were out of petrol in a non-English speaking country? Is there any technology that might help you?

5.11 Apps & Maps

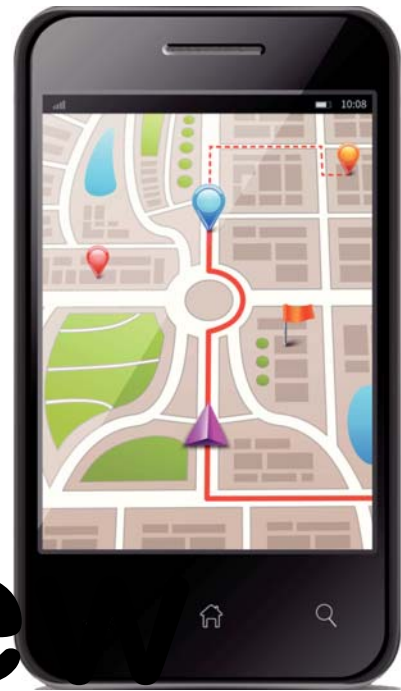
Maps v apps

Do you ever see people walking around streets while using their devices to find out where they are going? What do you think about them? Or is that you?

Mapping apps, GPS and other technological locators can provide enormous benefit for travellers, as well as for everyday people. They are very useful when one is lost, because they can show you, or even tell you where to go!

On the downside, screens can be too small, GPS can suggest routes that ignore local knowledge (which can increase travel time) and users seem to be dumbing down and becoming technologically dependant. People are even walking past destinations while looking at their phone, instead of just looking!

Paper maps and street directories can also be extremely useful in the right circumstances. Users can see a large area, instantly recognise features, and orient the map in the direction they are travelling. However, they can be too large, can date quickly, and can cause distractions when



"Where would you be without me?"

Image: Askold Romanov/
iStock/Thinkstock

A Apps v Maps

Outline the advantages and disadvantages that you experience when using 'printed maps', such as a street directory, as opposed to electronic maps, such as GPS or a phone app. Consider personal and work-related situations.

Personal situations		Work-related situations	
Example	Advantage/disadvantage	Example	Advantage/disadvantage

Which do you prefer, old school paper maps or new school digital maps; or even some other method of finding out where to go? Each can be useful in different situations. Which type of map (or method) would you use in the following situations and why? Can you foresee any problem arising from your choice? Explain carefully.

Situation	Method?	Why so?	Potential problems?
You have to travel to the CBD for a job interview at 10am on a Monday.			
You are meeting a friend outside their workplace; you've never been there before.			
You have to plan a short jog finishing back at your home.			
You want to hit all the bargain and retro shops in a hipster suburb on a day blip.			
You are planning a one-week road trip with friends, by car.			
You are planning a one-week road trip, alone, by car.			
You are planning a weekend of off-roading in the bush.			
You want to undertake a series of nature walks over a weekend.			
Going to a party in a seedy neighbourhood you exit the platform to a very dark street.			
You land at an airport in a foreign non-English speaking, major city.			
You get off the train in a foreign non-English speaking, rural village.			
You encounter an unexpected road block while driving and your Sat Nav isn't up-to-date.			

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5.13 Apps & Maps

C Get out and fill up

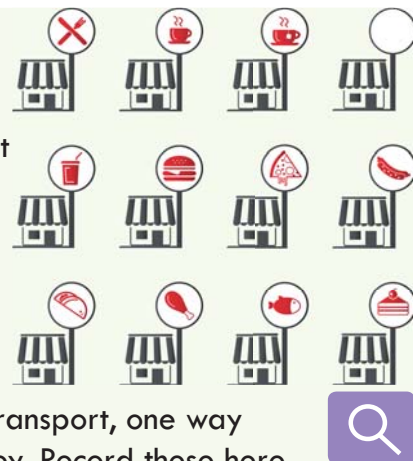
Image: Madedee/
iStock/Thinkstock

1. Plot all the outlets of your favourite fast food joint or another favourite destination on a map.

Choose a geographic boundary to work within, or set a limit to a manageable number of venues.

2. Starting from and finishing at your house or school, plot the most efficient route to visit them all. Choose a mode of transport, such as walking, bike, public transport, car or some other way of getting around.

Allow for time of day, traffic conditions, mode(s) of transport, one way streets or other features that might affect your journey. Record these here.



Preview

3. Using your preferred style of map, estimate the distance. Compare your estimates to the actual distance travelled recorded on a road meter, a fit tracker or a pedometer. Comment on the accuracy of your estimate versus the actual.

Sample:

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4. Using your preferred style of map, calculate the travel time. Compare your estimates to the actual time travelled as recorded on a timing device. Comment on the accuracy of your estimate versus the actual.

Copy

5. Estimate the time you will spend in each place. Did this change? Why or why not?

6. Pick up a souvenir from each destination visited.

Name(s): _____

Map of: _____ Date: _____ Scale: 10mm: _____

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5.15 Assessment Task

AT5 Old school vs Nu skUL battle



Overview

You are required to construct an old-school vs new-school battle to determine the relative effectiveness of different mapping methods.



Tasks

1. Working in groups choose a destination in consultation with your teacher.
2. Split your groups in half. One group will only use 'old school' technology to navigate to the destination. The other group will only use 'nu skUL' technology to navigate to the location.

Old-school group

3. Use a grid to make a detailed 'old school' map of the route. Choose a suitable scale and compass bearing.
4. Include any landmarks, roads, intersections and any other distinguishing features, prominently.
5. Estimate travel times and distances.
6. Test your route by travelling it using your map.
7. Time the travel and record any failures in the route or map - inaccuracies, failure to account for time of day, traffic, conditions, legibility of map, use of scale, etc..

Nu-school group

3. Use only 'nu skUL' technology to navigate to your destination.
4. Note any landmarks, roads, intersections and any other distinguishing features given by your technology.
5. Get estimates of travel time and distance from the technology.
6. Test your route by travelling it using digital maps.
7. Time the travel and record any failures in the technology - inaccuracies, failure to account for time of day, traffic, conditions, legibility of map, use of scale, etc..

Swap roles based on a new destination and repeat the tasks

8. In your groups, discuss the success or otherwise of 'old-school' vs 'nu skUL'. Report to the class.
9. Who or what is better suited to each method? Why/why not?
10. What improvements would you suggest and/or what advice would you give?

Image: AntonioGuillem/
iStock/Thinkstock



Name(s): _____

Map of: _____ Date: _____ Scale: 10mm: _____

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5.17 Numerical Language

When dealing with numerical skills related to **location (S5)** and **time (S6)** there are a number of key terms and phrases that you might hear and be expected to know. Provide a definition and outline how each relates to personal and work-related situations.

Term/phrase	Definition	Personal application	Work-related application
landmarks			
routes			
directions			
degrees			
scale			
GPS			
travel miles			
km/litre			
litres/km			
24-hour time			
GMT			
time zones			
duration			
productivity			

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Got The Time?

6

Contents

6.01 Time	138	6.13 Transport and Cost.....	150
6.05 Time - Duration	142	6.17 Future Travel	154
6.07 Time Zones.....	144	6.19 Assessment Task.....	156
6.09 Rates and Ratios.....	146	6.23 Self-Reflection.....	158

Activities 6: Got The Time?

	p.	Due date/Done?	Comment
6.01A It's about time	138		
6.02B Time will tell	139		
6.04C Calculating	141		
6.05A How long?	142		
6.08A Time zones	145		
6.10A Rates - Time and Distance	147		
6.11B Rates - Cooking	148		
6.12C Rates - Health & fitness	149		
6.14A Drive your dollars	151		
6.15B Moving about	152		
6.16C Travel costs	153		
6.17A In my future	154		
6.18B My transport costs	155		
AT6 Where, How and Why?	156-157		
6.21 Self-Reflection	158		

Comments:

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6.01 Time

Time

Time is an arbitrary construct which breaks life down into years, hours, minutes, seconds and so on. We use time to govern many facets of our personal, social and work-related lives.

People talk about 'making' time, 'juggling' time, 'losing' time, 'gaining' time, 'costing' time, 'biding' time, 'marking' time and various other ways of dealing with time in their lives.



Image: Kudryashka/
Depositphotos.com

- ⇒ Time is a counting tool. e.g. You can count how many minutes it takes you to get ready for work.
- ⇒ Time is also an estimating tool. e.g. You can estimate how long it should take you to make coffee or breakfast.
- ⇒ Time is also a measuring tool. e.g. You can measure how long it will take you to travel for a night out.
- ⇒ Time is also a costing tool, 'time is money'. e.g. You can measure how much labour work time is involved in doing a job for a customer or a client.

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A It's about time



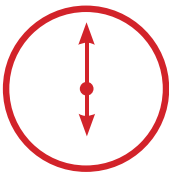

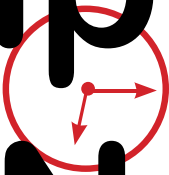

Use an example from your own experiences to explain the meaning of each of these time-related terms. Add 3 more of your own choosing

Term	Meaning	Your example
24-hour time		
analogue time		
taking your time		
costing time		
time as labour		

Time will tell B

People in certain situations and workers in varied occupations and industries, prefer and use different time methods for displaying time.

1. Complete the table as a refresher on identifying times using analogue and 24-hour time methods. (Don't forget about am and pm).

15:50	17:15	21:45	23:30
06:00	04:25	09:45	19:30
20:00	00:00	12:00	24:00
			

2. Outline different personal and work circumstances where a particular time method might be used. Why?

3. Which method do you prefer and use? Why so?

4. What about your classmates? Who is wearing an analogue watch? Do you know anyone who communicates using 24-hour time?

6.03 Time

Time travel

Time is one of the most important measures related to travel. We have to estimate travel times and plan our schedules to take account of these times.

We rely on the **timetables** and **schedules** of transport providers so that we can get on with our personal, social, school and work life.

We 'use' up time to travel to and from school and work. We 'spend' time waiting for a train to arrive. We 'lose' time if traffic is heavy. And we 'waste' time waiting for others - you know that friend who is always late!

It is also important that we understand different time zones, especially for international travel and for doing business globally. This involves an understanding of **time zones** (based on longitude) and **Greenwich Mean Time (GMT)**.

Airline tickets are always issued in the local time and date which means that sometimes you can travel 'back' in time; i.e. you arrive at your destination before you even leave your port of anyway. See if you can come up with an example of this.



Image: artisticco/Depositphotos.com

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Sample:
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i. Hours to minutes

To convert from hours to minutes we simply **multiply** the number of hours by 60. For example:

$$\Rightarrow 3 \text{ hours} = 3 \times 60 \text{ minutes} = 180 \text{ minutes.}$$

$$\Rightarrow 20 \text{ hours} = 20 \times 60 \text{ minutes} = 1,200 \text{ minutes}$$

$$\Rightarrow 2 \text{ and a half hours} = ? \text{ (So let's do the calculation)}$$

$$= 2 \times 60 \text{ minutes plus another half an hour}$$

$$= 120 \text{ minutes} + 30 \text{ minutes}$$

$$= 150 \text{ minutes}$$

ii. Minutes to hours

To convert from minutes to hours we perform a **division** calculation.

We divide the total minutes by 60 (which equals 1 full hour).

$$\Rightarrow 240 \text{ minutes} = 240 / 60 = 4 \text{ hours}$$

$$\Rightarrow 540 \text{ minutes} = 540 / 60 = 9 \text{ hours}$$

$$\Rightarrow 900 \text{ minutes} = 900 / 60 = 15 \text{ hours}$$

Minutes to hours (cont.)

With many time conversions we are likely to get a **remainder**, because few tasks take 'exact' hours to complete. For example:

$$\begin{aligned} \Rightarrow 150 \text{ minutes} &= 150 / 60 \\ &= 2 \text{ hours } 30 \text{ minutes (or } 2 \frac{1}{2} \text{ hrs).} \end{aligned}$$

iii. Adding time

To add time, we add the hours first and then we add the minutes. e.g.

$$\Rightarrow 1 \text{ hr } 30 \text{ mins} + 1 \text{ hr } 15 \text{ mins} = 2 \text{ hrs } 45 \text{ mins}$$

If the total minutes part of the answer is greater than 60 then that is a whole other hour. So we have to take 60 away from this 'minutes' total and add it back as 1 hour to the 'hours' part of the calculation.

$$\begin{aligned} \Rightarrow 1 \text{ hr } 30 \text{ mins} + 1 \text{ hr } 45 \text{ mins} \\ &= 2 \text{ hrs and } 75 \text{ mins} \\ &= 2 \text{ hrs and } (75 - 60 \text{ mins}) \\ &= (2 + 1 \text{ hrs}) \text{ and } 15 \text{ mins} \\ &= 3 \text{ hours and } 15 \text{ minutes} \end{aligned}$$

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Calculating time C

1. Convert the time for the following situations.

1 hour 50 in minutes	4 hours in minutes	7 hour 15 minutes in minutes	210 minutes in hours
4.5 hours in minutes	20 hours in minutes	72 hours in days	15 minutes in hours
7 minutes in seconds	2.5 minutes in seconds	10 mins & 45 seconds in seconds	1,019 seconds in minutes

2. Estimate and/or find out the travel time for the following situations.

Your home to CBD by car on a weekday for work	Your home to CBD by car on a Sunday night	Your home to CBD by a preferred two-wheeled public transport.	Your school to nearest train station (or bus for regional) by walking.
Melbourne to Perth direct flight.	London to Sydney direct flight.	Hong Kong to London flight with stopover.	Melbourne to Tokyo fastest flight.

3. Choose 6 activities that you regularly do in your personal life. For each activity:
- Estimate the time that the activity takes to complete.
 - Calculate this time in days, hours, in minutes and in seconds. For shorter activities you might need to use fractions and decimals, e.g. $1/16$ th of a day.
 - Identify any rates that apply to this activity, e.g. travel speeds.
 - Discuss whether anything associated with doing the activity 'wastes' time. e.g. Waiting for a friend to turn up who is always late.
 - Describe methods that you use (or could use) to improve the efficiency of this activity. Consider tasks that you could do concurrently, or perhaps how changing the order of doing tasks would make better use of your time.

6.05 Time - Duration

Elapsed time (duration)

Elapsed time, which is also called duration, indicates how much time has passed between one time and another.

For example, the elapsed time in 1 hour = 1 hour (or 60 minutes!). That's pretty straightforward! So therefore the elapsed time between 3pm and 4:00pm is 1 hour. Or the elapsed time between 6:45am and 7:45am is 60 minutes. There you go!

Elapsed time or duration is used to calculate how 'long' something takes. This is vital for personal situations, such as cooking, for transport and travel times, for work times and rosters, for task times or even for leisure times.

Sporting activities rely on elapsed time such as football, soccer, netball and rugby. The game time dictates how long the play goes for. Other sporting activities use duration (or how long) to record achievement, such as the 100m sprint, the 1,500m freestyle, the marathon and the 1000m cycling road time trial. Fastest wins!

We especially need to pay attention to elapsed time when working, when doing work tasks, in medical situations, when travelling and in many other personal and work activities. Duration might be a key safety issue in certain tasks.

One method to work out duration or elapsed time is by using a visual timeline. However, you should be able to work out elapsed time in your head; or on paper, or by using a calculator for more complex situations.

Preview:
Sample:

A How long?

Image: wickerwood / Depositphotos.com



Calculate how much elapsed time is represented by the clocks.

Image: BravissimoS / Depositphotos.com

Elapsed time (duration)

To calculate total **duration** in hours and minutes we need to see how much time has passed (or elapsed) between one period of time and another.

Some calculations are easy. e.g.

⇒ 3pm to 4pm = 1 hour (or 60 minutes).

⇒ 7:45pm to 8:30pm = 45 mins (15 mins to the end of the hour, plus another 30 mins).

⇒ 11:30pm to 2:30am = 3 hours (or 180 mins).

But some calculations are a bit harder. To calculate elapsed time we use 3 steps.

i. e.g. 5:15am to 7:50am (**later time minutes > than earlier time minutes**)

1. First you subtract the hours (later minus earlier).

= 7 - 5 (hours) = 2 hours

2. Then subtract the minutes (later minus earlier).

= 50 - 15 (mins) = 35 minutes

3. In this case (because the later minutes are higher (>) than the earlier minutes) you combine the answers as an addition.

= 2 hours plus 35 minutes

Note: If the earlier time starts as a '12'
e.g. 12:30am treat the 12 as a '0'.

ii. e.g. 7:45pm to 8:30pm (**later time minutes < than earlier time minutes**)

1. First you subtract the hours (later minus earlier).

= 8 - 7 (hours) = 1 hour

2. Then subtract the minutes (later minus earlier).

= 30 - 45 (mins) = -15 minutes

3. In this case (because the later minutes are smaller (<) than the earlier minutes) you combine the answers as a subtraction.

= 1 hour minus 15 minutes

= 45 minutes

Note: If the earlier time starts as a '12'
e.g. 12:30am treat the 12 as a '0'.

iii. e.g. 8:30am to 4:30pm (**later time crosses over am or pm**)

For times that cross over into am or pm use 3 steps.

1. Subtract earlier time from the next 12.

= 12:00am - 8:30am

= (12 - 8) hours 00 - 30 (minutes)

= 4 hours - 30 minutes

= 3 hours 30 mins

2. Add the time that has elapsed after the 12 (am or pm)
(This means that you are treating the 12 as '0').

= 4 hours 30 minutes

2. Add these 2 times together.

= 3 hours 30 mins plus 4 hours 30 mins

= 7 hours 60 mins

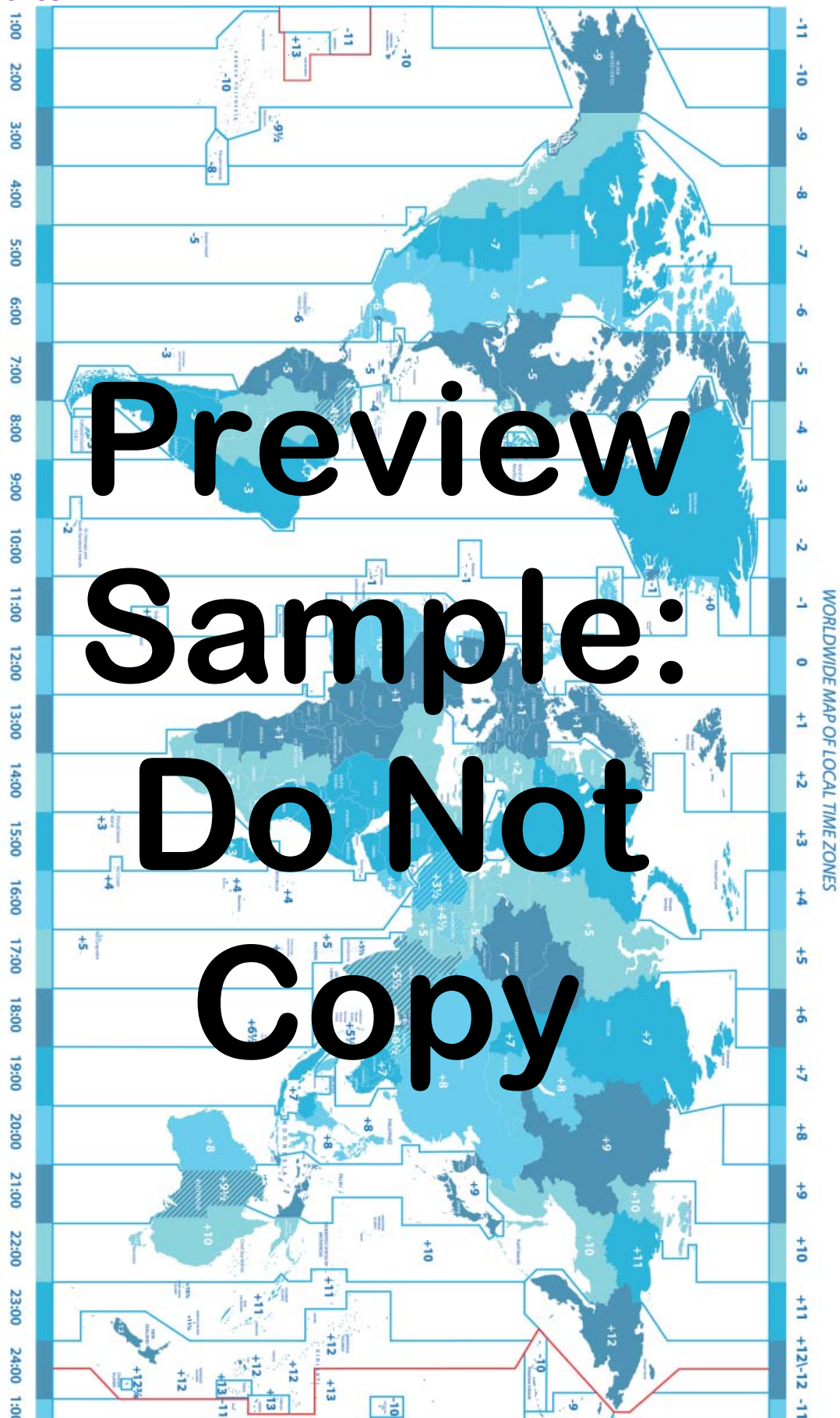
= 8 hours

Note: If the earlier time starts as a '12'
e.g. 12:30am treat the 12 as a '0'.

6.07 Time Zones

Time zones

Image: Jktu_21 /
Depositphotos.com



1. What is Greenwich Mean time?

2. Use the map to identify the time zones for key cities in the world. Add 4 more.

Sydney & Melbourne (GMT + or -)	London (GMT + or -)	New York (GMT + or -)	Tokyo (GMT + or -)
Beijing (GMT + or -)	Los Angeles (GMT + or -)	Berlin (GMT + or -)	Mumbai (GMT + or -)

3. Calculate the equivalent local times for each of these times. (Assume no local daylight savings). Add 4 more of your own. How many hours difference is there, and is this **forward** or **back**?

Melbourne: 11:00 London?	London: 05:30 Melbourne?	New York: 09:30 Melbourne?	Melbourne? 07:30 Tokyo?
Beijing: 23:15 Perth	Los Angeles: 17:15 Sydney	Berlin: 05:30 Auckland	Mumbai: 12:00 Brisbane

4. So you fly out to Venice at 17:30 AEST. When are you likely to arrive local time? You have to call home. Will you be waking someone up? Calculate and explain. You leave Venice at 06:15 local time for LA. When do you arrive? You fly back to Oz from LA 21:30 local time. When do you land at the airport, and when do you get home?

6.09 Rates and Ratios

Rates and ratios

Put simply, a rate is the **ratio** between two different quantities. A rate allows us to perform a calculation to measure how much of one quantity (usually an **outcome** or an **output**) is achieved based on another quantity (usually an **action** or an **input**).

Rates can involve:

- ⇒ rates of speed, such as kilometres per hour (km/h), or metres per second (m/s)
- ⇒ rates of consumption, such as kilometres per litre (km/l), or litres per 100km (l/100km)
- ⇒ biological rates, such as for pulse, heart beats per minute; or for respiration, such as breathes per minute.

Many technical rates apply in relation to electrical power, mechanical force, movement force, movement acceleration and deceleration, cooking, and of course work productivity. Many rates are measured in time. But other rates may be related to various statistical measures, such as interest rates and the unemployment rate. A lot of financial rates are measured in %'s per annum.

Time and distance

One of the most common ratios you will encounter in life relates to travel time and distance. This rate measures how fast you are travelling and is indicated by a speedometer on a vehicle.

For example:

Clarrie drives his beloved Austin Kimberley very carefully when he comes to town. The main shopping street of Magooville is 1km long and it usually takes Clarrie about 3 minutes to drive the entire strip. So at what rate (speed) is Clarrie driving? To work this out we have to calculate the ratio of distance travelled to time.

Speed = $\frac{\text{distance}}{\text{time}}$ = $\frac{1 \text{ km}}{3 \text{ minutes}}$ = 0.33km/min (or 20km/hr)
(We normally express vehicle speed in km/hr, so we have to multiply the answer, 0.33 by 60 because there are 60 minutes in an hour.)

If you want to check that you've done this correctly you can do the calculation the other way (i.e. by **transposing** the formula).

Distance = speed x time

Distance = 20km/hr x 3 minutes (Convert 3 minutes into hours which = 1/20 or 0.05)
= 20km/hr x 0.05hr (The hr units cancel each other out)
= 1km

On the other hand, the pimped out Suzuki Mighty Boy with the personalised number plate D'Hoon normally does the strip of Magooville in 1 minute flat. So what speed is D'Hoon going? And is the driver breaking the law? Think carefully about this as you discuss it

🗣️ with your classmates.

Image adapted from:
ankomando/
Depositphotos.com



Rates - Time and distance A

1. Calculate the following rates using the appropriate units.

i. Travelled 10 km in 10 minutes.	ii. Travelled 20 km in 30 minutes.	iii. Travelled 40 km in 25 minutes.	iv. Travelled 100 km in 100 minutes.
v. Travelled 10 km in 75 minutes.	vi. Travelled 5 km in 90 minutes.	vii. Travelled 1,000 km in 1,800 minutes.	viii. Travelled 0.4 km in 50 seconds.

Preview

2. Calculate how long it would take to complete these trips.

i. Travelled at 60 kmh for 60 km.	ii. Travelled at 80 kmh for 40 km.	iii. Travelled at 100 kmh for 250 km.	iv. Travelled at 30 kmh for 10 km.
v. Travelled at 50 kmh for 5 km.	vi. Travelled at 8 kmh for 5 km.	vii. Travelled at 6 kmh for 20 km.	viii. Travelled at 100 kmh for 4,000 km.

Sample:

Do Not

Copy

3. Calculate fuel consumption and fuel costs for these trips. Choose 2 different types of motor vehicles. How long might each trip take?

i. Your home to the CBD.	ii. Your home to work.	iii. Your town to Byron Bay.	iv. Melbourne to Perth

6.11 Rates and Ratios

Cooking

Rates and ratios are particularly important for cooking in both personal and commercial situations. Recipes specify ingredient quantities, which when combined together make an output (i.e. your food). Sometimes tweaking the recipe or ingredients can deliver a better outcome. But at other times it can cause the recipe to 'fail'.

In numerical terms key ingredients in recipes actually constitute a formula. e.g. $2 \text{ eg} + 100 \text{ ch} + 150 \text{ mu} + 50 \text{ on} + 100 \text{ to} = \text{A mushroom omelette}$. But generally we don't think of recipes in algebraic terms, although everyone who is a good cook has a well-developed sense of practical algebra!

With commercial cookery that uses larger quantities of ingredients, recipes are sometimes expressed as formulaic ratios. The 'cavalas' blouse in coffee making, i.e. what is the 'mix' for a perfect latte?



Image ankomando/
Depositphotos.com

In industrial cookery and beverage making (such as brewing) the development and use of formulaic ratios is very important when dealing with bulk quantities, even though these 'recipes', 'mixes' or 'blends' might be more likely expressed in words and numbers rather than algebraic symbols.

Cooking times are very important and vary depending on the size (portions), weights, and volume of the ingredients used, as well as the intensity and duration of the heat that is applied. This is especially relevant when cooking different types and sizes of meat. Strict health and safety guidelines apply to cooking meat, otherwise a chef can 'poison' their diners with salmonella and other bacteria that is not 'cooked out' of the meat.

B Rates - Cooking

1. Use your existing applied knowledge, and research, to find out rates and ratios related to food. Add 3 more your own.

i. Cook a whole chicken.	ii. Cook a 2kg pork roast.	iii. Boil 4 eggs.
iv.	v.	vi.

2. In your workbooks explain 5 reasons why it is important to get food and cooking rates and ratios correct. Give an applied example for each of these reasons.
3. Watch the TV show *Unwrapped 2.0*. Outline some of the ratios used in the industrial processes to make these treats. Discuss these as a class.

6.13 Transport and Cost

Travel costs

Getting to different locations costs! Travel costs money, or time, and/or both time and money! There is a very real relationship between location, time and money. As part of your personal and professional (work and/or study) life you need to consider how to allocate your **scarce resources**, such as **time** to efficiently travel between different locations; and also how to allocate your scarce resources, such as **income** to 'buy' different travel options.

At times it is better to catch public transport. It might save time, money, stress and vehicle wear and tear. Plus you can get a lot done while you're on public transport, such as updating your status, putting your make-up on and pretending that you can't see anyone else around you! And public transport might also give you a little bit of exercise as well.

At other times it is better to travel by motor vehicle. You might get to destinations faster, you can carry more (such as your tools of the trade) and you can move about from location to location during the day or night.

Some people like to car pool. They take turns driving when travelling to work, to study, or when holidaying. This cuts travel costs and builds socialisation skills.

Other people like to make their parents do the work. That's OK if you're still at school, but when you're an adult - think about it - should you be making your olds drive you about all the time?

Increasingly people are cycling or walking to work and to study. This is practical in the inner city, is free and is great exercise. But not so practical if you live in Castlemaine and are studying in Bendigo!

So what's best for you, which methods of travel do you favour to get from location to location?

Preview
Sample:
Do Not
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Image: adapted from:
AnnaFrajtova/iStock/Thinkstock

Vehicle costs

Last year in Numeracy Intermediate some of you would have started to explore how to estimate and calculate the direct costs associated with motor vehicle travel. Now when we think vehicle costs we think about petrol costs, such as (\$/litre), and we think about rego and CTP, and we should think about insurance, and then there's repairs, and tyres, and then there's... and so on. Or do we? Perhaps we fail to get past the subbies?

Direct costs associated with motor vehicle travel includes 'visibles', such as direct petrol costs and rego, as well as 'invisibles', such as vehicle wear and tear.

According to the RACV in 2018, a Holden Commodore RS cost 18.84c per kilometre to run compared to a Kia Picanto Si at 12.38c/km. These running costs include petrol and other consumables, tyres, servicing and repairs. Different cars have different running costs depending on their size, fuel consumption and service requirements.

Apart from running costs, cars also incur 'standing costs'. These include costs, such as registration and insurance, depreciation of the vehicle, interest cost on the car loan and so on.

According to the RACV in 2018, the Holden Commodore RS had standing costs of \$183.48 per week. The Kia Picanto's was \$85.70/week. Different cars have different standing costs depending on their purchase price and estimated trade value.

The total vehicle costs for the Holden Commodore RS totaled \$237.81 per week based on an average drive of 15,000 kms per year. This equates to 82.44c per km, or an annual cost of \$12,337 for the Commodore. The Picanto's were 37.96/km, \$121.40/week and \$6,312 for the year. What about a bicycle?

Check out www.racv.com.au for Driving Your Dollars survey and look up the information for different cars.



Do Not Give your dollar A

1. Create a formula to calculate the total annual cost and the total weekly cost based on the information from 2018 for the Commodore and the Picanto.

Car/model/year	Running costs per year	Standing costs per year	Total costs per year	Total cost per week
Holden Commodore RS 2018				
Kia Picanto 2018				
Annual cost formula =		Weekly cost formula =		

2. Look up the most recent survey figures for some cars of your choice. Does the information surprise you?



6.15 Transport and Cost

B Moving about

Complete the following calculations based on travel, distance and cost. Comment on the results and any impediments and restrictions on the travel (i.e. no public transport!), giving advice on how to improve transport efficiency for people.

Mode	Calculations	Comment/advice
Your home to the CBD by car.	Distance: Time: Litres of petrol: \$ per litre: Other costs:	
Your home to the CBD by public transport.	Distance: Time: Fares: \$/km: Other costs:	
Your home to the CBD by taxi.	Distance: Time: Fares: \$/km: Other costs:	
Your home to the CBD by Uber.	Distance: Time: Fares: \$/km: Other costs:	
Your choice:	Distance: Time: Fares: \$/km: Other costs:	

Preview
Sample:
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Estimating

Create a budget based on the estimated expenses associated with buying and running a motor vehicle as an 18 year old. Do this off the top of your head using what you already know, and what you have learned so far. (You could use a spreadsheet).



- ☐ You will need to choose your most likely first motor vehicle.
- ☐ You will need to estimate likely travel distances and totals.
- ☐ You will have to identify common motor vehicle expenses.
- ☐ You will need to calculate to work out annual, monthly, and weekly expenses.

Motor vehicle expenses and estimates

Preview Sample:

Researching

- a. Do some research and create another budget using the information that you have researched. **Do Not** You might be able to put the 2nd budget up on the same document using different columns.
- b. Calculate differences between the 2 budgets in \$ terms and % terms. Comment on where the differences are and why these have occurred.

Reporting

Prepare a report to the class that:

- ☐ summarises your key findings
- ☐ explains the assumptions you used
- ☐ describes numerical costs based on your calculations
- ☐ describes costs using different time periods
- ☐ discusses the differences between your estimated budget and your budget based on research
- ☐ provides key recommendations for young people managing the costs associated with their first car
- ☐ other important information.



Copy

6.17 Future Travel

Next year and beyond

This time next year your life is likely to have altered dramatically. Some of you will have made the transition to full-time work, perhaps as an Australian Apprentice or in some other type of employment. Others of you might be working one or two (or even more) casual and part-time jobs. Some of you will be studying at TAFE or some other training institute and will be most likely combining your studies with casual or part-time work. You might also be undertaking work placements as part of your studies. Others will be actively seeking work and participating in volunteer and/or community work. And a few of you might even be running your own micro start-up enterprise.

Then there's all the activities that come with being an adult that might include more socialising, more family responsibilities and generally more travel.



Image: andresimaging/
iStock thinkstock

A In my future

Ok. Take a moment to look into your future and see what your most preferred, or most likely personal, professional (work-related) and study situations might look like. Do some planning, estimation and research and answer these questions.

What am I most likely to be doing this time next year? Why is that?	Where are these personal, professional and study commitments most likely to be located?
What modes of transport will I most likely be using for my personal, professional and study commitments?	What distances might I be covering for my personal, professional and study obligations?
What costs might be associated with travelling for my personal, professional and study obligations?	From where am I going to source money or income to pay for this? Can I foresee any problems?

My transport costs B

1. List all of the potential costs that you will experience as part of your personal (P), professional (W) and study (S) commitments. Label these with the letters in brackets. You might incur some of these daily (e.g. daily train fares, tolls or parking), weekly (weekly pass or petrol), monthly, or even annually (student concession, car rego, etc..) Some might even be unexpected, e.g. fines, repairs.
2. Calculate a weekly average and a total weekly average below.
3. How's your travel 'budget' looking? From where might you source this money? What can you do about this?



Travel costs	Daily	Weekly	Monthly	Yearly	Total per week
<div>Preview</div> <div>Sample:</div> <div>Do Not</div> <div>Copy</div>					
Totals					

6.19 Assessment Task

AT6 Where, How and Why?

Overview

You are required to use your skills in planning and organising, mapping, locational direction, and estimation and calculation of travel costs and times, to complete one of these 2 projects.


Each project draws on similar skills but you will have to apply your skills in varied ways. The requirements for each project are outlined in the table below. Your teacher will discuss the suitability of each project for you and your class.

In completing your project you must do the following.

- ☐ Estimate and calculate distances, times and travel costs.
- ☐ Use timetables, travel schedules and other information.
- ☐ Use and apply effective mapping techniques to scale (including noting location directions).
- ☐ Describe appropriate routes as part of effective instructions and/or advice.
- ☐ Develop a diagram, chart or other visual representation to represent some of the information.



<input type="checkbox"/> Itinerary	<input type="checkbox"/> Cost-related costs
<p>You are required to plan, estimate and cost a 2-week overseas trip.</p> <ol style="list-style-type: none"> 1. Decide on your destination(s). 2. Plan your travel route, travel modes, travel times; and calculate the costs of your travel including insurance. 3. Draw or print a map and show your travel destination and routes. 4. Find out room rates for where you are staying and calculate the total cost of your accommodation for the holiday. 5. Identify any attractions and activities that you will be enjoying; and list any costs associated with these. 6. Calculate your total budget (don't forget to include money for food, spending money and other expenses). 7. Produce a diagram, chart or other visual representation to arrange and summarise key numerical information. 8. Prepare, and if required, present a summary report. <p><i>Add any other important task information.</i></p>	<p>You are required to investigate a cost-saving strategy to reduce work-related travel time and/or costs.</p> <ol style="list-style-type: none"> 1. Choose your workplace and outline its operations. 2. Identify key work-related travel costs, such as fuel, transport costs, courier and delivery costs, about costs related to travel; and other relevant issues. 3. Estimate and calculate current costs related to travel and transport. 4. Investigate and summarise cost-saving strategies. 5. Make a comparison between costs before and after cost-saving strategies. 6. Outline key recommendations to reduce costs including reasons. 7. Produce a diagram, chart or other visual representation to arrange and summarise key numerical information. 8. Prepare, and if required, present a summary report. <p><i>Add any other important task information.</i></p>

Tasks - AT6: Where, How and Why?		Re- quired	Due by	Done	Teacher initials
Project:					
Focus:					
1. Choose and outline destination, features or workplace.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
4.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
5.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
6.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
7. Produce diagram, chart or other visual representation.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
8. Prepare and present a report.					
⇒ Prepare your report.	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
⇒ Present your report (if required). 	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Preview
Sample:
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Additional information:

Signed: _____

Date: _____

6.21 Self-Reflection

Self-Reflection Pro-Forma

Which numeracy skills did I develop during this unit?

→ _____

→ _____

→ _____

How have the skills of numeracy helped improve my personal life?

→ _____

→ _____

How have the skills of numeracy helped my development of work-related skills?

→ _____

→ _____

How would I rate my performance (use a circle) in developing my numeracy skills this unit?

0 not shown	1 low	2 reasonable	3 good	4 very good	5 excellent
----------------	----------	-----------------	-----------	----------------	----------------

What were my strongest areas of performance and what should I work on improving?

My strongest topics/skills were	But need to improve my skills in:

Signed: _____ Date: _____

Teacher initials: _____ Date: _____

Measure By Measure 7

Contents

7.01 Measurement.....	160	7.13 Measuring Angles.....	172
7.05 Measuring in Action.....	164	7.19 Assessment Task.....	178
7.11 Measurements and Safety	170		

Activities 7: Measure By Measure	p.	Due date/Done?	Comment
7.01A Measuring	160		
7.02B Measuring devices	161		
7.03A Ye olde measures	162		
7.06A Perimeter and area	165		
7.07B Volume	166		
7.08C Getting it right	167		
7.09D Measurement	168		
7.10E Stop the goats	169		
7.11A Goldilocks	170		
7.12B Safe weights	171		
7.16A Measuring angles	175		
7.17B Angles at play	176		
7.18C Driving and angles	177		
AT7 Measuring Up	178		
7.21 Numerical Language	180		

Comments:

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7.01 Measurement

Measuring up

As part of our day-to-day personal and work-related lives we have to measure many different things. Measures might include:

- ⇒ times for cooking, or how much time it might take for a client’s hair appointment
- ⇒ distance for a weekend road trip, or distance to a client’s premises
- ⇒ cost of our petrol bill, or cost of petrol to run a courier business
- ⇒ mass (weight) of food ingredients, or mass (weight) of a package to be sent to a customer
- ⇒ depth of a swimming pool, or depth of a foundation hole on a construction site
- ⇒ area of a house and land package, or area of a field to sow
- ⇒ volume of a gift package, or volume of a shipping container
- ⇒ speed of a car or the speed of a passenger jet

Measuring units and devices

A measurement is a particular and precise unit that is standard. Standardised measuring units make it easier to do calculations and comparisons. They also make it easier for people to communicate more effectively in personal and work-related situations by sharing a common language, and by developing a technical and professional vocabulary.

Measuring units are calibrated to produce standard readings of measuring devices. We can use some of these in our personal lives; such as a thermometer for cooking, or to assess health, or to measure our personal comfort. At work we might use a thermometer while working as a chef, or as a vet nurse, or as an air-conditioning mechanic.

Preview
Sample:
Do Not
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A Measuring



1. What measuring devices do you commonly use? How are they calibrated?
2. How do you know just what is an acceptable reading? e.g. Too hot or too heavy?

Measuring device	Calibration	Understanding of reading

Units of measurement

Key measuring units you should be familiar with include:

- ⇒ Temperature: how hot or cold, measured in degrees Celsius, or $^{\circ}\text{C}$
- ⇒ Length: how long or short, measured in mm, cm, m or km
- ⇒ Mass: how heavy or light, measured in μg , g, kg, tonne
- ⇒ Perimeter: how far around, measured in m (metres)
- ⇒ Area: how much spread or coverage measured in mm^2 , cm^2 or km^2
- ⇒ Volume (fluid): how much, or the capacity, measured in ml^3 , l^3 or cc.
- ⇒ Volume (solid): how much, or the capacity, measured in mm^3 , cm^3 or m^3 .

NUM
SUPER
SKILLS

Measuring devices B

- What do each of these measuring devices measure, and what units do they commonly use? Add 2 of your own.
- Explain how you might use each of these in personal and/or work-related applications. Find images of these and include them in your workbooks.



Measuring device	What does it measure?	Personal or work-related example
thermometer		
caliper		
altimeter		
odometer		
scale		
ammeter		
speedometer		
measuring tape		
barometer		
wind vane		
pedometer		
sphygmomanometer		
your choice:		
your choice:		

Preview
Sample:
Do Not
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7.03 Measurement

Measurement

Useful and accurate measurements rely on the use and application of estimates, calibrated measuring devices, calculations, experience and transferable and work-related skills.

Some measurements rely on estimates and approximates. For example, how much paint to buy to paint a bedroom, what sized clothing to order online, and the distance and duration of a journey to drive to the beach. Other measurements will rely on more accurate calculations, such as lengths of timber needed to build a carport, amount of tiles needed to complete a patterned wall feature, and appropriate temperature at which to safely cook meats, such as chicken, or to heat baby formula.

You might also encounter **macro-measurements** in construction, mining and agricultural industries, such as the mass of concrete needed for an apartment block’s foundations, floor and structure, the mass tonnage that a mining dump truck transports each trip from a coal mine, or the area of crop that needs to be sprayed with insecticide.

In some cases you might need to be very precise to perform accurate **micro-measurements**, such as in precision trades like jewellery making, in health-care for pharmaceuticals and medicaments, and in engineering and the manufacture of components in hi-tech electronic technology devices.



C Ye olde measures

Most of our modern measures are standardised using the metric system. (But not in the US of A). However, there were many old measures used by people.

- 1. Find out the meaning of each of these old measures and what they measured.
- 2. Explain how they compare to a modern unit, and also if they are still in use today.

Old measure	Definition	Comparison/ & are they still in use?
cubit		
hundredweight		
furlong		
league		
peck		
ell		
chain		
your choice:		

Key measurements

Some key measurements that you need to know how to calculate are covered here. Many of you might have already developed your numeracy skills in using some of these, so let's consider this as a recap and upskill activity.

⇒ Length

Length is a simple measurement. How long is that object? Length measures distance. Long distance might be better said as 'how far', e.g. "How far from Melbourne to London?"; or how close, e.g. "Where are you now?", "I'm just a km away". In reality most of the lengths we measure are quite small, such as the length of our body, the length of our clothes and the length of the distance of our eyes from our screens!

⇒ Perimeter

The perimeter is the distance around an object; or in other words, the combined lengths of all the sides or edges. Therefore, to calculate perimeter we simply add up the length of all sides of an object. Note the perimeter of a circle is called its circumference.

⇒ Area

Area is a 'how much' sort of calculation and measures the 2-dimensional coverage of an object or shape. i.e. How much area does that lawn cover? Surface area relates to how much of something is needed in 2D to cover the surface of a 3D object, such as gift wrapping a present.

⇒ Volume

The volume of an object refers to how much space it occupies. Volume is different from area in that it relates to 3 dimensions; length, width and height (or depth). In theory volume is actually measured by how much space an object displaces. However, it is fine to think of an object's volume as how much it holds; or in other words its capacity, like a 600ml bottle of Pepsi Max.

⇒ Temperature

Temperature can be commonly referred to as the intensity of heat of an object, fluid, surface or other substance. Temperature is usually measured using a calibrated thermometer or similar device.

⇒ Mass

Mass is the appropriate term to describe how much matter is in an object. This then determines how 'heavy' an object is. Objects of the same size might have a different mass depending on the density of the matter from which the object is made. Consider the different mass of a gold bar and a chocolate bar of the same size.

We often use the word 'weight' when describing how heavy an object is. But technically this term is incorrect as weight describes the force of gravity on an object. (Yep; think about astronauts leaping about on the moon - same 'mass' as on earth but different weight.) But you can use the word weight in most practical applications as long as you understand that what you are really referring to is an object's mass!

We commonly measure weight (mass) in grams (or multiples thereof), but there are other measures of weight (mass), such as carats for gemstones.

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7.05 Measuring in Action

Measurement in action

You need to be able to estimate and calculate perimeter, area and volume. These measurements all rely on the use of straightforward formulae that is not necessarily based on mathematical expertise, but rather on the application of logic.

Often these measurements might start as an estimate, even moreso as you become experienced and build your suite of transferable and work-related skills. However, you will have to calculate exact measurements of objects and numeracy scenarios to determine exact perimeters (e.g. fencing), area (e.g. fabric cover), and volume (shipping and transport). Especially when you move from a quote to an actual billing or buying stage.

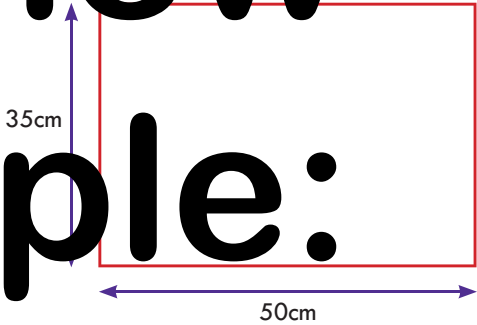
Perimeter

- ⇒ The perimeter is the distance around an object.
- ⇒ To calculate perimeter simply add up the lengths of all sides of an object.

Perimeter: Rectangle

Perimeter of rectangle
= length + width + length + width
or $l + w + l + w$; or $(2l + 2w)$

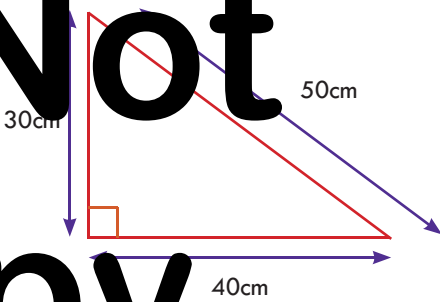
Calculate perimeter of rectangle:
= $35\text{cm} + 50\text{cm} + 35\text{cm} + 50\text{cm}$
= 170cm or $(1,700\text{mm})$
(Note: Nearly all trades use mm as measurements rather than cm).



Perimeter: Triangle

Perimeter of triangle
= length side 'a' + length 'b' + length 'c'

= $30\text{cm} + 40\text{cm} + 50\text{cm}$
= 120cm or $(1,200\text{mm})$

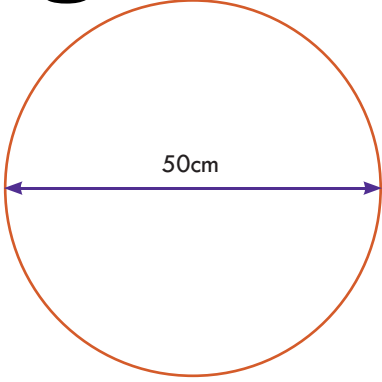


Circumference (perimeter): Circle

Circumference (perimeter) of circle
= diameter x 3.142
(Note: 3.142 is pi or π) or $c = d\pi$

= $50\text{cm} \times 3.142$
= 157.1cm or $(1,571\text{mm})$

Pi is always used for circles as it is a mathematical constant that measures the ratio of a circle's circumference compared to its diameter. As the circle gets wider, its circumference gets proportionally bigger!



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Area

- ⇒ Area measures the 2D surface coverage of an object.
- ⇒ To calculate area we multiply the key dimensions; the answer will always be in units².

Area: Rectangle

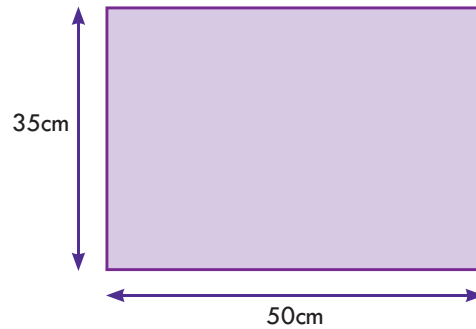
$$A = \text{length (l)} \times \text{width (w)}$$

Calculate area of rectangle:

$$A = 50\text{cm} \times 35\text{cm}$$

$$A = 1,750\text{cm}^2 \text{ (or } 0.175\text{m}^2\text{)}$$

Note: Here the unit, cm, is squared (²). That's because cm is multiplied two times in the calculation (i.e. cm x cm). And of course you are working in 2 dimensions with area, hence cm²!



Area: Triangle

$$A = \frac{1}{2} \times \text{base} \times \text{height}$$

(or $A = \frac{1}{2}bh$)

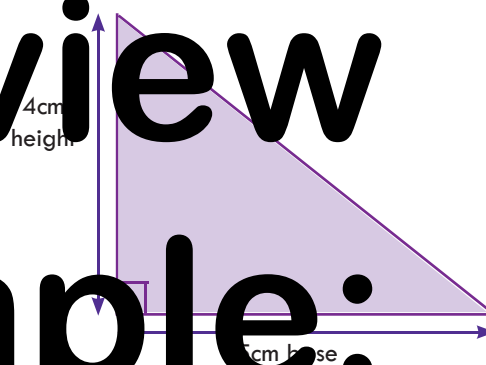
$$A = \frac{1}{2} \times 5\text{cm} \times 4\text{cm}$$

$$A = \frac{1}{2} \times 20\text{cm}^2$$

$$A = 10\text{cm}^2$$

Now, this formula makes sense because when you think about it, a right-angled triangle is basically half a rectangle.

So the formula for calculating the area of a right-angled triangle is the same as that for calculating a rectangle, but halved!



Area: Circle

$$A = \pi \times \text{radius}^2$$

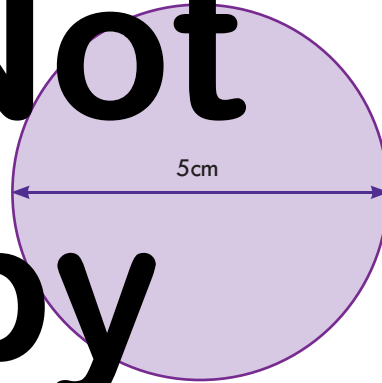
(or $A = \pi r^2$)

$$A = 3.142 \times (2.5\text{cm})^2$$

$$A = 3.142 \times 6.25\text{cm}^2$$

$$A = 19.6\text{cm}^2$$

The radius is half the diameter, or half the 'width' of the circle. You know how your circumference that as a circle gets wider, its circumference gets proportionally bigger, and of course so too does its area. There's that good old pi again!



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Perimeter and area A

Calculate the perimeter and then the area for each of the following.

i. A circular rug that has a radius of 260mm.	ii. The roof of a rectangular garage that is 4.6m x 270cm.	iii. A triangular sail that has a height of 1,400mm and a base of 0.75m.
iv. The room in which you are sitting/standing right now.	v. Your backyard (or a friend's backyard).	vi. A 4 hectare property.

7.07 Measuring in Action

Volume

- ⇒ The volume of an object measures its 'capacity' or 'size' in 3 dimensions.
- ⇒ To calculate volume we multiply the key dimensions; the answer will always be in units³, because now you are working in 3 dimensions!

Volume: Rectangular prism (cuboid)

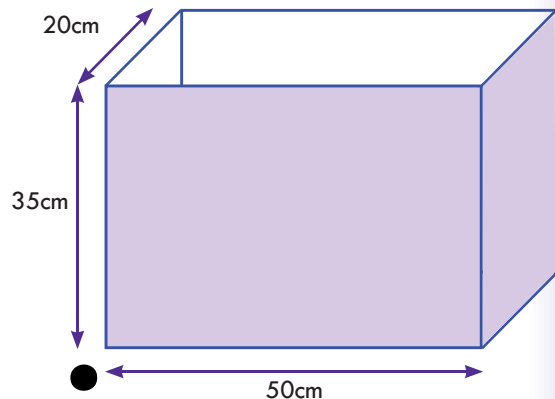
Volume of a cuboid

$$V = l \times w \times h$$

$$V = 20\text{cm} \times 50\text{cm} \times 35\text{cm}$$

$$V = 35,000\text{cm}^3 \text{ (or } 0.035 \text{ m}^3\text{)}$$

Note: Here the unit, cm, is cubed (³). That's because cm is multiplied three times in the calculation (i.e. cm x cm x cm). And of course you are working in 3 dimensions with volume hence cm³!



Volume: Cylinder

Volume of a cylinder

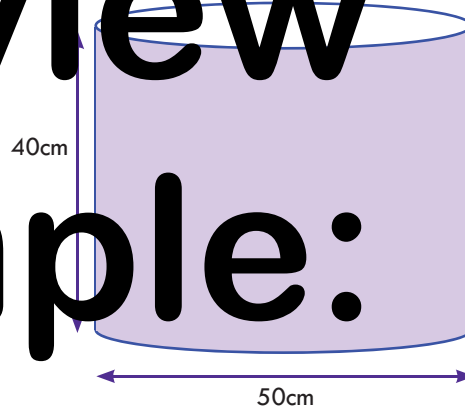
$$V = \pi r^2 h$$

$$V = 3.142 \times (25\text{cm})^2 \times 40\text{cm}$$

$$V = 3.142 \times 625\text{cm}^2 \times 40\text{cm}$$

$$V = 19,637.5\text{cm}^3 \times 40\text{cm}^2$$

$$V = 785,500\text{cm}^3 \text{ (or } 0.7855 \text{ m}^3\text{)}$$



Volume: Sphere

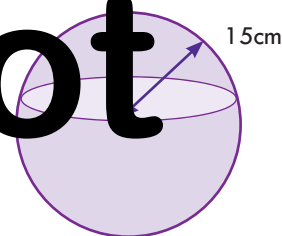
Volume of a sphere

$$V = \frac{4}{3} \pi r^3$$

$$V = 1.333 \times 3.142 \times 15\text{cm}$$

$$V = (4.188) \times 3,375\text{cm}^3$$

$$V = 14,134.5\text{cm}^3 \text{ (approx due to pi and rounding)}$$



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B Volume

1. Calculate the volume based on these dimensions. Draw each of the objects.

a. A prism with dimensions of 10, 20 and 40 cm.	b. A cylinder with a radius of 20cm and a height of 100cm.	c. A sphere with a diameter of 50cm.
d. A compound object featuring the prism from 'a' and the sphere from 'c' on top. Draw this - what object might this resemble?	d. A compound object featuring the cylinder from 'b' on a base of a 40cm cube. Draw this - what object might this resemble?	f. A compound object featuring 2 spheres from 'c', 1 cylinder from 'b' and 3 prisms from 'a'. Draw this - what object might this resemble?



2. List and discuss practical examples when you would have to apply volume calculations.

Old-school v nu skUL

- ⇒ As technology increases we are seeing a growing incidence of digital measuring devices replacing analogue ones. The claims supporting digital devices are that they are more precise and therefore more accurate, faster and safer.
- ⇒ Many devices use lasers for measuring levels, distances and angles. Others are used in technical and construction activities for locating electrical cables, gas lines, water pipes and other hidden dangers.
- ⇒ Digital laser rangefinders calculate accurate distances and support one-person operation. These devices can also store information, perform calculations and calculate area and other required measurements.
- ⇒ If you pay enough to invest in state-of-the-art, industry-standard devices, then the device can also send data to a smart phone app that can be stored in a spreadsheet to save having to transcribe while on the job.



⇒ Old school measures involve the user physically making the measurement and writing the data. This can lead to measuring inaccuracies or transcription errors, but it can have the advantage of a hands-on approach, whereby a person uses their physical expertise, their 'eye' and their experience to measure (and estimate) accurately.



Images: (t) nikkitok/ (b) Tuned_In/ iStock/Thinkstock

Preview Sample:

Getting it right C

When you use digital devices and phone apps for measuring you need to be able to know that the reading that you get is accurate. The device will always give accurate measurements (unless the batteries or charge is low). But when you first start using digital devices you might not be measuring the right 'thing', or perhaps you are not operating the device properly, or you might even record the measurements incorrectly; i.e. mixing up height and width which could cause problems if you start working with materials. So how will you know?

1. Start by **estimating** the dimensions of this room. Calculate its perimeter and its area. Use an app or online calculator to calculate its volume.
2. Use a **digital measuring device** to record the perimeter and area of the room. Use these measurements to calculate the volume of the room.
3. Use **manual measuring instruments** to measure the perimeter and area of the room. Calculate the volume.
4. Compare your initial estimates, the digital measurements and the 'manual' measurements. How close are the results? Which are correct? How do you know? And how would you check?
5. Research digital measuring devices and find out usage instructions, tips, guidelines and troubleshooting information. Summarise these and present the information in a short report to the class.



7.09 Measuring in Action

D Measurements

1. Perform the following calculations showing all workings. (Tip: It might be a good idea to draw a sketch in your workbooks!)
 - a. The perimeter of a fence around a rectangular yard measuring 10m x 8.5m.
 - b. The surface area of the lawn of this yard (assuming it goes right up to the fence).
 - c. The surface area of a right-angled triangular compost structure located in the yard that has a height of 90cm and a base width of 2m.
 - d. The area and volume of a rectangular 'cubby house' measuring 2m by 3m with a height of 120cm.
 - e. The area of a circular concrete fountain with an edge width of 75cm.
2. The owners are thinking of laying a synthetic lawn. Calculate how much surface area of lawn remains uncovered after the compost, cubby house and fountain are incorporated into the yard.
3. How much might a synthetic lawn cost approximately? Go online and find some more exact prices. What about natural turf? Which is cheaper and why?

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Stop the goats E

Farmer Tone has been living on his 2.5 acre square patch of land for many years and as a retirement hobby he grows turnips, sprouts and of course his prizewinning onions.

His peace is shattered when Starlight Moonbeam and her partner Krusty Longshanks take over the vacant plot next to him. Living out there and their



Image: Angela940/iStock/Thinkstock

rainbow Bongo (an elderly cow) are trying to live a sustainable lifestyle and as such they allow their goats Marcel, Rayo and Freida to roam free. The problem is that the goats are getting into Farmer Tone's vegie patch and gobbling up all of his hard work.

Tone can't take it any more when he comes out to see all 3 goats greedily devouring his prize onion. He is even more puffed that Marcel appears to be smiling at him as he chows down on a particularly big bulbous carrot. Farmer Tone thought might have a chance at this year's county fair.

Tone has had enough and goes over to 'negotiate' with his neighbours. "Look guys, I'm as reasonable as the next man, but we have to stop the goats." They reach agreement to build a fence and share costs.

1. Draw a sketch of the patch and state the goats.
2. What length of fencing (in metres) would be needed to protect the block's perimeter from the goats? What type of fencing would you recommend? Why?
3. Farmer Tone sees an opportunity in this and thinks he might be able to increase the area of his vegie patch. What is the total area of Tone's block?
4. Tone uses 40% of the block for his house, outbuildings and other amenities. What area would potentially be available for an expanded vegie patch?

Tone notices that his neighbours trap a lot of their water in tanks. Good thinking by these green folks - this could save him some money. He looks online and sees a cylindrical tank that measures about 1.6 metres in height with an internal diameter of approximately 900mm.

5. What would be the approximate capacity (volume) of this tank in litres?
6. How much might a tank like this cost? How much might it save Tone on his water bill?
7. How long do you reckon this could last to water his expanded vegie patch?



7.11 Measurements and Safety

Temperature

Temperature is commonly referred to as the intensity of heat of an object, fluid, surface or other substance. It is usually measured using a scaled mercury-based thermometer using degrees Celcius (°C). Celius is a comparative scale based on the freezing point of water, which is 0°C, and the boiling point of water, which is 100 °C. (However, some slight variations to this definition do exist for scientific purposes.)

It is vital that you are aware of safe temperature ranges for personal and work-related situations. Too hot, and indeed too cold, can result in injury (burns and scalds), illness (food poisoning) and even the risk of death (hypothermia and hyperthermia).

There are so many safe temperature issues, too many to list here. It's better for you to be aware of common safe ranges and others that are relevant to you.



A Goldilocks

Goldilocks never did Numeracy Senior, but if she had, her story might have ended differently, and perhaps she wouldnt be doing porridge. Research the following safe temperature ranges. Add some of your own ideas.



Example	Too hot	Too cold	Just right
porridge			
cooking chicken			
baby formula			
baby bathwater			
adult's temperature			
infant's temperature			
dairy food storage			
car radiator			
cuppa' coffee			
iced slushi			

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Weight

Weight (mass) is another quantity that also needs to be safely estimated and measured. People get injured in their personal, social and work-related lives by lifting too much weight, lifting weight incorrectly, lifting weight repeatedly, moving weight incorrectly, bending and twisting while carrying weight, and even suffering crush injuries from weighted objects.

Weight is also a safety issue in these situations, as well as many more (suggest some others as a class).

- ☺ Cooking, e.g. minimum cooking times for portions.
- ☺ Transport, e.g. overloaded and unbalanced loads.
- ☺ Caring and nursing, e.g. safely moving and lifting patients.
- ☺ Health and medicine, e.g. dosages for body weight and drug measurements.
- ☺ Sport, e.g. physical stress injuries to muscles, joints and ligaments.
- ☺ Personal life; e.g. too much body weight.

"I don't know why I keep doing my back when I bend over to pick up Tiddles?"



Preview Sample:

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Find out limit guidelines related to these statements about weight. You will have to do some research and you will need to gather relevant details to apply to some scenarios. Work in pairs. Add 3 more of your own.

a. Single person manual lifting of a package or object.	b. Two person manual lifting of a package or object.	c. Weight to power ratio of a car for a probationary driver.
d. Transport vehicle tonnage on a normal license.	e. Medical dosage per kg for a child.	f. Medical dosage per kg for a pet.
g. Weight limit on a ladder.	h. Recommended weight based on your height and age.	i. Weight limit on a trailer.

Weight B



7.13 Measuring Angles

Angles

An angle measures the 'distance' between 2 **rays**. When drawn these rays might be represented by lines. In the real world the 'rays' might actually represent the edges of physical objects or components of an object. For example, a carpenter and joiner building the roof for a pergola might have to affix 2 lengths of timber (the 'rays') with the edges at an angle of 90° .

An angle is measured in degrees. One full turn of an angle equals 360° . Therefore a $\frac{1}{4}$ turn represents 90° , which is called a **quadrant**. Therefore, four quadrants make up an entire 'turn'. Just like if you face north and turn 90° to face west, turn another 90° to face south, turn 90° again to be facing east, and then 90° once more; you're back facing north. That's 360° in total. And you're back to the same direction you were in the beginning.

One of the most common ways of measuring degrees is to use a **protractor**. You probably are used to seeing them in sets of drawing and writing implements as part of your booklist. You've also probably used a protractor many times in the past.

The major directional points on a compass each represent 90° .

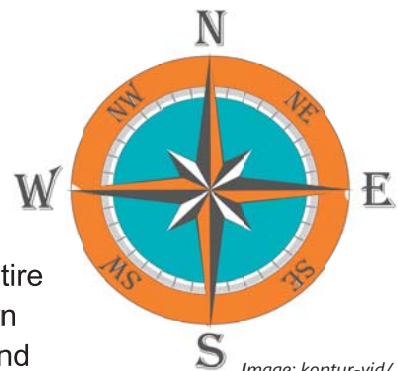


Image: kontur-vid/iStock/Thinkstock



Image: Serhiy Stakhnyk/iStock/Thinkstock

Personal application

Using angles is a natural part of our lives. It's just that we don't really think about them that much. From the angle of our pillow (comfort) to the angle of high heels (discomfort), we use visual spatial accuracy to assess and accommodate angles in a daily basis.

- ⇒ We use angles to assess how our clothing sits on our body.
- ⇒ We open our mouth at different angles, depending on how big the burger we are trying to fit in is!
- ⇒ When singing, a different angle of vocal cavity can change pitch and volume.
- ⇒ When dancing, angles can be used to accentuate line and to drive movement.
- ⇒ We try to get the best angle when watching screens.
- ⇒ We angle the cue stick and angle how we hit the cue ball when playing pool.
- ⇒ Angles are very important when parking a car, such as parallel parking, 45° parking (which is called angled parking!) and when making tricky turns.
- ⇒ Self-obsessed people try out angles when taking selfie after selfie in the mirror!

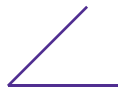
Using any kind of trailer requires a good sense of angles.



Image: Fab_Vietnam Photography/iStock/Thinkstock

Types of angles

Acute: An acute angle is less than 90° .



Looking down:
Opening a door.

Straight: A straight angle is exactly 180° .



Looking side-on:
Laying down flat.

Right: A right angle is exactly 90° .



Looking front-on:
Wall meeting a floor.

Reflex: A reflex angle is greater than 180° .



Looking side-on:
Doing a hyper-extension on a bench.

Obtuse: An obtuse angle is more than 90° but less than 180° .



Looking side-on:
A reclining chair.

Full: A full angle is 360° .



Looking down:
Performing a pirouette!

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Preview

Work-related applications

Being able to measure angles is very important in many work-related situations. Many experienced and skilled employees actually do this by developing and applying their visual-spatial skills, through imagination, application and muscle memory.

- ⇒ Carpenters and joiners assemble timber framing using angled angles.
- ⇒ Tilers have to cut tiles for geometric patterns based on the calculation of angles.
- ⇒ Multimedia designers rotate design elements based on angles.
- ⇒ Clothing makers use angles to determine garment shape and hang.
- ⇒ Furniture makers design and build chairs at different sitting angles.
- ⇒ Nurses and carers have to support patients at different angles, often using a motorised bed, trolley or chair.
- ⇒ Truck and lorry drivers use angles to make turns and to reverse park their vehicles and loads.
- ⇒ Hairdressers style and cut geometric hair shapes and patterns.
- ⇒ Furniture removalists calculate angles when moving large-size floor furniture items through narrow spaces.
- ⇒ Construction workers use angles for many tasks, including the safe placement of a ladder.

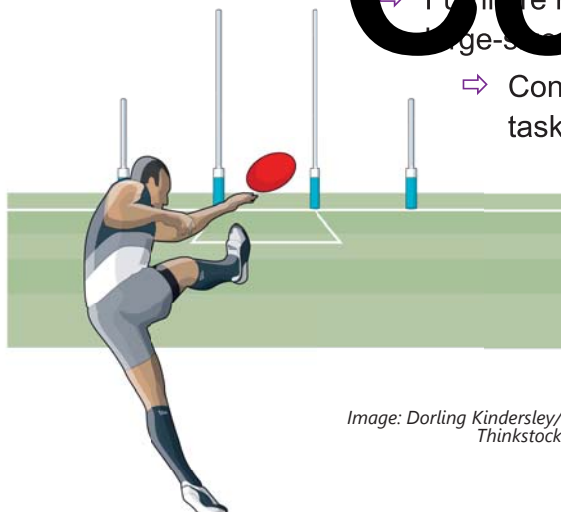


Image: Dorling Kindersley/Thinkstock

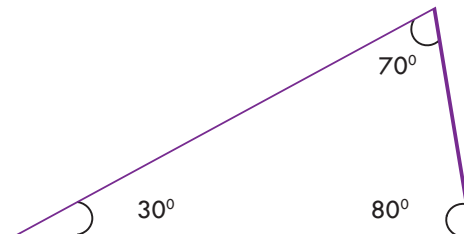
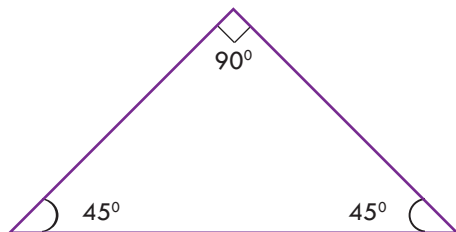
- ⇒ Sportspeople rely on the use of angles, such as footballers and soccer players kicking for goal, cricketers when bowling and batting, hockey players hitting the ball, soccer goalkeepers making a save and many more diverse applications in basketball, archery and even darts!

7.15 Measuring Angles

Triangle

A triangle is a plain figure that has three straight lines that are joined. In 2-dimensions (such as when drawn) it is one of many **polygons** because it has more than one 'edge' (in fact it is a **trigon** with three 'edges').

The three angles inside a triangle will always add up to 180° . By applying this Euclidean principle you can calculate the value of a missing angle.



Triangle shapes are used in many activities from cutting food, clothing, and craft through to using a ladder, constructing frames as well as for bracing structures to add strength.

Triangular objects in 3D form into **pyramids** with the addition of a base. A good example, think of the pyramids!

Some pyramids have a square base with the apex directly above the centre of the base.

A pyramid with a non-rectangular base is called a **tetrahedron**.

And of course a triangular object with a circular or cone-shaped base is called a **cone**.



Image:
valigursky/
iStock/Thinkstock

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Types of triangles

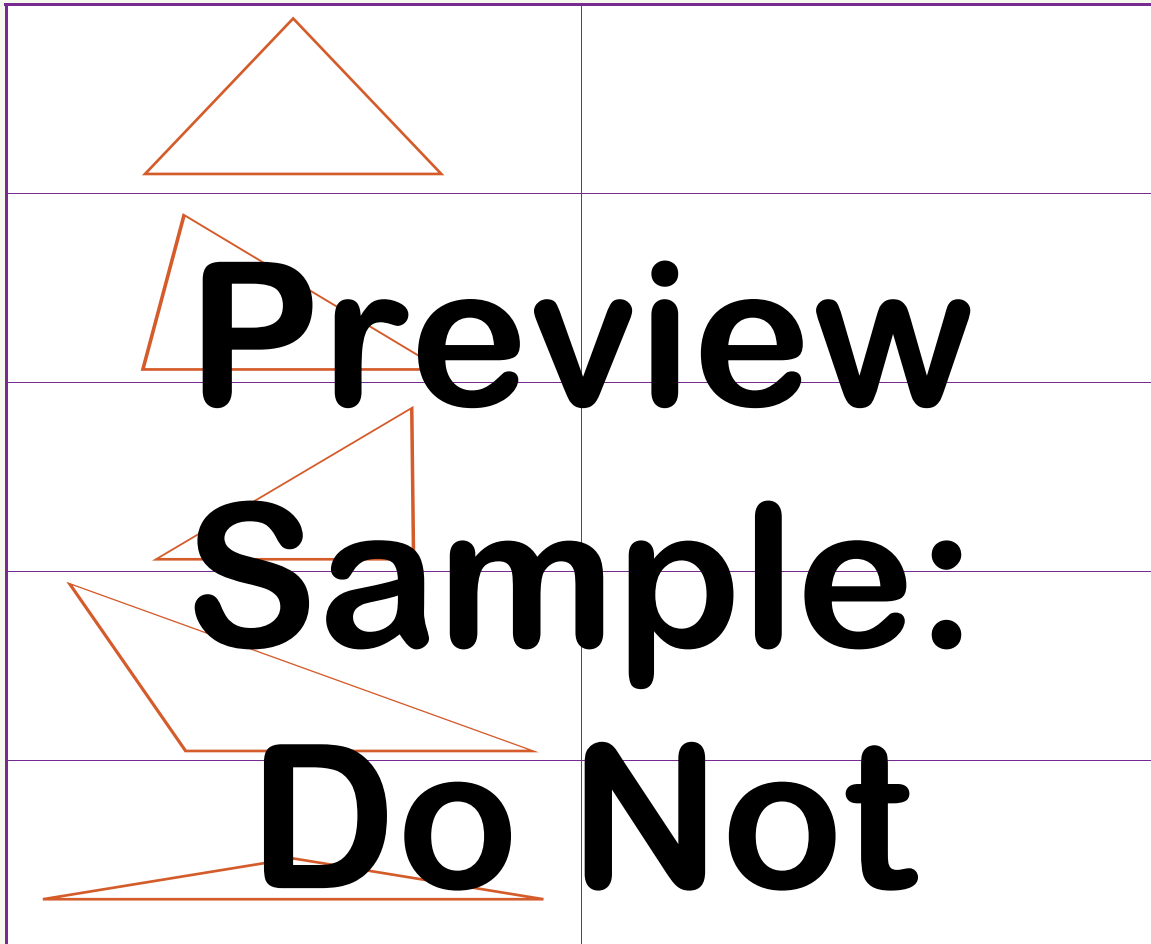
Right-angled: Has a 90° angle in it. **Equilateral:** All 3 sides of equal length, therefore all 3 angles are the same.

Isosceles: Has 2 sides of equal length, therefore 2 angles will be the same.

Scalene: All the sides are of different lengths; therefore 3 different angles.

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1. Use a protractor to measure each of these angles. Where might you experience, use, or apply these shapes or angles in the real world?
2. If you've measured 2 angles correctly do you have to measure the third? Try and create a formula for this as a short cut.



The corn chip challenge

Many corn chips are triangular in shape. Although when they are cut they do not have 'exactly' straight edges, they will make for an interesting case study in the power of the triangle.

In pairs, get hold of some corn chips and lay them out flat. Record the weight of the chips based on the package weight and using an accurate scale. The class should investigate different packaging sizes and brands. Arrange the chips carefully into a rectangular 'sheet' to see how much surface area they cover. Calculate the **perimeter** of the most regular shape you can make. Measure the **area** of this shape. (Note: Due to 'gaps' these measurements will be approximates.)

Re-arrange the chips to make different shapes. Photograph these and see who comes up with the most interesting arrangements. Record these in your workbooks. Prepare a multimedia report to the class reporting on your findings. Discuss your findings as a class. (Tip: Handling food = wear gloves and clean up afterwards!)



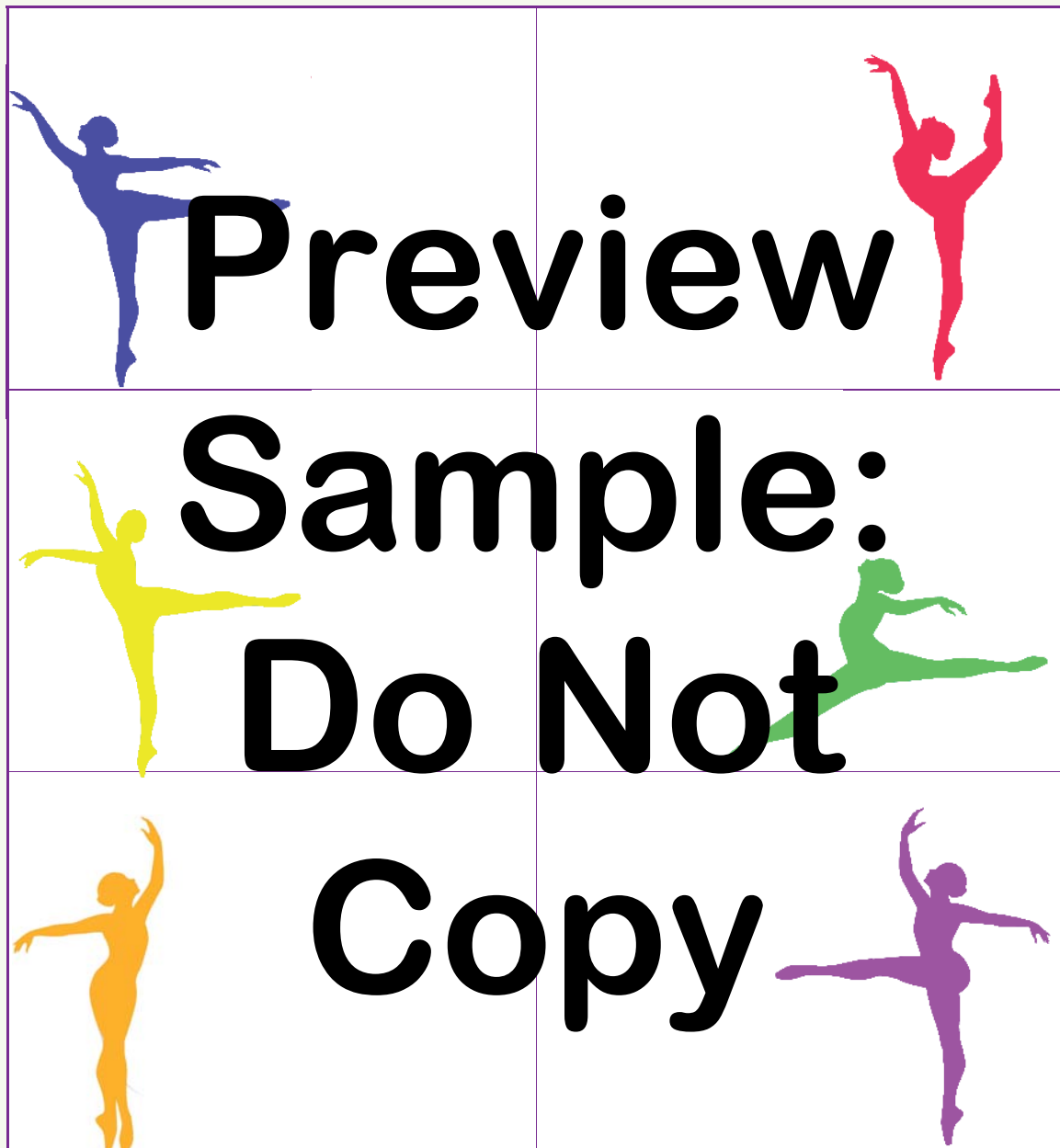
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7.17 Measuring Angles

B Angles at play

Physical activity is good both for your physical health and mental wellbeing. Dancing is fun, hard work but a good workout. Ballet dancers in particular have to reach the ultimate level of fitness, skill and grace.

1. Measure the angles made by different body parts of this dancer, Susan, as she demonstrates various moves. Could you do that? Why/why not?



Images: Adapted from Alina Fedorova/iStock/Thinkstock

2. Research and explain how angles are important in a physical activity you are interested in, such as working out, a ball sport, swimming, diving, cycling or some other recreational pursuit.



By now some of you might already have your license or be well on the way to building up your hours as part of your 'L's. Driving motor vehicles is one of the most common, and important, ways that we use angles on a day-to-day basis.

If you get the angle wrong when parallel parking for your test - you fail! If you get the angle wrong when reversing into a driveway, you might take down the letterbox and dent your panel. And if you get the angle wrong when turning into a dual-carriageway, you might almost have a head-on! And nobody wants that to happen.

Complete the table by describing when angles are important as part of motor vehicle use. Trucks, motorcycles, trailers and other specialty vehicles also have their own issues with angles. Explore these if they relate to you. Add some of your own.

Example	Describe / type of angle	What should/can you do?
parallel parking		
angle parking		
reversing out a park		
reversing into park		
rounding a bend		
turning into a dual carriageway		
U-turn		
hook turn		
3-point turn		
towing a trailer		
driving in the rain		
off-road driving		

Preview
Sample:
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7.19 Assessment Task

AT7 Measuring Up

Overview

For this assessment task you are required to describe and apply practical measuring skills and techniques for personal and work-related situations of your own choice.

You need to investigate and apply measurements of:

- ☐ perimeter and circumference
- ☐ area
- ☐ volume (fluid and/or solid)
- ☐ weight (mass)
- ☐ temperature
- ☐ angles
- ☐ relevant rates and ratios

Required

1. Choose an activity related to your personal life to focus on. This could be a sport, hobby, interest, responsibility or some other relevant focus. Some examples are listed below but you could negotiate your own focus activity with your teacher.

- | | | |
|---|--|--|
| <input type="checkbox"/> driving | <input type="checkbox"/> art & illustration | <input type="checkbox"/> model-making |
| <input type="checkbox"/> motor vehicles | <input type="checkbox"/> design & illustration | <input type="checkbox"/> clothing and design |
| <input type="checkbox"/> cooking | <input type="checkbox"/> performing arts | <input type="checkbox"/> electronics |
| <input type="checkbox"/> fitness | <input type="checkbox"/> making and creating | <input type="checkbox"/> computing |
| <input type="checkbox"/> health | <input type="checkbox"/> building and constructing | <input type="checkbox"/> travelling |
| <input type="checkbox"/> sport | <input type="checkbox"/> domestic indoor work | <input type="checkbox"/> camping/outdoors |
| <input type="checkbox"/> recreation | <input type="checkbox"/> domestic outdoor work | <input type="checkbox"/> volunteering |
| <input type="checkbox"/> gardening | <input type="checkbox"/> pet care | <input type="checkbox"/> your choice! |

2. Outline tasks related to your focus activity that involve, or rely on, measuring.

3. Describe how you use measuring in these tasks. Include:

- ☐ measurement techniques, units and devices
- ☐ key measurements that you make
- ☐ key angles that apply
- ☐ rates and ratios that apply
- ☐ how you use and apply estimation, accuracy and precision
- ☐ the importance of safety
- ☐ other relevant information.

You must ensure that you describe measuring related to: **perimeter** and/or **circumference**, **area**, **volume/capacity** (fluid and/or solid), **weight** (mass), **angles** and (if relevant) **temperature**.

4. Explain how you can transfer, or have transferred, these personal skills and competencies to work-related situations.



5. Prepare and present a multimedia report to the class. Your teacher will advise you of the guidelines for this.

Name:	Project dates:			
Focus activity:				
Tasks - AT7: Measuring Up	Re- quired	Due by	Done	Teacher initials
Stage 1: Focus activity				
1. Negotiate your topic with your teacher.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2. Outline activity tasks that involve measuring.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Stage 2: Applied measurement				
3a. Measurement techniques, units and devices you use.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3b. Key measurements that you make.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3c. Rates and ratios that apply.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3d. Estimation, accuracy and precision.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3e. The importance of safety.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3f. Other relevant information	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3g. Describe perimeter or circumference.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3g. Describe area.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3g. Describe volume.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3a. Describe angles.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3g. Describe weight.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3g. Describe temperature.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Stage 3: Transferring skills				
4a. Describe how you could transfer these skills for work.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
4b. Describe how you have transferred these skills to work.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Prepare and present a report.				
⇒ Prepare your report.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
⇒ Obtain and respond to feedback.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
⇒ Present your multimedia report.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Additional information:				
<div style="display: flex; justify-content: space-between;"> <div>Signed: _____</div> <div>Date: _____</div> </div>				

Preview
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7.21 Numerical Language

When dealing with numerical skills related to **measuring (S7)** and **representation & design (S8)** there are a number of key terms and phrases that you might hear and be expected to know. List key terms/phrases, provide a definition, and outline how each relates to personal and work-related situations.

[illegible]

Representation and Design 8

Contents

8.01 Visual Numeracy.....	182	8.13 Scaling.....	194
8.05 Plans and Diagrams	186	8.17 Assessment Task.....	198
8.11 Models and Prototypes	192	8.19 Self-Reflection.....	200

Activities 8: Representation and Design	p.	Due date/Done?	Comment
8.02A Visual numeracy	183		
8.04B 2D into 3D	185		
8.06A Flowcharts	187		
8.08B Sketches	189		
8.10C Plans	191		
8.12A Modelling	193		
8.14A Scaling objects	195		
8.15B Mixing scale	196		
8.16C Technical drawings	197		
AT8 Make Me Up	199		
8.19 Self-Reflection	200		

Comments:

8.01 Visual Numeracy

Visual numeracy

Visual numeracy involves being able to 'think' visually. This ability leads to skills development related to designing and interpreting plans, diagrams, flowcharts, sketches, maps and other forms of visual numerical communication, including the manipulation of objects in 2D and 3D.

We call on visual numeracy in personal situations when we drive, cook, play sport, care for children, renovate, decorate, fix things, move house, as well as many other tasks.

Visual-spatial numerical skills are essential for people who work in design, trades, manual and practical jobs, technical fields, visual arts, ICT and multimedia, construction, hospitality and transport.

So have a read of this description of visual-spatial learners and 'see' how much this sounds like you.



Preview

These people tend to have well-developed observational skills and abilities with images (visual-spatial).

Characteristics include:

- ☺ reflective and quieter, with active eyes
- ☺ able to interpret meaning from images and diagrams
- ☺ prefer visual instruction and manuals
- ☺ can memorise and interpret concepts as pictures or graphics
- ☺ likely to draw diagrams and plans; or sketches and concept maps.

However, they:

- ☹ can become distracted when hearing or reading text-based information
- ☹ might seem distant and poor communication
- ☹ might not understand how other people can't follow visual or written instructions
- ☹ can have trouble following verbal instructions.

More suited for occupations in fields, such as:

- ✓ construction, mining and trades (working with equipment and materials)
- ✓ technical and scientific (researching and applying visual and written information)
- ✓ ICT & multimedia (developing systems and interfaces)
- ✓ visual arts and design (by being able to draw, create and design).

Some other possibilities include:

- ✓ emergency services, such a police officer paying visual attention to peoples' actions
- ✓ medical, such as physiotherapist visually assessing a patient's movement
- ✓ agriculture, such as a farmer surveying their land, crops, stock and the weather.

They might often say:

- ⇒ "Just show me!"
- ⇒ "Look here!"
- ⇒ "Let's take a look at this"
- ⇒ "Did you see what happened to so and so?"
- ⇒ "I can't see what's happening!"

1. How would you assess your own skills in visual numeracy? Use examples to support this as well as the info from p.182. (Perhaps you should use an image!)

2. Complete the table for these examples with the application of visual numeracy. Add 2 more examples of your own choosing.
- a. Explain how you might apply each in personal situations.
 - b. Describe how you (or a worker) might apply each in work-related situations.

Example	Personal example	Work-related example
judging distance		
moving objects		
following instructions		
making a sketch		
reading plans		

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8.03 Visual Numeracy

3D objects

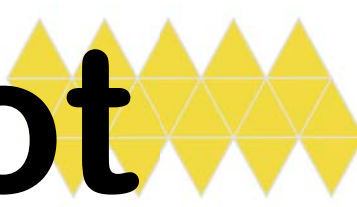
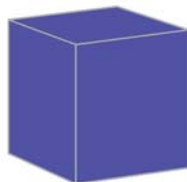
A key part of visual numeracy is the ability to estimate and manipulate objects in three dimensions.

One way to work with solid objects is to use **object nets**. You probably have already worked with object nets before so you it's time to refine your skills.

Consider the 3D properties of a cube. A cube is a solid 3-dimensional item and this shape is used for items, such as dice, a block of sugar, a pen holder, a gift box and concrete building materials.

How about a pyramid? Triangular shaped objects are less common than cubes but can be found in packaging, building materials, furniture and other real world applications.

You need to be able to demonstrate the ability to assemble 3D objects from 2D objects nets, as well as the ability to turn 3D objects into 2D object



Preview
Sample:
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*Image adapted from: Furian
Depositphotos.com*

Solid objects

Vertex: A vertex is a point where two or more lines, curves or edges meet, i.e. a corner! Of course this meeting point will form an angle. The plural of vertex is vertices. e.g. A cube has 8 vertices. Vertices are often indicated by a dot.

Edge: An edge is a line segment between faces. e.g. A cube has 12 edges, and these will all be the same length. Edges are shown by lines.

Face: A face is a single flat surface. e.g. A cube has 6 faces. Faces are shown by a 2D shape.

So have a go at counting the number of vertices, edges and faces for each of the objects shown above.

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Part A:

1. Print or create this object net on hard card or using foam core board.
2. Cut, assemble and glue your image to make the object.



Image adapted from: Furian
Depositphotos.com

Part B:

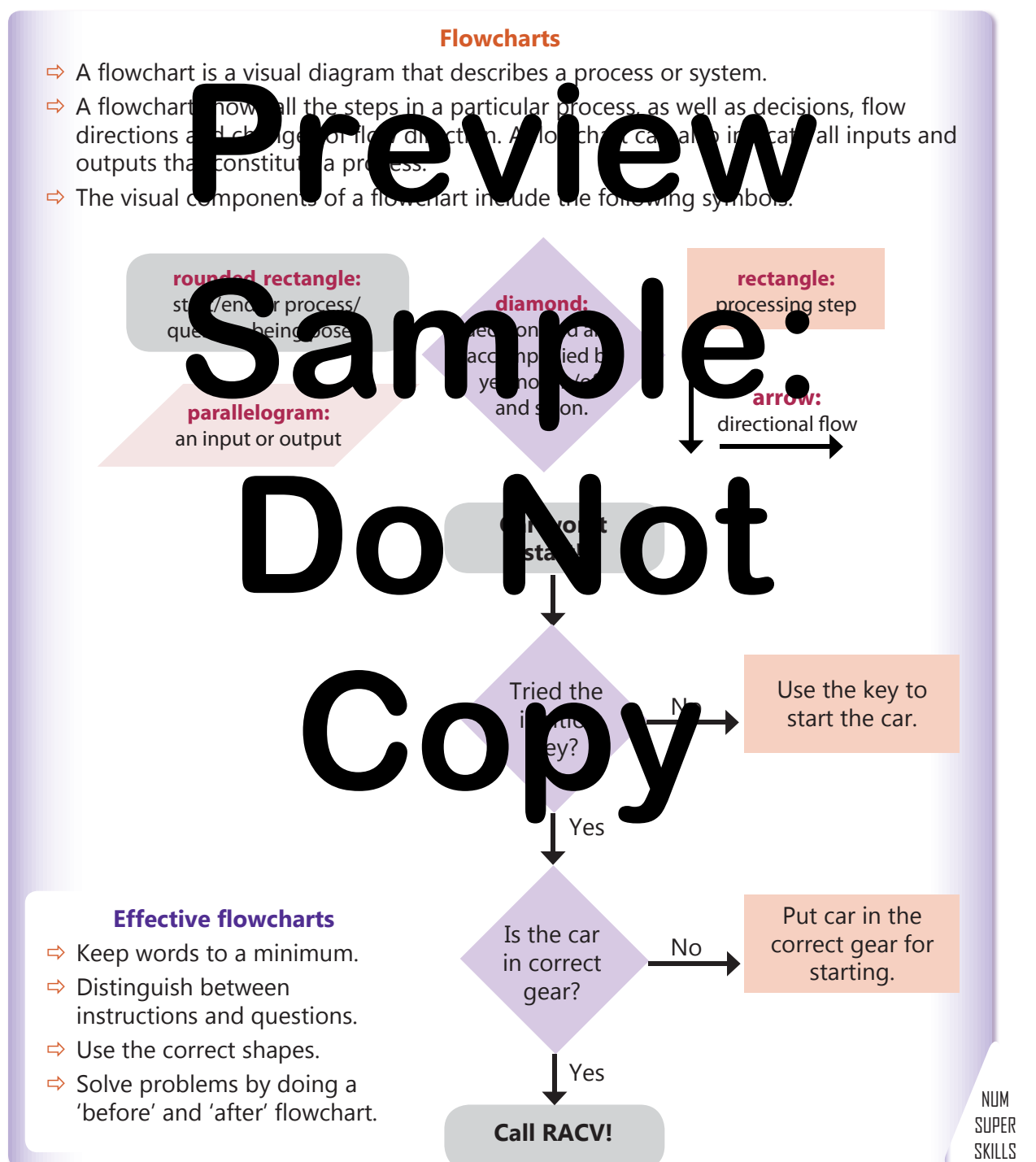
1. Make an object net for a cube. Make a sketch below.
2. Number the faces from 1 to 6, taking care to orient the numbers so that when assembled, the object will resemble a die with the numbers 'reading' the right way up.
3. Assemble your net carefully into the object.
4. How did you go with the orientation of your numbers?
5. What does this way of thinking show you about how to form shapes, and how to successfully manipulate visual information in 3 dimensions.

8.05 Plans and Diagrams

Diagrams

A diagram is a visual representation of an image, object, process, layout or other scenario including plans, schematics, maps, flowcharts, mind-maps (concept maps), instructional signs, graphs, pie charts, infographics, screen layouts or even sketches. There are many specific types of diagrams that are used in business, ICT, maths, healthcare, transport, trades and other fields.

Diagrams can be helpful because many people think in series of steps and decisions. A diagram, such as a flowchart, can allow us to visually represent that process. This visual representation of these steps can aid teaching and learning, or reinforce safety, or assist in quality improvement.



You are required to design a flowchart for a straightforward personal or work-related task using the correct symbols. For example, you might instruct someone on how to change a tyre, use a coffee machine, make breakfast, solve a multimedia problem or some other task that you are interested in.

Start to draft ideas on this page and then complete your final flowchart in a large format. For those of you with good ICT skills perhaps you could develop a multimedia tool. Look online for examples of other flowcharts to guide you.

Make sure you test your flowchart and work through all the steps.

Flowchart: Information and planning

Preview Sample: Do Not Copy

8.07 Plans and Diagrams

Sketch

A sketch generally refers to a quick and stylised visual representation of an object or scenario. Sketches often act as the first stage in the development of an image-based, or object-based, project. The quality of a sketch is not usually reliant on the quality of the drawing; but rather on the ability of the sketcher to clearly illustrate their intentions.

For example, if you are going to build a new deck, you might draw a rough sketch to help visualise its size, its placement and the materials needed as part of your project. Then you take that to Bunnings and get advice on what you need. Bunnings might also supply you with a more technical set of instructions using properly drawn diagrams and plans.

Perhaps you have an idea for a new clothing range? Initially a designer will draw quick sketches to get an idea of cut, line, shape, colour and other elements of the clothing. They might then show these sketches to a dressmaker to assess their feasibility. If things seem feasible then they might work with an illustrator to **render** the drawing in a finished form.

Advertisers and media producers use sketches to storyboard films and ads. Illustrators and costume designers might sketch drafts as they go through the development phase of a new creative work. Industrial designers might sketch new ideas for **prototypes** products.

And a sketch artist, of course, makes sketches to order; be that a portrait of a loving couple; or a photo-image of a wanted criminal!

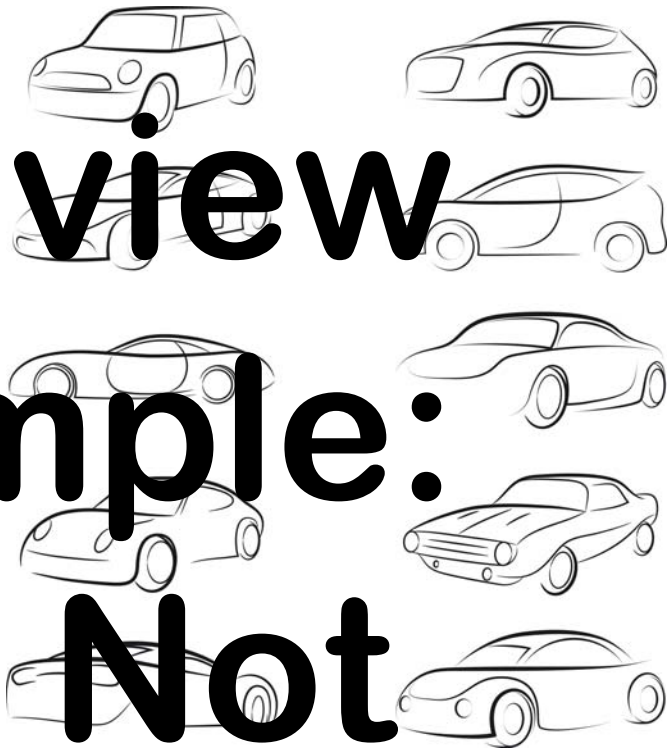


Image: gurita hitam
iStock/Thinkstock

- # Copy
- ⇒ In the 'old days' drawings were done by hand. People worked as drafters or commercial artists and made sketches to order.
 - ⇒ Nowadays the use of CAD, multimedia drawing programs, apps and other computerised tools and platforms means that the job of draftpersons, illustrators, designers and commercial artists has evolved.
 - ⇒ But which is better; old-school or new school? Is this a matter of quality, accuracy, aesthetics and/or efficiency?
 - ⇒ What do you think? Discuss as a class using examples sourced online.



Images: (t) Zoonar/N.Okhtin/Zoonar
(b) Maxim Kostenko/iStock//
Thinkstock



You are required to develop 2 sketches. One is of a personal item, such as a car, bike, item of clothing, jewellery or a personal effect. The second sketch is of a process such as a home improvement, vehicle enhancement, idea for a project, idea for a product, a design layout, a storyboard, a character or another similar concept idea.

Now this isn't a test of drawing skills, although those of you with good drawing and design skills will produce well-rendered sketches. Rather, this is a test of your ability to communicate information simply, clearly and effectively using a fairly quick sketch to convey your idea.

Sketch: Drafting and planning

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8.09 Plans and Diagrams

Visual plans

Plans are generally technical in nature and are prepared and used by workers in various industries. **Diagrams** are usually less technical and can include words, symbols, steps and explanations.

Some of you were introduced to plans in Numeracy Intermediate. Many of you would also have been exposed to plans as part of your day-to-day personal lives and in work-related situations you have experienced.

Visual plans are an essential component in developing and communicating numerical information visually.

Plans can take many forms, ranging from a menu plan for an event, a seating plan for a wedding, a stylised floor plan for a house for sale, or an architectural technical drawing for a building.

On a **macro** level plans are also used to denote the location of infrastructure, such as sewerage systems, electrical and gas supply lines, road and rail networks, telecommunications systems and many more.

On a more focused **micro** level, plans may denote:

- ⇒ the exact location of underground electrical cables, gas lines and water pipes
- ⇒ circuit diagrams or schematics that show the wiring of a house or electrical device
- ⇒ blueprints and technical drawings for prototype products and designs
- ⇒ maps to show local travel routes, store layouts and many more.

Types of plans

- ⇒ plan
- ⇒ map
- ⇒ diagram
- ⇒ floorplan
- ⇒ blueprint
- ⇒ schematic
- ⇒ diagram
- ⇒ circuit diagram
- ⇒ technical drawing
- ⇒ sketch

Image: cosmin400/
iStock/Thinkstock



Scale

- ⇒ When preparing plans and diagrams it is important to make use of a scale.
- ⇒ If a plan is drawn to scale this means that an alloted distance on the plan corresponds with a distance in real life. (However, not all plans are to scale.)
- ⇒ A scale measures a ratio, such as 1cm = 1m. Scale might be written as 1:100 (e.g. 1cm = 1m). So each measurement of 1cm will equal an entire metre in 'real life'!
- ⇒ Scale allows us to make an accurate reproduction of an object either smaller (1:100), larger (5:1) or exact (1:1).
- ⇒ Floor plans usually have a scale of 1:50 or (1:100) of actual size (see below).
- ⇒ Site plans usually have a scale of 1:200 or (1:500) of actual size; because the object is larger, the scale is smaller.
- ⇒ Technical and industrial drawings might use a scale of 2:1 or larger; because some technical objects are very small and need to be drawn oversized for design and instructions purposes.

1:100 cm



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Take some time to study this house plan then complete the following tasks.

1. Does this plan seem to be drawn to scale? Why so/why not?
2. Estimate the size of the overall block and the size of the house (and in 'squares').
3. Apply a reasonable scale and estimate/measure the internal size of each room.
4. List the features shown on the plan. Are they to scale? How do you know?
5. What do you think of this house plan? Would it suit your family; or suit you in your future? Explain your answer.
6. How much might this house cost to build? Look at current build prices and land prices in your area? How do you feel about this?



Image: dancingwithvectors
iStock/Thinkstock



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1.	2.
3.	4.
5.	6.

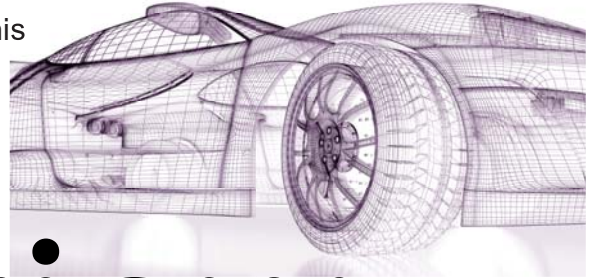
8.11 Models and Prototypes

Models and prototypes

A **prototype** is a physical model of a product in development, and is used for testing and evaluation purposes. Organisations are increasingly making virtual prototypes using **computer-aided design** (CAD) that can be modified quickly and efficiently. This requires a high degree of visual acuity, design skills as well as advanced training on CAD software.

Image: UmbertoPantalone/iStock/Thinkstock

However, many models are still **rendered** in 3D. As humans we respond to three dimensions. This is, all after, how we live! So people continue to make scale models, dioramas, prototypes, set designs, mini-cities and other 3D models. And seemingly, more adults are playing with Lego, than kids are!



Model-making

Model-making is a sophisticated occupation that involves highly developed visual numerical skills. Model-making combines eye-hand co-ordination, accurate measurements, artistic and craft-based talents and a committed discipline to accuracy, precision and quality.

Model-making involves estimating, measuring, crafting, carving, casting, layering, scraping, baking, setting, colouring and many more skills and activities. Wood-modelling may involve wood-turning, metals modelling - casting, plastics modelling - casting, fibreglass modelling - moulding, confectionary modelling - shaping, and so on.

Many industries still use model-makers to create scale or life-size 3D models of their products.

- ⇒ The automotive industry makes scale clay models of concept vehicles and then full-size clay models of new vehicles. Look those new cars are really cool!
- ⇒ Industrial designers will work with model-makers to produce prototypes of new products.
- ⇒ Toy manufacturers will make prototypes from which to develop casts. (This makes Star Wars collectors very happy!)
- ⇒ Other industrial makers stamp dies from models to make other shapes from models.



Old-school v nu skUL

- ⇒ Have you ever used a 3D printer? Has your school got one?
- ⇒ 3D printing is an innovation that can help people render their prototypes, designs and products in real-life form. 3D printers have been used to make industrial components, jewellery, action figures, weapons, household items; and even houses!
- ⇒ However, a 3D printer can only render what it is told to. It can't make a bad design better nor can it make a dud product sell!
- ⇒ Quality 3D printing is not yet at a cost-effective stage whereby it can replace mass production, but it is good for niche products, and for hipsters (remember them?!)



Draw, render or design a scale-model based on a product or object you like.
Perhaps you can design a prototype for a new concept or innovation?

- ☐ Include an original image of the object.
- ☐ Make accurate measurements and develop a scale.
- ☐ Produce your 2D image by hand or using multimedia; or render your 3D model.

Drafting, measurements, planning and images.

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8.13 Scaling

Representing size

It takes a special set of skills to represent objects accurately.

Both scale and size ratio are important applied design and representational concepts when working with objects

Of course large-sized objects get represented as smaller design elements or images, such as the drawing for a concept car.

Smaller shapes and objects are represented bigger, such as multimedia graphics for a biological model.

For this topic it's best to use as few words as possible, so let's get into the drawing!

Scale and ratio

A scale is used to represent the relative distance or size of a map, diagram, shape or object compared to itself in real life.

Scales use quantity ratios, e.g. 1:4, 1:20, 1:10,000 or even 2:1!

A map scale of 1:10 (in cm) means that every 1cm on the map represents 10cm in real life. Or, the map is 1/10th the size of real life.

An action figure might be in 1:6 scale. This means that every 1cm of the action figure represents 6cm in real life. So the action figure is 1/6th the size of the character it is representing.

A small object such as a fly might be drawn at 4:1. This means that the drawing is increasing the real life size of the fly by a factor of 4.

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Preview:

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Do you like models, miniatures, dioramas and other representations like this?
Many people love this old-school style of modelling. Indeed many 'new-skul' designers and computer modellers, who are stuck at their computer screens all day, come home and unwind by doing physical drawing, modelling and modelling.

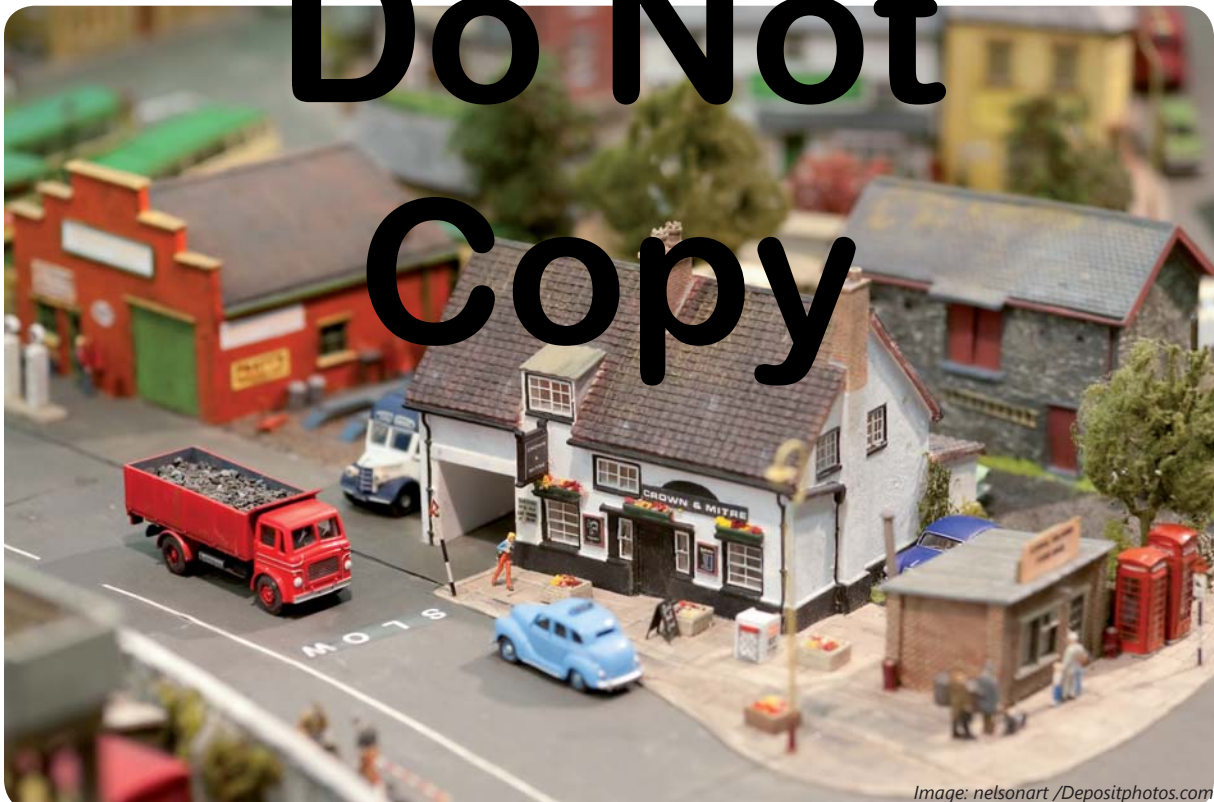


Image: nelsonart /Depositphotos.com

Scaling objects A

1. Estimate the dimensions (size) of these objects as shown on the page.
2. Measure these images. How did you go with your estimates?
3. Estimate the depth dimension measurements of these objects.
4. Estimate the scale of the drawings of each icon compared to the object that each represents in real life.
5. Sketch or draw these objects first by hand, and then using multimedia, at 1:1, 1:2, 2:1, 1:4 and 4:1 scale (you don't have to do every scale for each object). If you have good drawing and design skills use perspective to create a sense of depth.

Preview Sample:

Image: doomu/Depositphotos.com

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Image: Dezay/Depositphotos.com



Image: Depositphotos.com



Image: StockerNumber2/Depositphotos.com

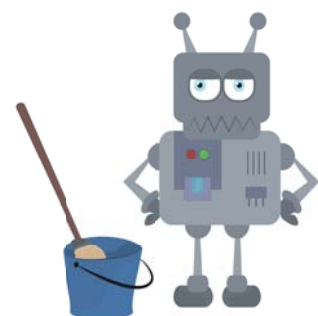


Image: themaka /Depositphotos.com

8.15 Scaling

B Mixing scale

LIT

Sometimes scale may be used to deliberately mix up imagery to create drawings, images or objects that convey greater meaning through using contrast, symbolism and metaphor.

1. What is being communicated by these images?



2. Create an image like these. Consider using a collage of visual effects. Have classmates suggest what they think the image is communicating. Give them feedback about how close they were; also you will have to take feedback from them about your image as well!

Preview Sample:



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Image: Nomadsoul1/iStock/Thinkstock

The ability to read, interpret, communicate and even create technical drawings is an important numeracy skills for a lot of applied work situations.

Designs, floor plans, blueprints, schematics, prototyping/modelling renders and other technical drawings all get created and interpreted by varied users at different stages; such as concept development, design, technical planning and engineering/constructing.

Calculating and communicating accurate measurements are key skills for these processes, especially the ability to turn 2D representations and measurements into 3 dimensions.

1. Carefully estimate the 3D dimensions for this rendering of a house, its rooms and some other key features. Make sure that your estimates are in relative scale to each other.
2. Sketch this house by hand or using multimedia, and add the measurements.
3. Create a sketch or image of your own dwelling (or some other dwelling you like). Add accurate 3D dimensions. You could have a go at constructing a model of this as well.

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8.17 Assessment Task

AT8 Make Me Up

Overview

You are required to use your skills in estimation, measurement and design to complete one of these 3 projects. Each project draws on similar skills but you will have to apply your skills in varied ways. The requirements for each project are outlined in the table below. Your teacher will discuss the suitability of each project for you and your class.

The three projects from which to choose are as follows.

- ☐ Develop your ideal house plan to scale and make a 3D model or diorama.
- ☐ Accurately measure, draw and render a model of a 'product', such as a motor vehicle, or another object.
- ☐ Accurately measure, draw and render a model of a person or an animal. This could be rendered like a toy, a doll or even in micron figure.

Ideal house plan	Model of product	Model of a person/animal
<ul style="list-style-type: none"> <input type="checkbox"/> Estimate size of exterior, interior rooms and fixtures and fittings. <input type="checkbox"/> Measure and use scale to produce a plan. <input type="checkbox"/> Create scale 3D model of exterior and interior rooms; and at least one room with fixtures and fittings. <input type="checkbox"/> Research costs, and compare proposed house with actual houses. <input type="checkbox"/> Comment on the accuracy of plan and model versus reality; and any issues. <input type="checkbox"/> List sources, measuring tools and methods. 	<ul style="list-style-type: none"> <input type="checkbox"/> Estimate size of 'object' and size of model. <input type="checkbox"/> Measure and use scale to produce sketch or technical drawing. <input type="checkbox"/> Create scale 3D model of 'object' in material of your choice. <input type="checkbox"/> Research and/or outline costs of rendering model in a permanent form. <input type="checkbox"/> Comment on the accuracy of plan and model versus reality; and any issues. <input type="checkbox"/> List sources, measuring tools and methods. 	<ul style="list-style-type: none"> <input type="checkbox"/> Estimate size of the person/animal and size of model. <input type="checkbox"/> Measure and use scale to produce a sketch or technical drawing. <input type="checkbox"/> Create scale 3D model of the person/animal in material of your choice. <input type="checkbox"/> Research and/or outline costs of rendering model in a permanent form. <input type="checkbox"/> Comment on the accuracy of plan and model versus reality; and any issues. <input type="checkbox"/> List sources, measuring tools and methods.
House budget = \$200,000		

Add other information, notes, key dates, etc..

Name:					
Project:					
Tasks - AT8: Make Me Up	Re- quired	Due by	Done	Teacher initials	
Stage 1: Estimating and Design					
i. Research and carry out initial estimates.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
ii. Identify appropriate measuring tools.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
iii. Identify and use appropriate scale or ratio.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
iv. Use measuring tools accurately for required units.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
v. Produce a plan, sketch or menu.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Stage 2: Creating a 3D Model					
i. Choose materials for 3D objects.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
ii. Make 3D diorama or model.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
iii. Research costs of rendering model in a permanent form.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
iv. Discuss with teacher and refine if necessary.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Stage 3: Analysing Information					
i. Comment on the accuracy of the outcome.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
ii. Comment on and explain any issues/problems.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Prepare and present a report.					
⇒ Prepare your report.	<input checked="" type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
⇒ Present your report.	<input type="checkbox"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Additional information:					
Signed: _____ Date: _____					

Preview
Sample:
Do Not
Copy

8.19 Self-Reflection

Self-Reflection Pro-Forma

Which numeracy skills did I develop during this unit?

→ _____

→ _____

→ _____

How have the skills of numeracy helped improve my personal life?

→ _____

→ _____

How have the skills of numeracy helped my development of work-related skills?

→ _____

→ _____

How would I rate my performance (use a circle) in developing my numeracy skills this unit?

0 not shown	1 low	2 reasonable	3 good	4 very good	5 excellent
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What were my strongest areas of performance and what should I work on improving?

My strongest topics/skills were	But need to improve my skills in:

Signed: _____ Date: _____

Teacher initials: _____ Date: _____