General Mathematics: Units 1&2
ClassPad activities

Using technology to support mathematics learning

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Using technology to support mathematics learning

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Introduction

This book comprises a series of activities which are designed to facilitate learning about both the technology and the mathematics. Unlike a textbook, the activities cover neither the whole course, nor are they restricted to purely course material. Activities beyond the course content can still assist you with solving problems within the course while also increasing your scope to explore broader mathematical questions, including further mathematics study. In contrast to electronic device manuals this book is about mathematics with detailed instructions on how the technology can be used.

The activities vary in the time needed to complete them. Some are primarily concerned with how to perform a particular technique within a ClassPad application, and some use the ClassPad output as the starting point. In others, the ClassPad is only a small part of the activity.

The activities are arranged into chapters matching the Australian Curriculum topics. Within each topic the activities reflect a possible sequence of learning related to that topic. Many activities can be used as a precursor to formal teaching of the concept thus encouraging a sense-making approach.

Each activity has an aim, linking to curriculum documents, the activity itself and usually a section of *Learning notes*. Fully worked solutions are provided at the end of the text. The learning notes are intended to help with the understanding of concepts, provide more detail or help with instructions for ClassPad use, provide additional explanations or point to interesting further explorations. As the course progresses more assumptions are made about the skills you have developed and so the instructions become briefer. Where more detailed instructions are required on ClassPad use, it will often be in the *Learning notes* rather than in the text of the investigation.

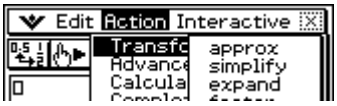
The Computer Algebra System (CAS) is very powerful but can also be frustrating. When we are doing algebraic manipulation with pen and paper, we often decide what to do next by considering the current line of working. Using CAS, however, requires the articulation of steps in words and these words are then the commands for CAS to perform the next step. *Solve*, *simplify*, *factor* and *expand* are examples of these words. Generally, the result is useful, but sometimes you might be unable to find a suitable command. In this case, you may need to work with part of an expression, or even return to pen and paper. Knowing when ClassPad use is quicker or more efficient becomes easier the more experience you have. Working through the activities will help you learn this.

What CAS enables us to do is to focus more on what we want to do rather than how do we do it. For example, in a modelling situation we may come across awkward functions that we may not have the tools to deal with by traditional methods. Often, however, CAS will provide an answer so you then evaluate the result, make sense of the result in the real situation and thus demonstrate your understanding of the process of doing mathematics.

A lot of detail has been provided in the ClassPad instructions. However, it is impractical to cover all possible arrangements and settings. These activities were written for the ClassPad 400 series.
(For the ClassPad 330 the instructions may require modification, usually minor changes such as accessing commands through the Keyboard menus and icons that look different).

In the instructions:

- *Press* refers to a key on the ClassPad;
- *Select* and *[ ]* refers to a menu option, e.g. *Select [Action | Transformation | expand]*: The Action menu is at the top of the screen. Transformation is one of the options with expand an option in the submenu.



It is advisable to:

- check the settings such as Standard or Decimal, angles are in degrees, … Being familiar with options can save time;
- become familiar with the soft keyboard and where to find commands;
- clear previous working, [File | New] and [Edit | Clear All] may be helpful; and
- know how to clear variables and functions from Memory manager. If variables are stored from previous work that may lead to unexpected results. In particular if a variable has been used to define a function it is not cleared when clearing all variables.

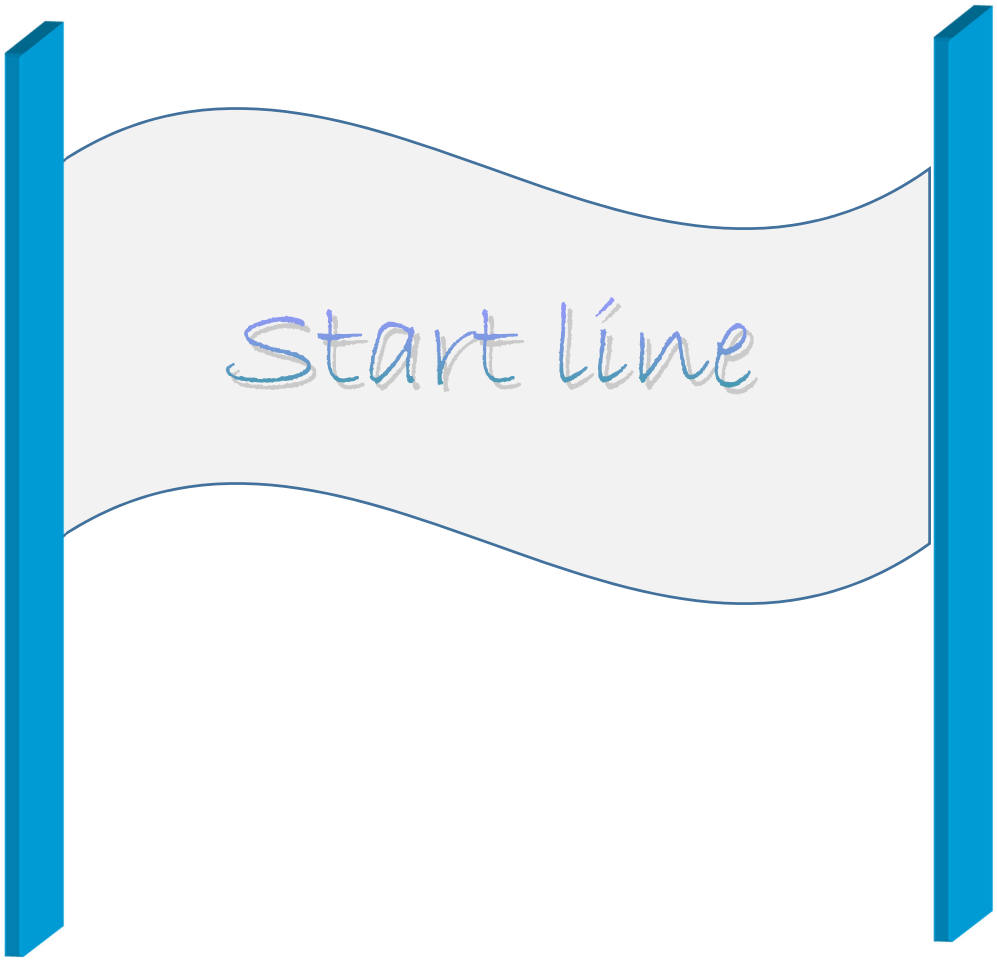
These materials have been developed from similar books written for Western Australian senior mathematics courses. The authors have mainly used the activities in class and as introductions to topics. During these periods there was much discussion between students as they learned the mathematics and enhanced their skills with ClassPad.

Ian Sheppard and Andrew Pateman

Chapter 1 Preliminaries

Activity	ClassPad applications	Key concepts
Basic calculations quiz	Main	How to perform basic arithmetic calculations
Connect the dots	Geometry	Review of coordinates in the Cartesian plane

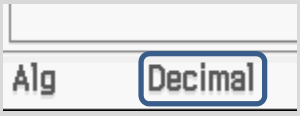
The activities in this chapter review content from previous years. They are a valuable introduction to the use of the Main and the Geometry application if you are not familiar with it.



Activity 1 Basic calculations quiz

Aim: Perform simple calculations with the ClassPad.

Setting up: refer to Learning Notes
Round off decimal answers to 3 decimal places.
Total your answers to Questions 1 – 10.
If all your answers are correct then your total will match the given value.

	Question	Hint	Answer
1	16.2×3.1		
2	$7+2\times3^2-15$		
3	$\sqrt{17}$	Press Keyboard 	
4	$\sqrt{9}+\sqrt{16}$		
5	$963.1\div171.6-6.3$		
6	$\sqrt{(9+16)}$		
For Q's 7 to 10 use a = 3.91, b = 1.0765, c = 6.3 and d = 8.9			
7	Calculate a^2 when a = 3.91		
8	Calculate $a^2 - c$		
9	Calculate $a \div d$		
10	Calculate $(a + b) \div b$		
	Total Q's 1 - 10		105.002

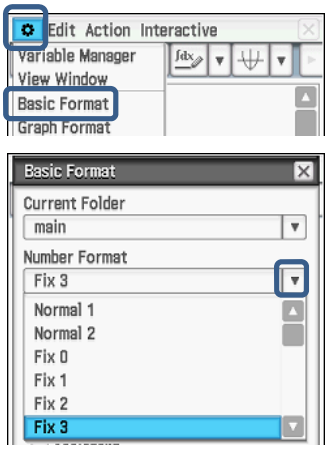
Learning Notes

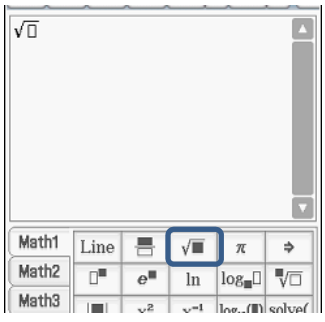
There are usually a number of ways of performing an operation on the ClassPad. The following is one way.

Set Up:

Display decimal answers • Tap Main $\sqrt{\alpha}$ • If Standard is showing at the base of the screen tap it to change to Decimal mode. Now calculations will be displayed as decimal answers.	

To set ClassPad to display a particular number of decimal places:

Display 3 decimal places • Tap ⚙ • Choose Basic Format • Tap on the Number Format pull down menu • Select Fix 3 for three decimal places. You may wish to reset this to normal 1 after completing the exercise.	

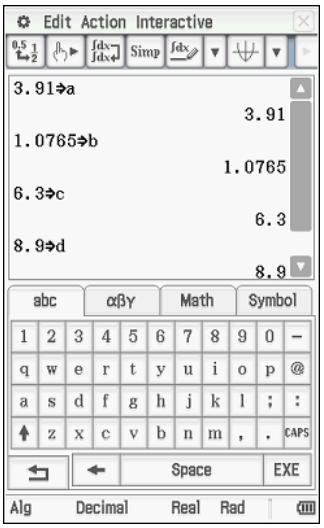
Calculate square root • Press Keyboard • Tap $\sqrt{\blacksquare}$ (The first row of the keyboard is the same in each of the math tabs)	

Note: ClassPad will assume a closing bracket if it is omitted. Incorrect calculations will result when a number of functions are part of the expression. So closing the brackets is a useful habit to develop.

Store the values of a, b, c and d.
This is one way of doing substitution and is usually quicker if the value(s) will be used a number of times.

- Tap Main $\sqrt{\alpha}$
- Press Keyboard
- Enter 3.91, tap ⇒ from the Math1 tab, tap the abc tab, tap a and Press EXE.
- Enter 1.0765, tap ⮌, tap ⇒, tap abc, tap b and Press EXE
- Enter 6.3, tap ⮌, tap ⇒, tap abc, tap c and Press EXE
- Enter 8.9, tap ⮌, tap ⇒, tap abc, tap d and Press EXE

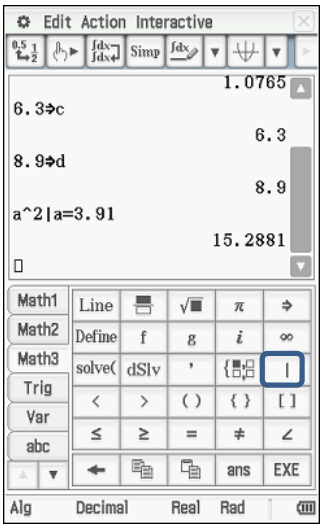
Now enter the expression e.g. a^2



If you go back and change the value of a variable and press EXE then all subsequent calculations are updated.

A slower alternative is to use the | to substitute. Access this through the soft Keyboard

- Keyboard
- Tap Math3
- Tap |



There are many useful tutorials at http://classpad.com.au.

Activity 2 Connect the dots

Aim: Plot and read coordinates.

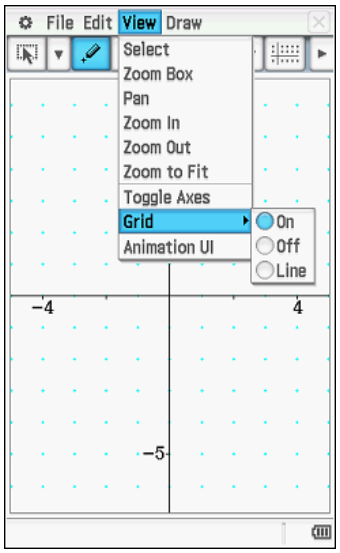
Plot points in Geometry application

Open Geometry

- Tap Menu
- Tap the Geometry button

Setup

- Tap to cycle through the display options
- Set to display axes and scale
- Tap View in the top menu
- Set Grid to On
- If you have a different scale [File | New] will reset the scale or you may need to zoom in or out to get a similar window

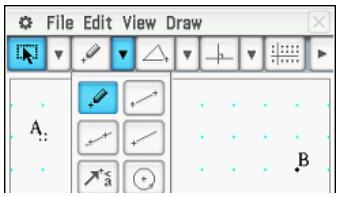


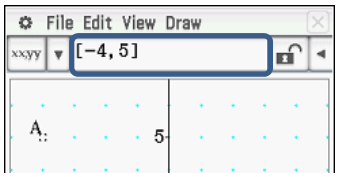
Plot point

- Tap , select from second pull down menu if required
- Tap in open space (where nothing is drawn)

Read coordinates

- Tap
- Tap on your point
- Tap to go round the corner
- Read the coordinates in the measurement box



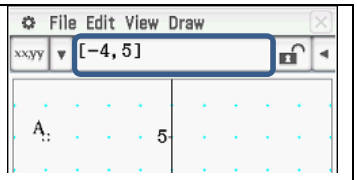


1. Drag the point elsewhere on the graph. Record the new coordinates.

2.

Setting the coordinates

- Tap in the measurement box
- Change to [0,0]
- Tap 🔓 to lock the coordinates
  Tap 🔒 to unlock and the icon will change accordingly



What happens to the point?

3. Plot this connect-the-dot puzzle on your ClassPad.
What is the image produced?

Start (–4, 4) → (–2, 4) → (–2, 1) → (–4, 1) → (–4, –2) → (–2, –2)
Stop
Start (0, –2) → (2, 4) → (4, –2)
Stop
Start (1, 1) → (3, 1) Stop

Clear the window

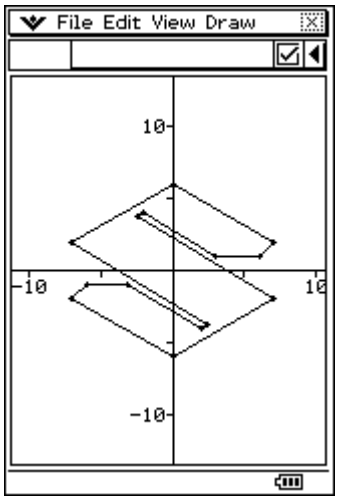
- Select [Edit | Clear All]

Draw a line

- Tap ▼ the pull down menu next to ✎
- Tap ⟋ to select the line segment tool

- Move to the approximate location on the graph for one of the end points and tap
- Move to the next point and tap

4. Create a connect-the-dot puzzle for the S logo shown.



Clear the window

- Select [Edit | Clear All]

Turn the integer grid off

- [View | Grid | Off]

Zoom out if necessary

- [View | Zoom Out]

Draw the lines

- Select the line segment tool tap ⟋
- Tap once for each end of the line

Adjust the lines

- Tap ⬚ for the select tool
- Drag or go round the corner and set coordinates to improve the image

Record the puzzle

5. Create your own puzzle and swap with a classmate.

Learning Notes

This activity is an introduction to the use of the Geometry application. Geometry is a recurrent theme through the course.

Skills covered include how to:

- Plot points;
- Plot line segments; and
- Set or constrain coordinates.

Diagrams often look better without the labels.

To Hide labels: • Tap  , select tool • Tap on object(s) • Select [Edit | Properties | Hide name]	

Chapter 2 Consumer arithmetic

Activity	ClassPad applications	Key concepts
Percentage quiz	Main	Calculations with percentages
Best buys	Main	Compare prices and values
Maddy's boots	Spreadsheet	Convert between currencies using exchange rates
Maxine's car	Spreadsheet	Investigate the potential running costs of owning a car

Activity 3 Percentage quiz

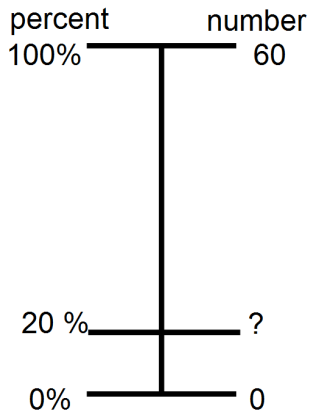
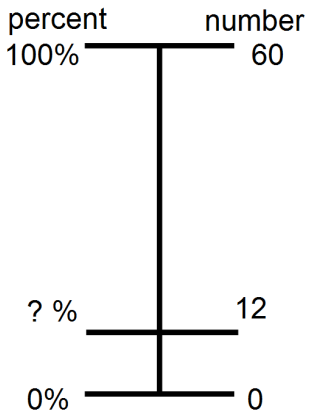
Aim: Solve percentage problems.

- Round off decimal answers to 2 decimal places.
- Total your answers to Questions 1 – 10.
- If all your answers are correct then your total will match the given value.

	Question	Answer
1	Determine the commission of 0.23% on $12 340	
2	An apartment is bought for $463 500 and sold for $521 000. What is the percentage increase?	
3	Wages are to increase by 3.2%. What will a wage of $17.34 per hour become?	
4	Wages have increased by 3.2%. How much did a person currently getting $17.34 per hour receive before the increase?	
5	A jacket is for sale for $120. Adam buys it for 25 % off and then sells it to George for a 25 % profit. What did George pay?	
6	64.3 increased by 5.2% is	
7	$796.90 decreased by 31% is	
8	What is the tax on an item that sells for $550 including GST of 10%?	
	<table><tr><th>Portfolio value</th><th>Fee</th></tr><tr><td>0 - $200 000</td><td>$3000</td></tr><tr><td>$200 001 to $500 000</td><td>commission of 1.5%</td></tr><tr><td>More than $500 000</td><td>$3500 plus a commission of 0.8%</td></tr></table> Questions 9 and 10 relate to Ann, a financial advisor.	
9	What will Ann charge for a portfolio of $450 000.	
10	What will Ann charge for a portfolio of $650 000	
	Total Q's 1 - 10	16305.48

Learning Notes

This is a visual summary of how to work with percentages:
12 out of 60 books on a shelf are sports books. This means 20% of the books are sport books.

<table>
<tr><th>Finding the part</th><th>Finding the percent</th><th>Finding the whole</th></tr>
<tr>
<td> 
</td>
<td> 
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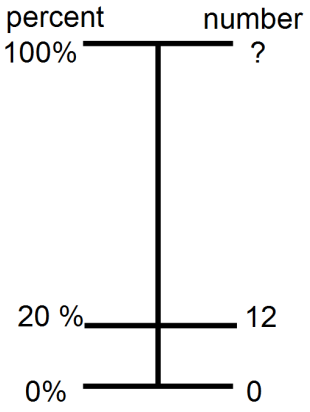
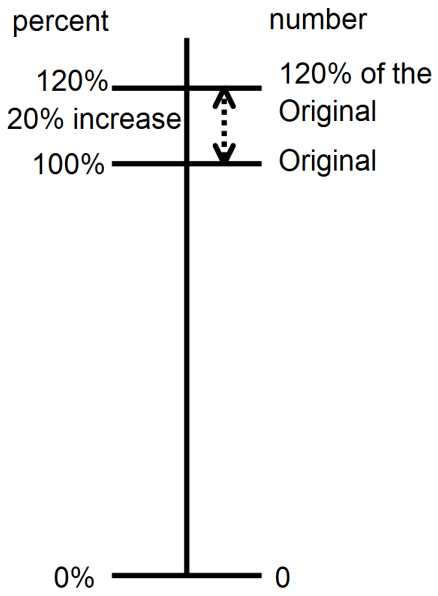
<td> 
</td>
</tr>
<tr>
<td>What is 20% of 60 books?
$60\times0.2=12$ books</td>
<td>12 out of 60 is what percentage?
$\frac{12}{60}\times100=20\%$</td>
<td>12 is 20% of how many?
$\frac{12}{0.2}=60$ OR 1% is
$\frac{12}{20}=0.6$
so 100% is $0.6\times100=60$.</td>
</tr>
<tr><th colspan="2">Percentage Increase</th><th>Percentage Decrease</th></tr>
<tr>
<td colspan="2"> 
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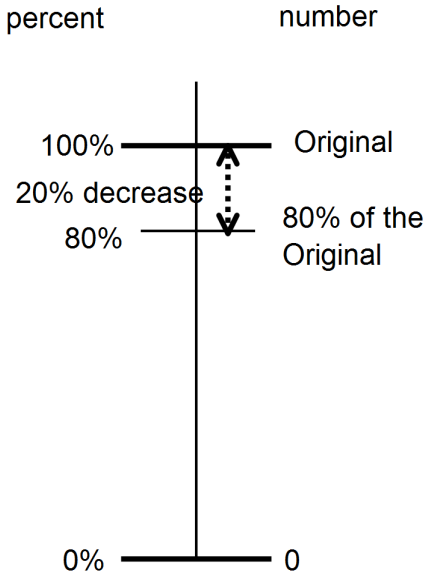
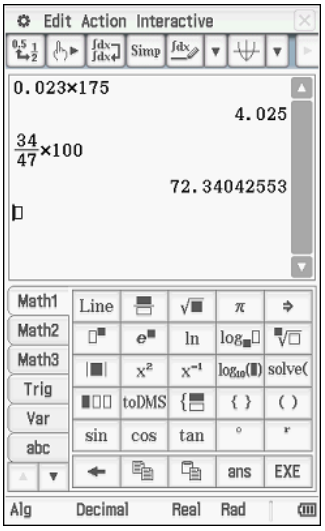
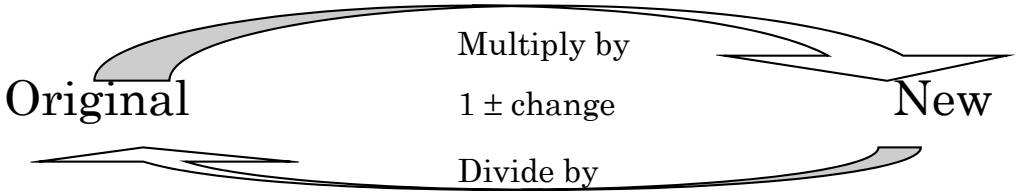
<td> 
</td>
</tr>
<tr>
<td colspan="2">The new amount is 120% (100 + the increase) percent of the original.</td>
<td>The new amount is 80% (100 – the decrease) of the original</td>
</tr>
</table>

Percentage means **per hundred** or how many out of every 100. It is important to decide what the percentage is out of. This is the whole or 100%

% of an amount	***Example 1*** *How much is 2.3% of 175?* It is 2.3 out of every 100 $\frac{2.3}{100}\times 175$ or $0.023\times 175 = 4.025$	
Amount - %	***Example 2*** *Jane gets 34 out of a possible 47 for her Maths test. What is her percentage?* 34 out of 47 is $\frac{34}{47}$ As a percentage: $\frac{34}{47}\times 100\% = 72.3\%$	

Percentage change problems : Original amount is 100%

New amount is 100% + increase OR 100% – decrease



Original to New **Original** Multiply by (1 ± change)	***Example 3*** *Increase 75 by 30%* New amount is 130% of original i.e. 75×1.3 ***Example 4*** *Decrease 75 by 30%* New amount is 70% of original i.e. 75×0.7	
New to Original **New** divided by (1 ± change)	***Example 5*** *What increased by 50% is 75?* New amount is 150% of the original Original = 75 ÷ 1.5 ***Example 6*** *What decreased by 50% is 75?* New amount is 50% of Original Original = 75 ÷ 0.5	

Activity 4 Best buys

Aim: Compare prices and determine the value for money.

Fill in the blanks in each statement and hence determine the better (or best) choice.

1. Fantasy Footy Tipping

Hi Jesse, Outstanding tipping for Round 5. You scored 5 points from the 7 games.	Hi Jesse, Great tipping for Round 8. You scored 6 points from the 9 games.

a) In Round 5 Jesse scored _____ points per game.

b) In Round 8 Jesse scored _____ points per game.

c) In which round was Jesse's tipping more accurate? _____

2. Land For Sale

Shell Cove subdivision
Three superior blocks

Block A	**Block B**	**Block C**
334 m^2	361 m^2	352 m^2
$224 000	$245 000	$240 000

a) Block A costs $ _____ per square metre.

b) Block B costs $ _____ per square metre.

c) Block C costs $ _____ per square metre.

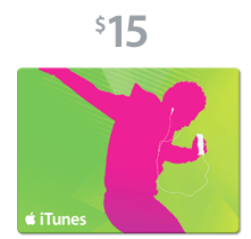
d) Which block is the best buy if the buyer wants land for the least cost per square metre?

3. Debbie is responsible for calculating the unit pricing to be displayed in the supermarket. Complete the table for Debbie.

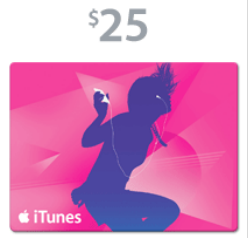
Item	Quantity	Price	Unit Price Quantity	Price per unit
Cooking Oil	750 mL	$6.43	1 L	
Fruit Juice	2.5 L	$7.96	1 L	
Chocolate bar	65 g	$1.50	100 g	
Flavoured Milk	600 mL	$2.50	1 L	
Bread	650 g	$4.45	1 kg	
Peanut Butter	450 g	$5.20	100 g	
Flour	2 kg		1 kg	$3.45

Learning Notes

Is 12 songs for $15 a better buy than 18 songs for $25?



12 songs



18 songs

Jesse thinks:

12 songs for $15
Means each song costs $15 / 12 = $1.25
18 songs for $25
Means each song costs 25 / 18 = $1.39
$1.25 per song is less than $1.39 per song.

Debbie thinks:

12 songs for $15
Means 12 / 15 = 0.8 songs per $1
18 songs for $25
Means 18 / 25 = 0.72 songs per $1
0.8 songs per $1 is better than 0.72 songs per $1.
Yes 12 songs for $15 is a better buy.

Both Jesse and Debbie come to the same conclusion:
12 songs for $15 is a better buy than 18 songs for $25.

Activity 5 Maddy's boots

Aim: Develop and use a currency converter spreadsheet.

Maddy is shopping online. She sees these boots that come from the United States.

How much will it cost to buy them?

She needs to "buy" US $16.58 and then there will be postage or shipping charges as well.

Exchange rate table Units of foreign currency per A$ on 20 Dec 2013	
United States dollar	0.8871
Japanese yen	92.67
European euro	0.6506
South Korean won	942.06
Singapore dollar	1.1236
UK pound sterling	0.5422
New Zealand dollar	1.0808
Thai baht	28.88
Malaysian ringgit	2.9128
Indian rupee	55.25
Indonesian rupiah	10867
Vietnamese dong	18722
South African rand	9.2170

Source: http://www.rba.gov.au/statistics/frequency/exchange-rates.html

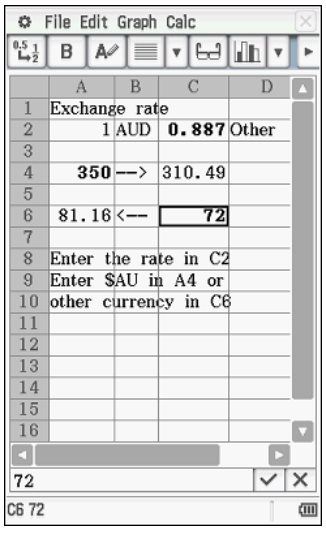
The exchange rate table shows how much of the foreign currency can be bought with A$1.00.

This activity requires you to build a spreadsheet to convert between currencies.

1. Build the spreadsheet shown

   Step by step instructions are in the Learning notes

   Ensure the correct formulas are used in cells C4 and A6.



   a) Describe what happens when the number in cell A4 is changed.

   b) Describe what happens when the number in cell C6 is changed.

2. Complete the table using the rates shown above

A$ (Australian dollars)	Other currency
A$214	Yen
	75 Euros
A$23.50	won
A$1093	Pound sterling
	200 000 Vietnamese dong
A$75	rupiah

3. Maddy wants to buy a new jacket online. It is advertised at $45.70 US. How much will it cost in AUD?

4. Repeat Q2 using current rates.
E.g. use http://www.rba.gov.au/statistics/frequency/exchange-rates.html

A$ (Australian dollars)	Other currency
A$214	Yen
	75 Euros
A$23.50	won
A$1093	Pound sterling
	200 000 Vietnamese dong
A$75	rupiah

5. Challenge: convert $45.20 US into Malaysian ringgit.

Learning notes:

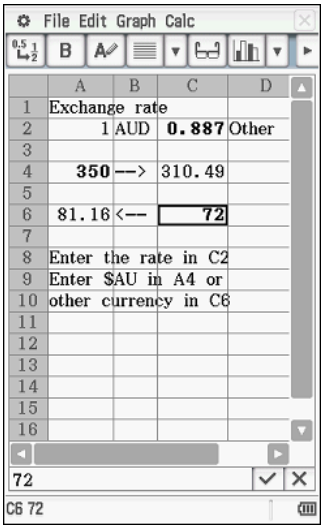
Detailed instructions to build the spreadsheet

Open spreadsheet

- Tap Menu, tap the Spreadsheet button

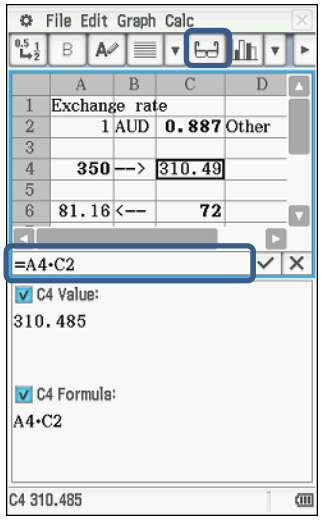
Enter values

- Tap in cell A1
- Enter a heading *Exchange rate*
- Tap B to make bold
- Tap in cell A2 and enter *1*
- Tap in cell B2 and enter *AUD*
- Tap in cell C2 and enter *0.8872*
- Tap in cell A4 and enter *350* (or any number you wish)
- Tap in cell B4
  press Keyboard, press − twice, select Math3 menu, tap > and press EXE
- Tap in cell B6, tap <, press − twice and press EXE
- Tap in cell C6 and enter *72* (or any other number)



Enter formulas

- Tap in cell C4 and enter =, tap in cell C2, press × tap in cell A4 and press EXE.
- Tap in cell A6 and enter =, tap in cell C6, press ÷ tap in cell C2 and press EXE.
- The formula is displayed at the bottom of the screen.
  Tap to view details of cell contents.
  Tap on a different cell to see another cell's contents.
- Tap again to close.



Enter instructions (optional)

- Tap in cell A8 and enter *Enter the rate in C2.*
- Tap in cell A9 and enter *Enter A$ in A4 or.*
- Tap in cell A10 and enter *Enter other currency in C6.*

Activity 6 Maxine's car

Aim: Build spreadsheets as a financial model.

Maxine wants to buy a car and wants to make sure she can meet the costs of running and maintaining the car. She can afford up to $50/week.

Her research is summarised in the table below.

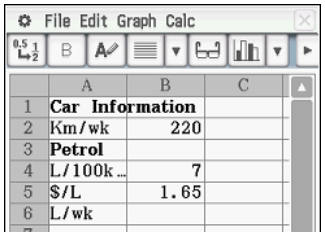
Item	Assumptions
Usage	220 km per week
Fuel (petrol)	Fuel is currently $1.65 / litre. The car uses 7 litres every 100 kilometres.
Tyres	A new set costs around $390 and lasts 50 000 km
Service	$150 every 5000 km
Repairs	$500 per year
Registration	$650 per year
Insurance	For third party property it is $235 per year

1. How much will Maxine pay for petrol each week?

   a) How many litres are required for 220 km?

   b) How much does that quantity of petrol cost each week?

2. Build a spreadsheet to do this calculation.



   a) What is the formula in cell B6?

   b) Compare your answers to Q1 a) and Q2 a)

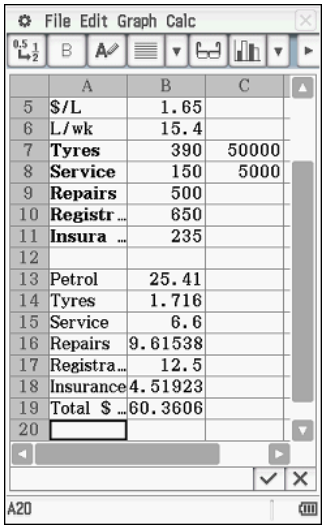
3. If Maxine chooses a more fuel efficient car that only uses 4.6 L per 100 km, what will petrol cost per week?
   (Hint: Tap in cell B4 and change the number. Change it back before answering Q4.)

4. Modify the spreadsheet as shown.

   - (Use the information shown in the table on the previous page.)
   - Cells B13 to B19 each require a formula.

   a) Use the spreadsheet to determine Maxine's total running costs per week.

   b) Hence determine whether or not she can afford the car.



	A	B	C
5	$/L	1.65	
6	L/wk	15.4	
7	Tyres	390	50000
8	Service	150	5000
9	Repairs	500	
10	Registr…	650	
11	Insura …	235	
12			
13	Petrol	25.41	
14	Tyres	1.716	
15	Service	6.6	
16	Repairs	9.61538	
17	Registra…	12.5	
18	Insurance	4.51923	
19	Total $ …	60.3606	
20			

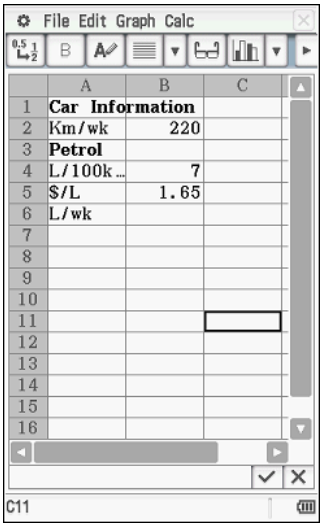
5. Research a car of your own choosing, adjust the values in your spreadsheet and determine the running cost per week.

Learning notes

Detailed instructions for complete spreadsheet

Build the spreadsheet shown.

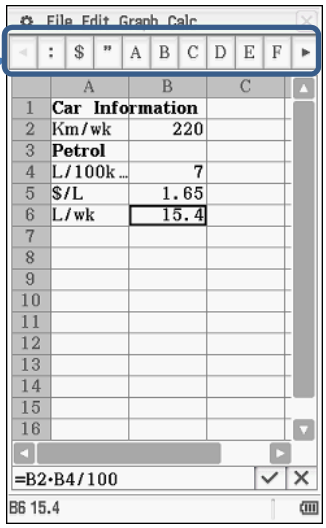
- Tap Menu, tap the Spreadsheet button
- Tap in cell A1
- Enter a heading Car information
- Tap B to make bold
- Tap in cell A2 and enter Km/wk
- Tap in cell A3 and enter Petrol
- Tap in cell A4 and enter L/100km
- Tap in cell A5 and enter $/L
- Tap in cell A6 and enter L/wk
- Tap in cell B2 and enter 220
- Tap in cell B4 and enter 7
- Tap in cell B5 and enter 1.65



Enter formulas

To enter a formula you must start with an =

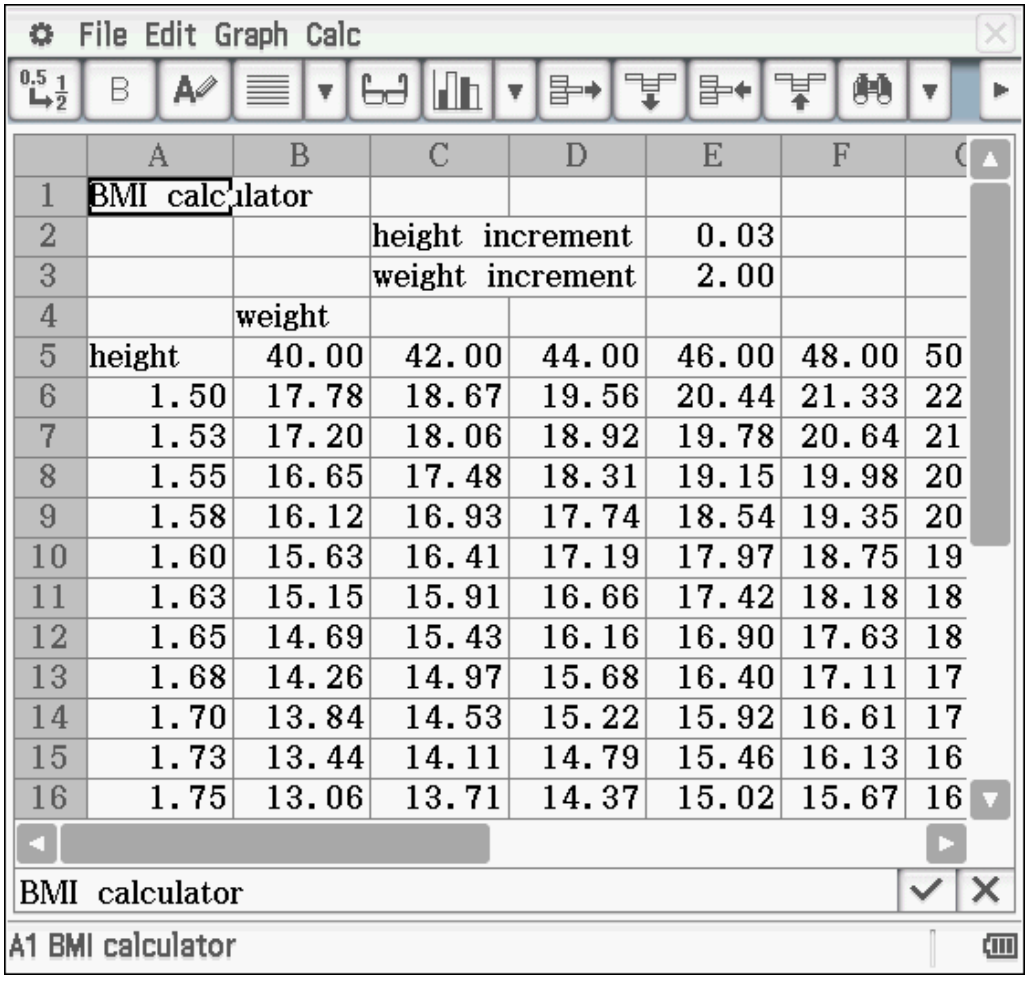
- Tap in cell B6
- Press = (the menu bar changes)
- tap cell B2, press ÷ ,enter 100, press ×, tap in cell B4 and press EXE
  (divide the 220 by 100 to calculate how many hundreds of kilometres and then multiply by the number of litres used per 100 km.)
- Tap in cell D6
- Press =, tap cell B6, press ×, tap in cell B5 and press EXE.



To convert cost per year to cost per week divide by 52.

Chapter 3 Algebra and matrices

Activity	ClassPad application	Key concepts
Algebra quiz	Main	Store values and substitute
Currency trade	Solve in Main	Rearrange formulae
Taxi charges	Main	Substitution (and solve)
Body mass index	Spreadsheet	Two by two tables for formulae
Matrix arithmetic	Main	Operations with matrices
Premiership table	Main	Calculations with matrices



Activity 7 Algebra quiz

Aim: Substitute into algebraic expressions.

Setting up: refer to Learning Notes

Store these values in your ClassPad: $a = 3.91$, $b = 1.0765$, $c = 6.3$ and $d = 8.9$.
Round answers to 3 decimal places.
Total your answers to Questions 1 – 10 and compare to the given value.

		Hint	Answer
1	Evaluate a^2	a [^] [2]	
2	Evaluate $a^2 - c$		
3	Evaluate $a \div d$		
4	Evaluate $(a + b) \div b$		
5	Find e if $e = 10 - (a + b)$	Enter expression $10-(a+b) \Rightarrow e$	
6	Find f if $f = \frac{\sqrt{a}}{b}$		
7	Find g if $g = \frac{e}{f}$	Store answers or drag values	
8	Find h if $a = h - b$	solve(a=h–b, h)	
9	Find i if $e = a + i(b + c)$		
10	Find k if $g + i = k - b$		
	Total Q's 1 - 10		48.019

Learning notes

Set up

Select the Main window

- Tap Main $\sqrt{\alpha}$

Ensure decimal answers will be displayed

- If Standard is showing then tap to toggle to Decimal.

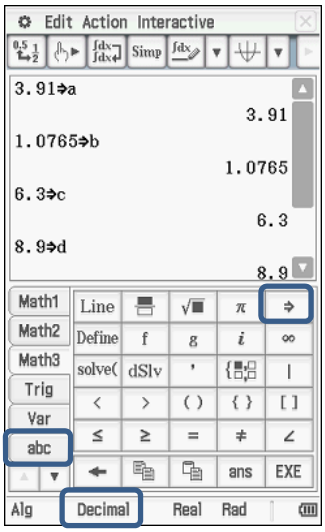
Clear variables

- Select [Edit | Clear All Variables]
- Tap OK

Store variables

- Press Keyboard
- Enter the number e.g. 3.91
- Tap ⇒
- tap abc and tap the variable name e.g. a
- Press EXE
- Tap ⮌ to return to math menu

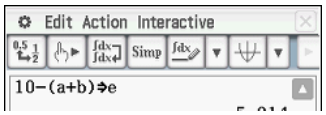
Repeat for the other variables



When the variables are stored as suggested, calculations automatically use the value.

Substitution can also be done using the | (given) command. For example a^2|a=3 will return 9.

It can be helpful to store intermediate results, e.g. after calculating Q5 then store it as variable e as it is used later on. You can edit the line and then press enter again.

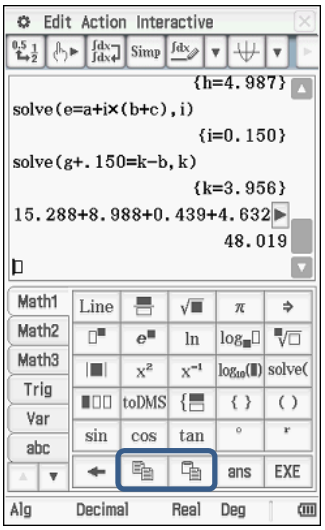


For Q's 8 – 10 the solve command can be used although you may prefer to rearrange the equation by hand.

Drag and drop to calculate the sum:

- Highlight your answer to Q1 and then drag it into the current line.
- Press +
- Highlight your answer for Q2 and drag to end of current line.
- Repeat with the remaining answers to calculate the total.

Copy and paste is an alternative which is better when the place you want to drop the number is not on the screen.



Activity 8 Currency trade

Aim: Rearrange formulas to use in spreadsheet.

Part A Currency trading

In Activity 3 you created a spreadsheet to convert money between $A and other currencies. This could be written as a formula $F = e \times A$ where F is the value of the foreign currency, A is the amount in Australian dollars and e is the exchange rate.

1. Convert A$300 to US$ where the exchange rate is 0.90 US per A$1.

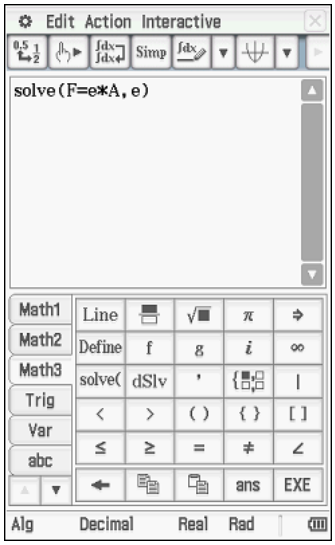
2. What is the exchange rate (the number of ringgits equivalent to A$1) if A$213 buys 598 ringgit?

For Q2 you probably divided 598 by 213.

3. Rearrange the formula to make e the subject.

Rearrange the formula

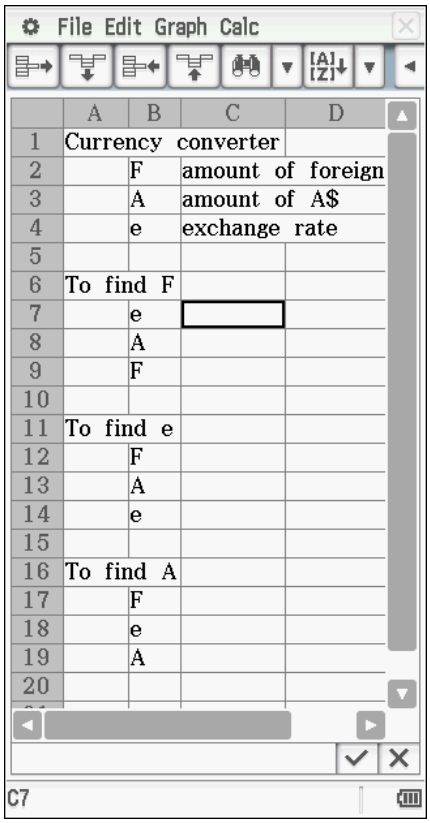
- Tap Main $\sqrt{\alpha}$
- Press [Keyboard] , tap [Math3] tap [solve(]
- Enter the formula, use the [abc] tab
- Press [,] and then the variable you want to solve for (make the subject of the formula)
- Press [EXE]



a) Record your answer.
(Note: This is the formula you would use for a spreadsheet set up to determine the exchange rate.)

b) Make A the subject of the formula and record the answer.

4. Create the spreadsheet shown to calculate the missing quantity knowing any two of F, e and A.



See Learning notes for more detail on how to create the spreadsheet.

In the first part it is intended that numbers be put in cells C7 and C8 and then a formula in C9 calculates the value of the foreign currency.

In the second part enter values for F and A and then calculate e.

In the third part enter values for F and e and then calculate A.

State the formulas required in cells

a) C9

b) C14

c) C19

Part B: Measurement formulas

5. Rearrange each formula to determine the:

a) radius of a circle given its circumference, $C = 2\pi r$

b) width of a rectangle given its perimeter and length, $P = 2(l + w)$

c) side of a square given its area, $A = l^2$

Learning notes

See earlier activities for general spreadsheet use.

Set up headings/labels

- Tap in A1 and enter *Currency converter*
- Tap in B2 and enter *F*
- Tap in B3 and enter *A*
- Tap in B4 and enter *e*
- Tap in C2 and enter the meaning for symbol F, e.g. *amount of foreign currency*
- Similarly for cells C3 and C4 as shown

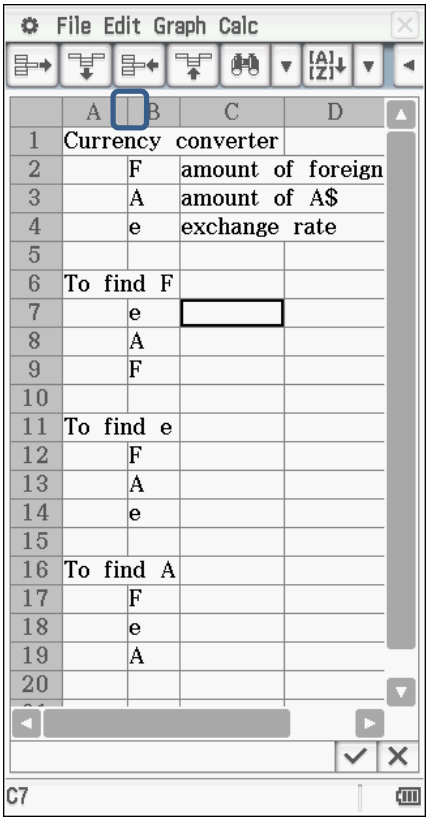
Adjust column widths

- Tap on the column boundaries in the grey header and drag

Knowing *e* and *A* calculate *F*

- Tap in A4 and enter *To find F*
- Tap in B5 and enter *e*
- Tap in B6 and enter *A*
- Tap in B7 and enter *F*

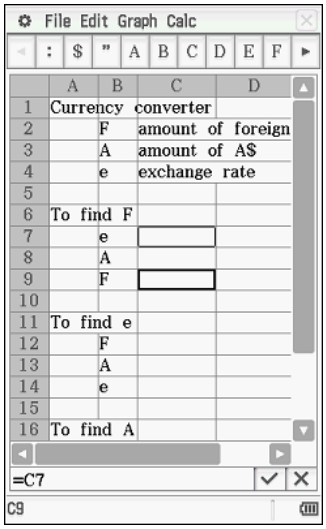
Repeat for the other two sections



Enter formulas

- Tap in cell C7
- Press [=]
- Tap in cell C5
- Press [×]
- Tap in cell C6
- Press [EXE]

Repeat for other formulas using your results from question 3



Screen shot shows formula partially done.

Activity 9 Taxi charges

Aim: Work with formulas.

Omar is a Sydney taxi driver. Charges are just determined by the meter installed in his taxi but he is curious as to the calculations involved. Perhaps if he understands this he can work smarter. He knows that the fare he can charge depends upon

- the distance,
- the time of day and
- how long is spent waiting for a booking or stuck in traffic.

In 2013 the maximum fare that could be charged by Sydney taxis (ignoring any tolls) was given by the formula

$F = H + r \times d + 0.921m$ where

H is the hiring charge or flagfall \$3.50 or \$6.00 at night (10pm to 6am).
r is the per kilometre rate \$2.14 per kilometre or 20% more at night.
d is the distance in km.
m is the number of minutes the taxi is moving at less than 26km/h.

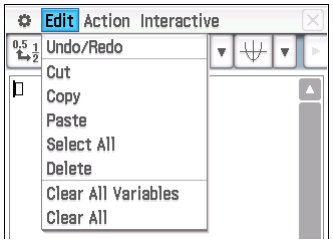
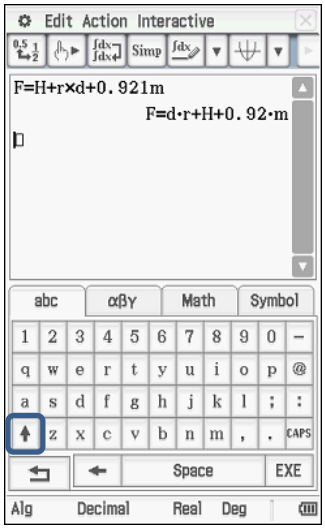
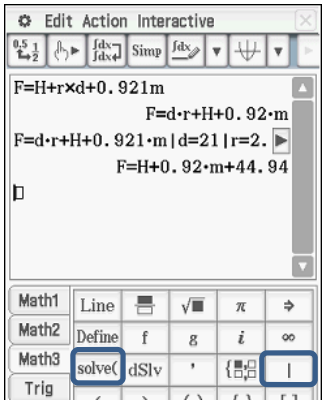
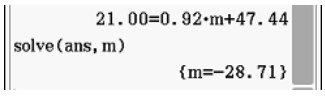
1. What is the maximum charge per km travelled at night?

2. Complete this table

Day/night	hire charge H	per km rate r	kms travelled	minutes waiting m	maximum fare F
day	\$3.50	\$2.14	8.6	2	
night	\$6.00		12	0	
day			14	5	
night			4.5	1	
day				12	\$41.37
night			7.2		\$40.15

Learning Notes

Variables may need to be cleared from previous activities

Clear variables • Select [Edit | Clear All Variables]	
Use the soft keyboard to **enter the formula** • Press [Keyboard] • Tap [abc] tab • Enter formula variables are case sensitive i.e. F is not the same as f. tap ⬆ to get capital letters	
Substitute known values • Tap [Math3] on the keyboard • Tap | • Enter the variable and its value More than one substitution can be done on the one line as shown. • Press [EXE]	
Solve for the unknown (if required) • Tap [solve(] • Tap [ans] or drag the previous answer • Press [,] • Enter the variable you want to find out • Press [EXE]	

Activity 10 Body mass index

Aim: Create a two-way table of values.

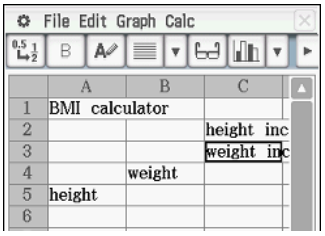
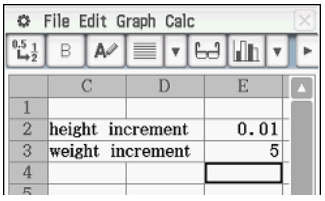
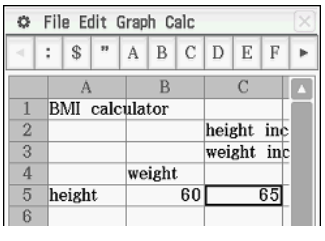
The Body mass index (BMI) is sometimes used as a health indicator.
It is calculated by dividing a person's weight (in kg) by the square of their height in metres.

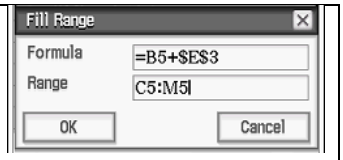
$$\text{BMI} = \frac{\text{weight}}{\text{height}^2}$$

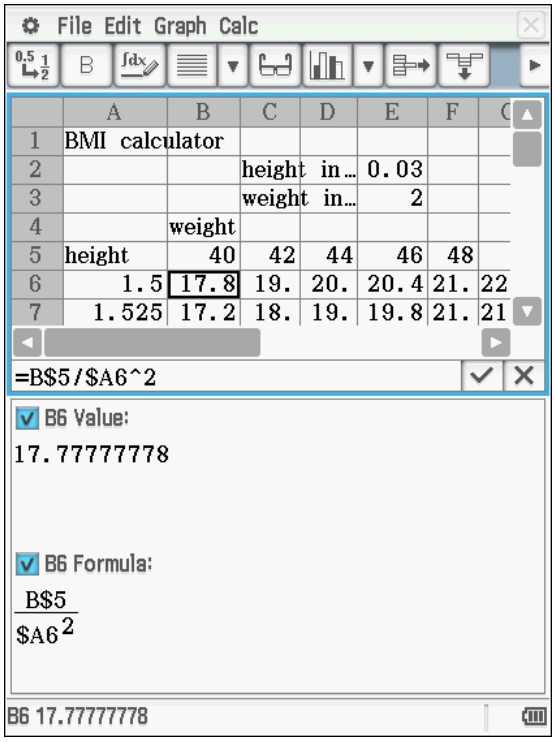
1. Estimate your own BMI.

2. What is regarded as a healthy BMI for Australians of your gender?
Refer to this or other sources: http://www.heartfoundation.org.au/healthy-eating/Pages/bmi-calculator.aspx

Build a spreadsheet to display a two-way table or chart for looking up BMI values.

Enter headings • Tap in cell A1 and enter *BMI calculator* • Tap in cell C2 and enter *height increment* • Tap in cell C3 and enter *weight increment* • Tap in cell B4 and enter *weight* • Tap in cell A5 and enter *height*.	
Set increments • Tap in cell E2 and enter 0.01 This is the difference in height between successive rows • Tap in cell E3 and enter 5 This is the difference in weight between successive columns	
Enter weight column headings • Tap in cell B5 and enter 60 or whatever you want for the smallest weight. • Tap in cell C6 and enter the formula =B5+$E$3.	

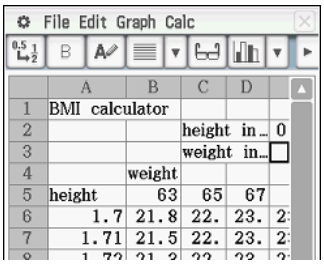
(using the menu bar is the quickest way to make the entry) • Tap in cell C6 • Select [Edit | Fill | Fill Range] • Set the range to C5:M5 • Tap OK	
Enter height row labels • Tap in cell A6 and enter 1.4, or whatever you want for the smallest height • Tap in cell A7 and enter the formula =A6+$E$2. • Tap in cell A7 • Select [Edit | Fill | Fill Range] • Set the range to A7:A20 • Tap OK	

Fill table • Tap in cell B6 and enter the formula =B$5/($A6^2) • Tap in cell B6 • Select [Edit | Fill | Fill Range] • Set the range to B6:M20 • Tap OK	

3. Set up your spreadsheet to display values so you are able to fill in the grid.

Adjust spreadsheet values

- Set the increment in E2 to 0.01
- Set the increment in E3 to 2
- Change the start height in A6 to 1.7
- Change the start weight in B5 to 63



Height	Weight (kg)			
	63	65	67	69
1.70				
1.71				
1.72				
1.75				

4. Complete the table

Height	Weight	BMI
1.78 m	75 kg	
164 cm	62 kg	
1.66 m		18.5
	85 kg	25

Activity 11 Matrix arithmetic

Aim: Perform matrix calculations on ClassPad.

Enter and store the following matrices:

Enter and store the matrices

$$\mathbf{A}=\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}\ \mathbf{B}=\begin{bmatrix}1 & 5\\ 2 & 3\end{bmatrix},\ \mathbf{C}=\begin{bmatrix}-1 & 3\\ 2 & -2\\ 5 & 1\end{bmatrix},\ \mathbf{D}=\begin{bmatrix}1 & 2 & -2\\ 4 & 2 & -1\\ 3 & -1 & 2\end{bmatrix}$$

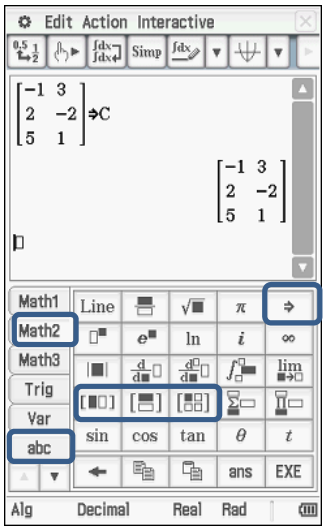
- Tap $\sqrt{\alpha}$ (Main)
- Press Keyboard , tap Math2

Enter matrix C

Use the matrix commands, for example to enter a 3 × 2 matrix (3 rows and 2 columns):

- Tap [▦].
- Tap [▤].
- Enter the values using the arrow keys to navigate between elements.
- Tap ⇒, tap abc.
- Tap ⬆, tap C.
- Press EXE.
- Tap ⮌ to go back to the Math menu

Enter and store matrices A, B, D



1. Perform the following calculations (if possible), and record the output. Where a calculation is not possible, explain why.

   a) $A + B$

   b) $3A$

   c) $2B$

   d) $2B + 3A$

   e) $A + C$

f) $B + 2D$

g) $A \times B$

h) $B \times A$

i) BC

j) $D \times C$

k) $C \times D$

l) A^2

m) $C - B \times A$

Learning notes

Matrices can only be added (or subtracted) when they have the same size, i.e. the same number of rows and the same number of columns.
For multiplication the number of columns in the first matrix must be the same as the number of rows in the second matrix. A reason for defining matrix multiplication in this way is demonstrated in the next activity.

Activity 12 Premiership table

Aim: Calculate with matrices.

Part A

Matt and Siji both follow London clubs in the English Premier League (EPL). This table shows the results of those clubs before 14th December 2013.

Arsenal is on top with 10 wins, 1 draw and 2 losses in their first 13 games.

Position	Team	P	W	D	L	GF	GA	GD	Pts
1	Arsenal	13	10	1	2	27	10	17	31
3	Chelsea	12	7	3	2	21	10	11	24
9	Tottenham Hotspur	12	6	2	4	9	12	-3	20
15	West Ham United	13	3	4	6	12	14	-2	13
18	Fulham	13	3	1	9	11	24	-13	10
20	Crystal Palace	13	2	1	10	7	22	-15	7

1.

a) Complete a matrix for the number of wins, draws and losses for each of the London clubs.

	Won	Drawn	Lost
Chelsea	7		
Tottenham Hotspur		2	
Arsenal			
West Ham United			
Crystal Palace			10
Fulham			

b) How many rows in this matrix?

c) How many columns in the matrix?

2. Results for the next month are:

$$\begin{pmatrix} 5 & 2 & 3 \\ 7 & 0 & 3 \\ 4 & 5 & 2 \\ 4 & 3 & 2 \\ 5 & 1 & 3 \\ 2 & 2 & 6 \end{pmatrix}$$

Note: the row and column labels are understood to be the same as in Q1.
In this period:

a) how many games has Crystal Palace won?

b) how many games has Tottenham drawn?

c) how many games has Arsenal played?

3.

a) Add the two matrices together.

b) What does this matrix represent?

Part B

Results before Christmas	Results end of season
$\begin{matrix} & W & D & L \\ \text{Arsenal} & 12 & 1 & 4 \\ \text{Tottenham} & 8 & 3 & 5 \end{matrix} = C$	$F = \begin{pmatrix} 21 & 7 & 10 \\ 20 & 9 & 9 \end{pmatrix}$

4. How many games did:

   a) Arsenal win between Christmas and the end of the season?

   b) Tottenham lose between Christmas and the end of the season?

5. Enter these matrices into ClassPad and store them.

   a) Record the result of subtracting C from F on your ClassPad, i.e. $F - C$.

   b) What does this matrix represent?

3 points are awarded for a win, 1 point for a draw and 0 points for a loss.

6. How many points does each team have at Christmas?

Enter the points for wins, draws and losses as a 3×1 column matrix $\begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}$ and store the result as matrix P.

7. Calculate

   a) $C \times P$

   b) $F \times P$

8. What do the answers to Q7 represent?

9. Write your own descriptions of how to:

   a) Add matrices together;

   b) Subtract one matrix from another;

   c) Multiply two matrices together.

Learning notes

See the previous activity *Matrix arithmetic* for instructions on entering and storing matrices.

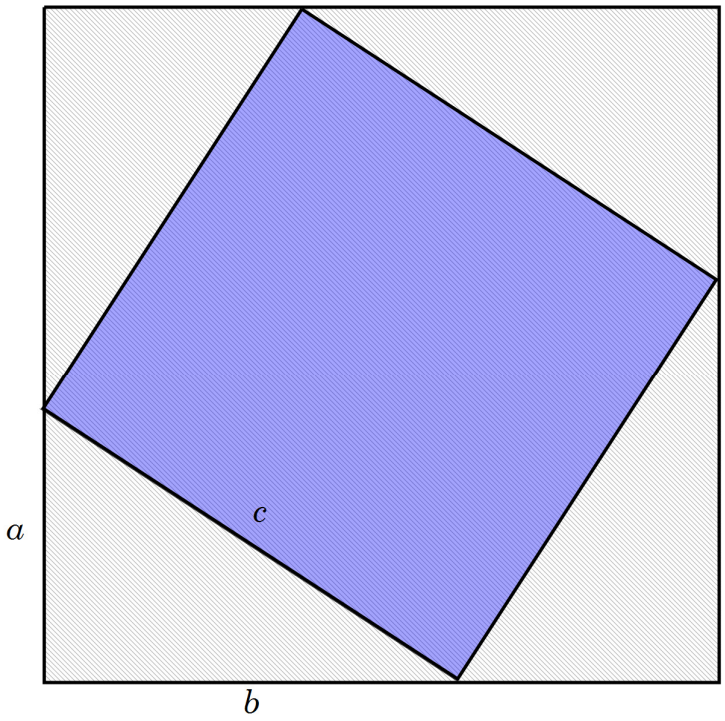
The activity is intended to provide a context where

- matrix addition
- matrix subtraction and
- matrix multiplication

make sense to be defined as they are.

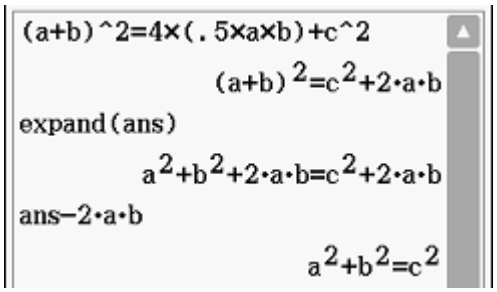
Chapter 4 Shape and measurement

Activity	ClassPad applications	Key concepts
Pythagoras	Geometry	Pythagoras' Theorem
Measurement formulas	Spreadsheet	Calculate areas and volumes



Area of outer square = area of inner square + area of four triangles

$$(a+b)^2 = 4\left(\frac{1}{2}ab\right)+c^2$$



Activity 13 Pythagoras

Aim: Solve Right Triangles using Geometry.

ClassPad's Geometry Application enables you to construct diagrams and then read off (measure) parts of the diagram. Effectively draw a scale diagram.

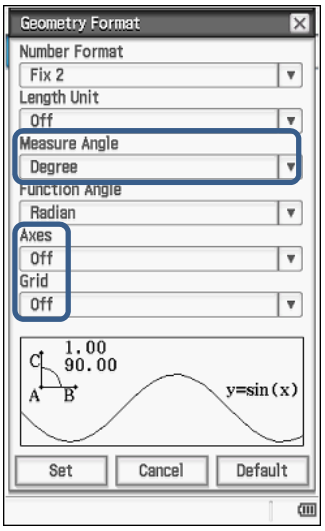
Activity 2, *Connect the dots*, may be a useful activity if you are new to ClassPad's Geometry Application.

Start Geometry with a clear screen

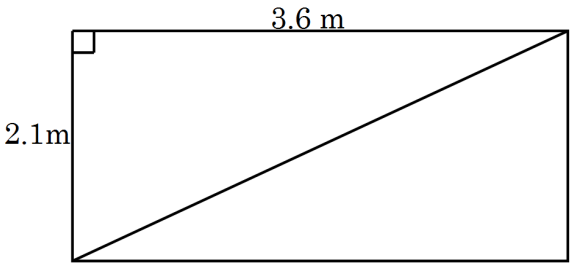
- Tap Menu, tap the Geometry button
- Select [Edit | Clear all]

Check Geometry Format

- Tap ⚙ (from Geometry or Main)
- Select Geometry Format
- Make sure Measure Angle is set to Degree (select from the pull down menu)
- Set axes to Off
- Set grid to Off
- Tap Set



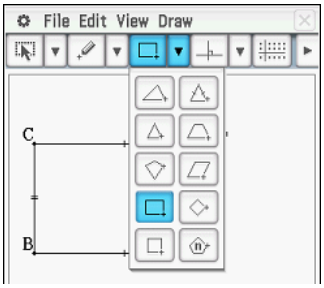
1. The farm gate shown below is to have a diagonal brace installed.

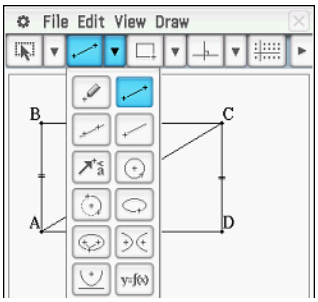
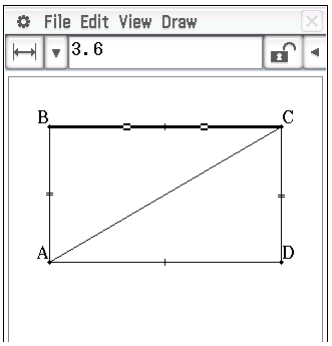


a) Draw the diagram in Geometry.

Draw rectangle

- Select and tap ▭, the rectangle tool
- Tap anywhere in the drawing space and drag diagonally to draw a rectangle.



Draw diagonal line (the brace) • Tap to select the line segment tool • Tap on one corner of the rectangle • Tap on the opposite corner of the rectangle • Tap – the select tool	
Set the given lengths • tap to go round the corner • Tap the top side of rectangle. Tap in the measurement box and enter 3.6 tap to set value • Tap in open space • Tap the left side of the rectangle • Tap in the measurement box, enter 2.1 and tap **Measure the diagonal** • Tap the diagonal and read the length from the measurement box.	

b) How long should Gerard cut the piece of steel pipe to fit the diagonal?

2. What do these tools draw?
You will need to explore the pull down menus to find the tool and then read the bottom of the screen to see what parts of your diagram to select.

a) 

b) 

c) 

d) 

e) 

f) 

g) 

h) 

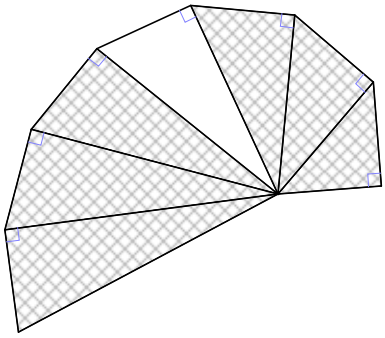
i) 

j) 

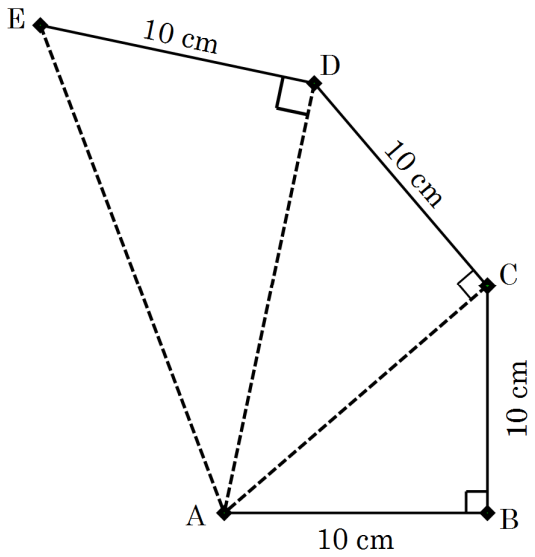
k) 

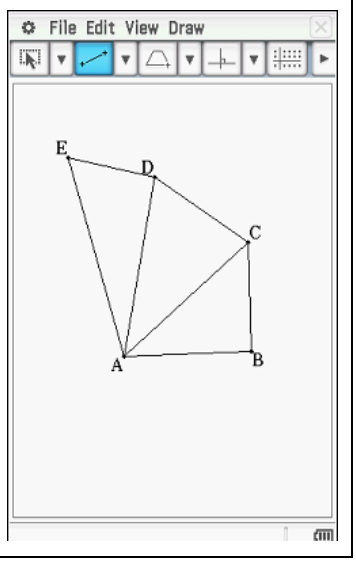
l) 

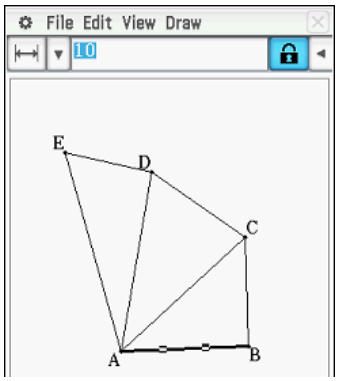
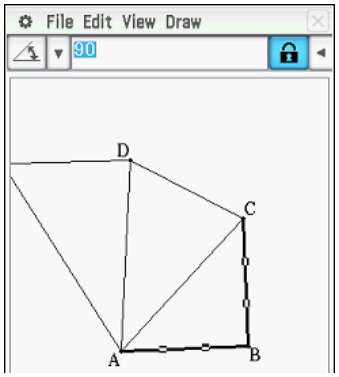
3. Glenn is building a spiral.
He begins with a right-angled isosceles triangle.
Right angled triangles with side 10 cm are added to the hypotenuse of the previous triangle as shown.



a) Calculate the lengths AD and AE



Clear the workspace (if required) • Select [Edit | Clear All] and tap OK **Draw a triangle** • Choose the draw line tool • Tap in open space • Tap to the right The line AB should be drawn. • Tap on point B • Move up and tap in open space The line BC should be drawn. • Tap on point C, tap on point A to complete the triangle **Add two more triangles** as shown	

Set the length of AB to 10 • Go round the corner • Tap side AB • Tap the measurement box and enter 10 • Tap 🔓 • Tap in open space **Repeat for BC, CD and DE**	
Set angle ABC to 90° • Tap in open space • Tap on AB, tap on BC • Tap the measurement box and enter 90 • Tap 🔓 **Repeat to set angles ACD and ADE to 90°**	
Read off the measurements • Tap in open space • Tap on AD and read off the length • Tap in open space • Tap on AE and read off the length	

b) While here we can measure other things. Determine:

(i) the length BE;

(ii) the area of the triangle ADE; and

(iii) the area of the pentagon ABCDE

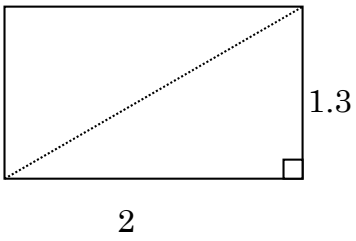
4. Write solutions to the following problems using Geometry, i.e.

- Draw a labelled diagram in your book
- Draw the diagram in geometry
- Make the appropriate measurements in Geometry
- Write your answer, with appropriate units in the book.

a) Luc is flying a kite with a 50 m length of string. The kite is 30 m above the ground. Draw a diagram showing this information. If the string were to break and the kite fall straight to the ground how far would it be from Luc?

b) What is the distance between the points (–2, 1) and (4, 9)?

c) How much shorter is the direct route from A to B than going around the edge?



d) A concreter checks the slab for squareness. One pair of opposite sides are 20.6 m and the other pair are 30.5 m long. A diagonal is measured to be 37.0 m. Is the corner of the slab a right angle? Explain your answer.

Learning notes:

The advantage of using geometry is that you are picturing the situation. You can also solve a much wider range of problems including ones where there are no right triangles. Geometry will not help if an exact answer like $\sqrt{17}$ is expected.

Your teacher may also want you to solve these problems algebraically.

To solve problems using geometry:

- Draw sketch
- Constrain measurements
- Read answer
- Write answer with appropriate rounding and units

To set the lengths of the sides of a rectangle use the left and bottom sides.

Q4 d) A possible approach is to

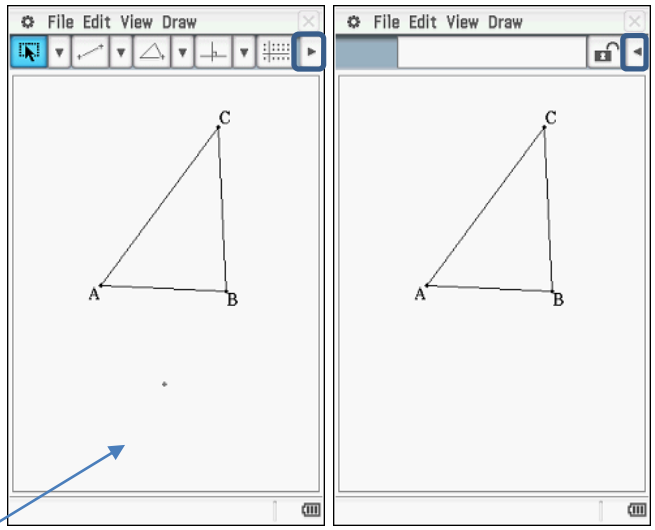
- draw four lines for the slab outline (don't use a rectangle because it may not be square)
- set the lengths of each line
- draw the diagonal and set the length
- measure the angle to see if it is 90.

Some key words used with the Geometry Application:

Select tool
Tap to select objects.

Round the corner:
Tap the arrow ▶ at the end of the menu bar to access more menu options.
Tap ◀ to go back

These arrows appear when the menu options don't fit.

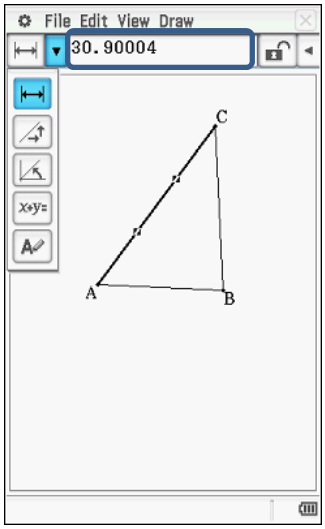


Open space
Tap anywhere in the drawing area that is empty, for example.

Measurement box
Displays a measurement for the selected object,

In the example line BC is selected and is shown by the darkness of the line and squares on the line. The measurement is 30.9 and the length is being displayed.

Length	
Gradient	
Angle	
Equation	



Activity 14 Measurement formulas

Aim: Use a spreadsheet to work with measurement formulas.

Build a spreadsheet to calculate surface area and volume of a cylinder.

Open Main with Spreadsheet

- Tap Main $\sqrt{\alpha}$
- Select Spreadsheet from the pull-down app menu.

Enter labels

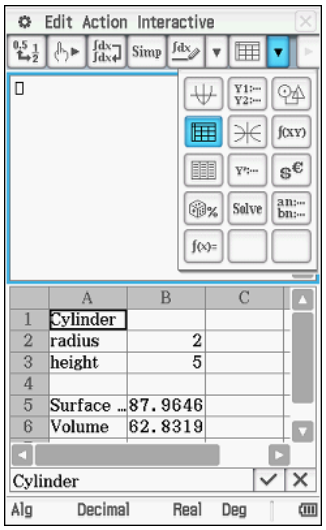
- Tap in cell A1 and enter Cylinder
- Enter labels in cells A2, A3, A5 and A6

Enter values for height and radius

- Tap in cell B2 and enter the radius of the cylinder
- Tap in cell B3 and enter the height of the cylinder

Enter formulas

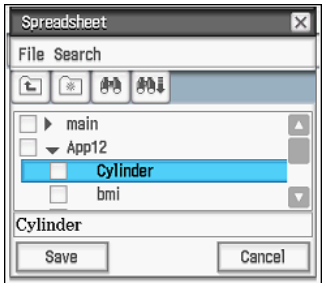
- Press Keyboard
- Tap in cell B5 and enter formula
  $=2\times\pi\times B2\times(B2+B3)$
- Tap in cell B6 and enter formula
  $=\pi\times B2\text{^}2\times B3$



Save your spreadsheet

- Select [File | Save]
- Enter a filename and tap Save

Once saved it can be opened by selecting [File | Open]



1. Connie measures the Pringles container. She records a diameter of 6.8 cm and a height of 10.4 cm. According to Connie's measurements:

   a) What is the volume?

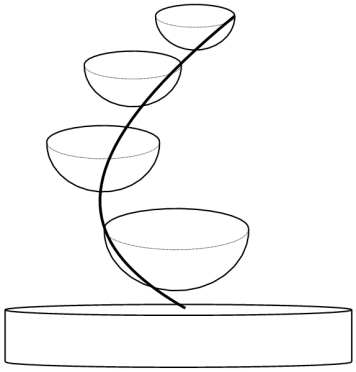
   b) What is the surface area?

2. How much water is required to fill Diana's spa bath? It is a circular spa that is 1.2 m deep and 2.1 m across.

3. Robin is designing a water feature. It is to be made from bowls (hemispheres). The top bowl has a radius of 4 cm. Going down the next bowl has radius 5 cm, then next radius 6 cm and the bottom radius 7 cm.

   The bottom is a cylindrical shape of radius 15 cm radius and the water must be at least 4 cm deep for the pump to work.

   What is the minimum volume of water required for the cascade to work?

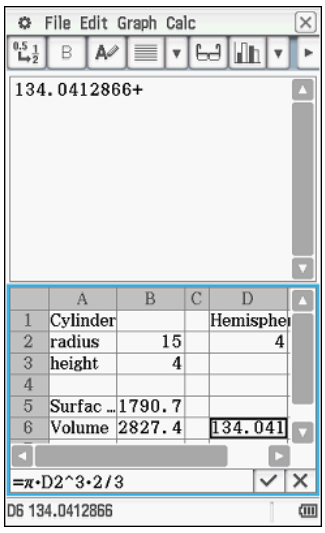


Add a formula for volume of a hemisphere

- Duplicate the cylinder section for a hemisphere.

Use your spreadsheet

- Enter 4 for the radius for the first bowl
- Tap in the cell giving you the volume
- Drag into the command line in the Main window
- Press ⊞
- Tap in Spreadsheet window
- Enter radius for second bowl
- Drag answer into Main
- Repeat for the other bowls and the bottom cylinder.



4. A balloon is being inflated. Assuming it is a sphere,

a) When the radius is 4.5 cm

(i) What is the surface area?

(ii) What is the volume?

b) When the radius has doubled to 9 cm

(i) What is the surface area?

(ii) What is the volume?

c) How much thinner will the balloon material be?

d) What is the ratio of the volumes of the balloon in part b) to part a)?

Learning notes

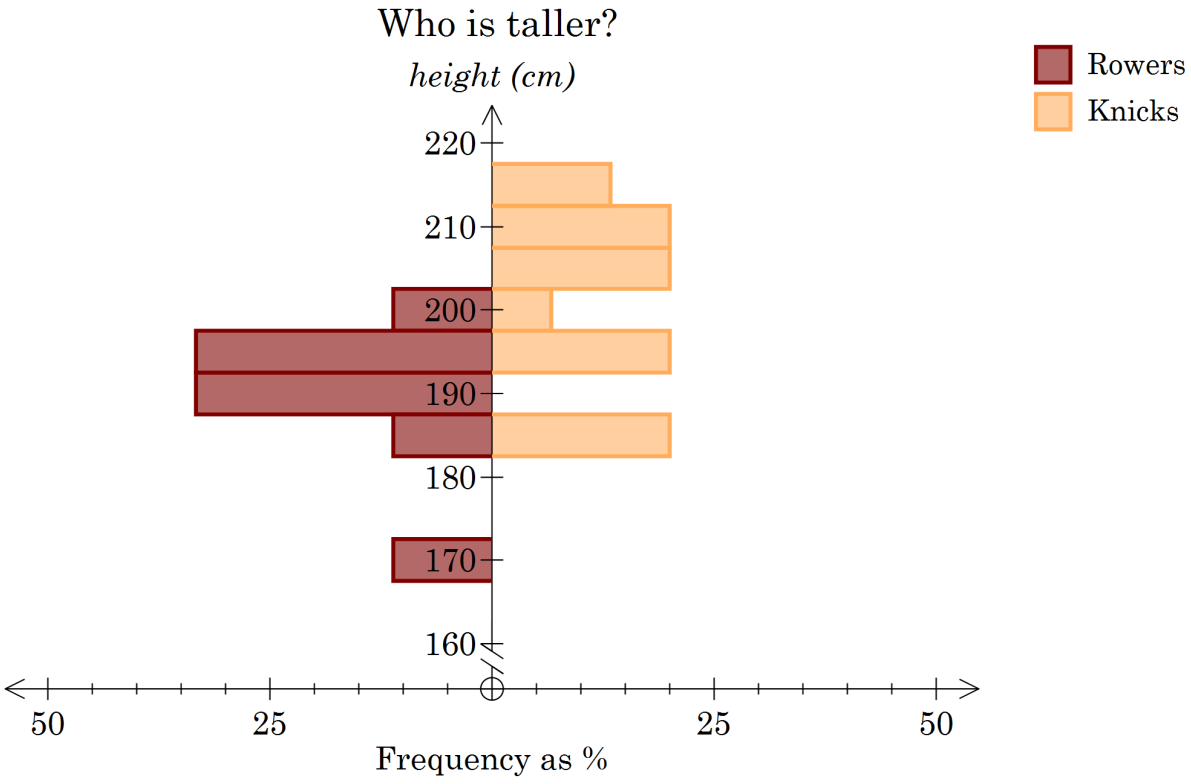
Using the two windows is new in this activity. It enables dragging of objects or results between main and other applications.
The spreadsheet is not the only nor necessarily the most efficient way of doing these problems. It is however a further support for using formulas in context.
The distance across a circular object is the diameter. The radius is the distance from the centre to the outside.

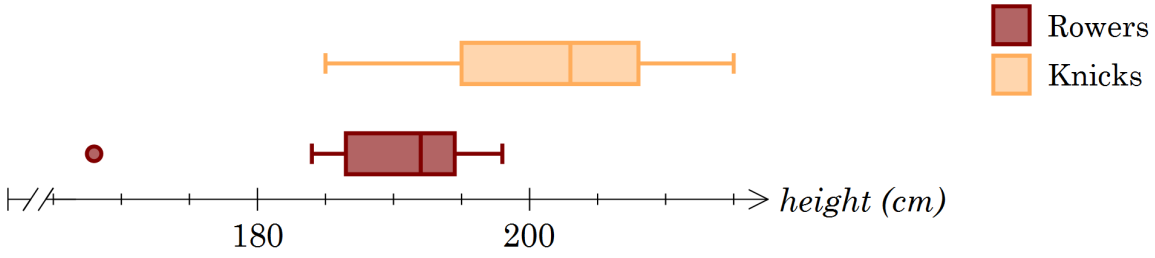
Q3 the calculation for volume needs to be done several times and the results summed. Set up the formula in the spreadsheet $\frac{1}{2}\left(\frac{4}{3}\pi r^3\right)$, then drag the result into Main and repeat for each piece is an efficient way of doing this problem.

Q4 c) As the balloon fills the surface area increases and the material gets thinner, being spread over a larger area. Calculate the ratio of surface areas.

Chapter 5 Univariate data analysis

Activity	ClassPad application	Key concepts
Knicks'tistics	Statistics	Calculate summary statistics
Knicks'tistics II	Statistics	Display distributions
Rowing v basketball	Statistics	Compare data sets
Reaction times	Statistics	Compare grouped data sets





Activity 15 Knicks'tistics

Aim: Determine statistics from a list of data.

Table 1 is a list of the heights (cm) and weights (kg) of the New York Knicks Basketball Players (as at Jan 2011).

Calculate summary statistics

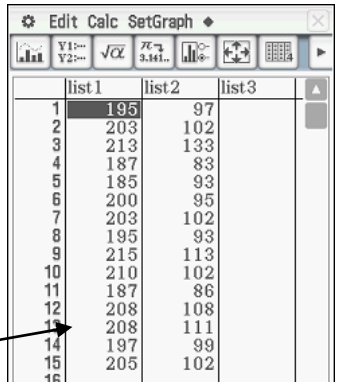
Open Statistics

- Tap Menu , tap Statistics

Enter data:

heights in list1, weights in list2.

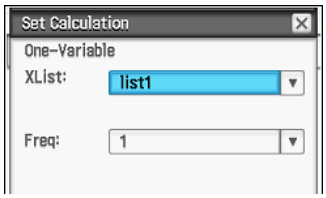
- Tap in the cell for the first element in list1.
- Enter 195 and press EXE.
- Repeat for the remaining data. (Your screen should look like this.)

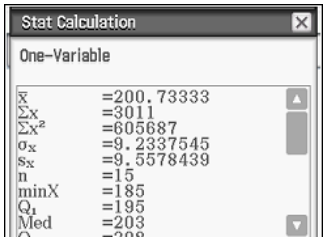


Calculate statistics

- Select [Calc | One-Variable]
- Set
  XList: list1 (list2 for weight)
  Freq: 1
- Tap OK

Use the scroll bar to see more calculations.





H (cm)	W (Kg)
195	97
203	102
213	133
187	83
185	93
200	95
203	102
195	93
215	113
210	102
187	86
208	108
208	111
197	99
205	102

Table 1

1. Complete the table for the Knicks statistics

	Height	Weight
Mean		
Median		
Maximum		
Range		
Inter-quartile range		
Standard deviation		

2. If the players were to lie down in a straight line head to toe would they reach the 28 m from one end of a basketball court to the other? Justify your answer.

3. Does the team weigh more than 1 tonne? Justify your answer.

4. How many players on the team's roster?
Where is this value shown in the stat calculation window?

5. You are added to the roster.
   a) Add your height and weight to the lists and complete the table.

	Height	Weight
Mean		
Median		
Maximum		
Range		
Inter-quartile range		
Standard deviation		

   b) Which of the above statistics is most affected by your height and weight being included?

Save your data for later use. (see Learning notes)

EXTENSION

Gather stats on a team you are part of, or support, and complete the table.

	Height	Weight
Mean		
Median		
Range		
Inter-quartile range		
Standard deviation		

Learning Notes

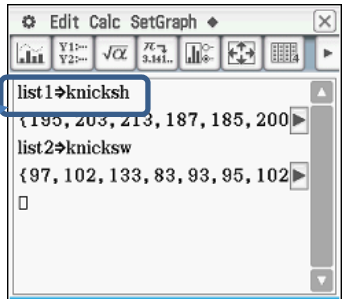
Symbols used by ClassPad and their meaning.

ClassPad symbol	Description
$\bar{x}$	Mean or average
Σx	Total of the numbers in the list
n	How many in the list
minX	Minimum
Q1	First Quartile
Med	Median
Q3	Third Quartile
maxX	Maximum
σ_x	Standard deviation

The Range is the difference between the maximum value (maxX) and the minimum value (minX)
The Inter-quartile range is the range for the middle half (Q3 – Q1).

Save data

- Tap Main $\sqrt{\alpha}$
- Press [Keyboard], tap [abc]
- Enter list1⇒knicksh and press [EXE]
  The name knicksh is your choice, just use something you will remember.
- Enter list2⇒knicksw and press [EXE]
- Enter the name of the list and press [EXE].



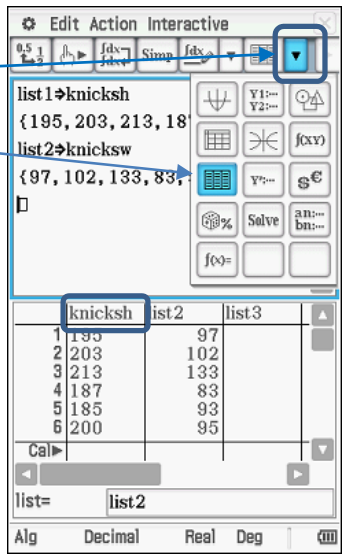
Open list

Open the Statistics app in a second window

- Tap [▼] here
- Tap to select Statistics

Open list

- Tap in the statistics window
- Tap in list where you want to place data, e.g.list1
- Select [Edit | Open List]
- Enter the name you used to save the list e.g. knicksh. It should be visible in the Main window
  The new title will be displayed at the top of the list
- Tap in next list2 and open the list of weights



Activity 16 Knicks'tistics II

Aim: Display data using histograms and box plots.

It is assumed you have the data entered from Activity 15 *Knicks'tistics*.

ClassPad is capable of storing instructions to draw 9 different statistics graphs. Most of the time you will only use one of these graphs; StatGraph1.

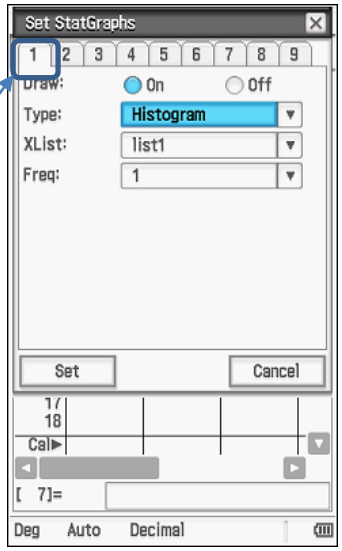
Draw Histogram

Open the Statistics app

- Tap Menu, tap the Statistics button

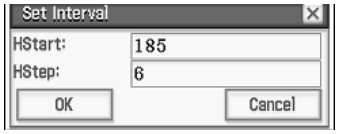
Set up the graph to construct a histogram of the heights.

- Tap
- Note the statgraph number you are defining, in the tab at the top of the window.
- Set
  Draw: On
  Type: Histogram
  XList: list1 (list2 to graph weight)
  Freq: 1
- Tap Set



Draw the graph

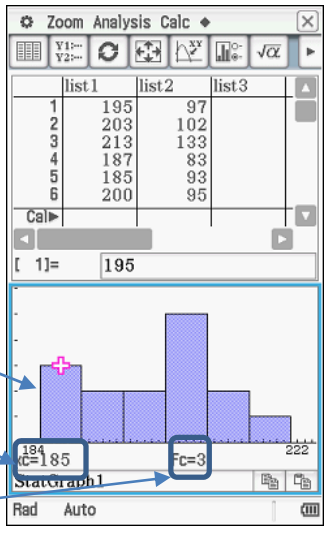
- Tap
- Set HStart to 185
- Set HStep: to 6 (a whole number is neater)
- Tap OK These values are chosen for Q1



Collect frequency table data

With the graph window active

- Select [Analysis | Trace]
- Press the left and right arrows to move through the data.



1. Complete the following frequency tables. (Use your graph and trace to get the values)

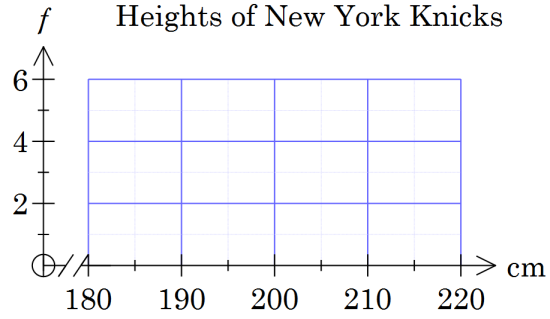
Heights: interval of 6 cm beginning at 185 cm
(HStart: 185, HStep: 6)

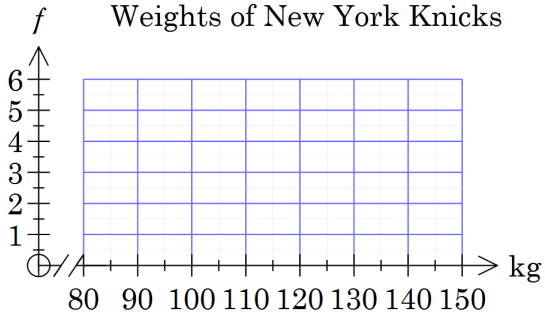
Interval		Frequency
Start	End	
185	190	
191	196	

Weights : interval of 5 kg

Interval		Frequency
Start	End	
80	84	
85	89	
90		
95		
100		
105		
110		
> 115		

2. Draw histograms for height and weight based on your frequency tables in Q1.





3. Comment on the data. The following is a good starting point.

a) Do any values (players) stand out as being different?

b) Predict the middle height and weight by looking at the graphs.

c) Where are most of the players in terms of height and weight?

d) Describe the spread of the data. Is it clumped together, spread out or … ?

EXTENSION:

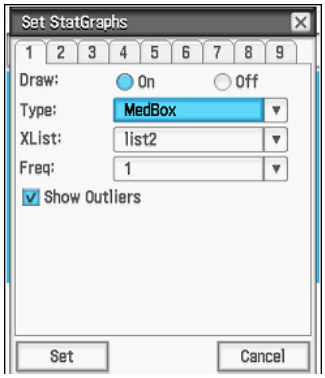
4. How is the graph affected by:

   a) changing the interval; or

   b) changing the starting value?

Draw a Box plot

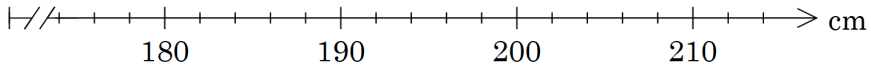
- Tap
- Set
  Draw: On
  Type: MedBox
  XList: list1 (or list2 for weights)
  Freq: to 1
- Tap Set
- Tap
- Tap OK



5. Draw box plots for height and weight (change XList to list2).
Remember to use [Analysis | Trace] to get accurate values to plot.

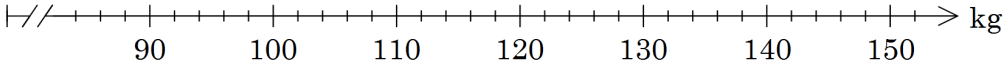
a)

Box Plot: Heights of NY Knicks roster



b)

Box Plot: Weights of NY Knicks roster

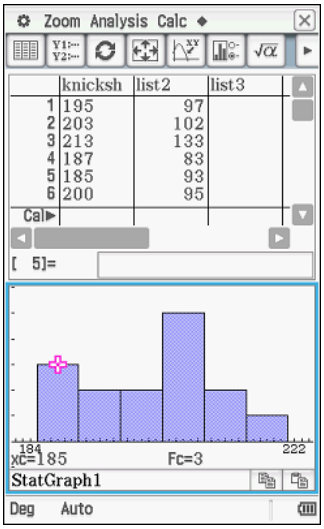


Learning Notes

You may like to ensure that the other graphs are all set to Draw: Off. (This is the default)

Histograms.

In the example shown the interval is 6. The left hand end of the interval is 185 and the frequency is 3. The rectangle on the histogram is then drawn with height 3 and from 185 to 191.



Activity 17 Rowers v Knicks

Aim: Compare data sets.

Box plots are useful for comparing data sets.
In this activity you will compare the New York Knicks professional basketball team with the Australian men's rowing eight.

New York Knicks	
Height (cm)	Weight (kg)
195	97
203	102
213	133
187	83
185	93
200	95
203	102
195	93
215	113
210	102
187	86
208	108
208	111
197	99
205	102

Australian Men's Rowing 8	
Height (cm)	Weight (kg)
184	87
192	94
189	86
198	94
193	92
192	87
195	93
194	90
168	55

(The last person is the cox)

1.

a) Calculate summary statistics for the heights of both groups and fill in the table.

	Heights in cm	
	Basketballers	Rowers
Mean		
Median		
Maximum		
Range		
Inter-quartile range		
Standard deviation		

b) For each statistic listed in your table comment on what it suggests about the groups. E.g. a higher mean suggests the group is taller.

c) Summarise the results from part b).

2. Calculate summary statistics for the weights of both groups.

a) Fill in the table.

	Weights in kg	
	Basketballers	Rowers
Mean		
Median		
Maximum		
Range		
Inter-quartile range		
Standard deviation		

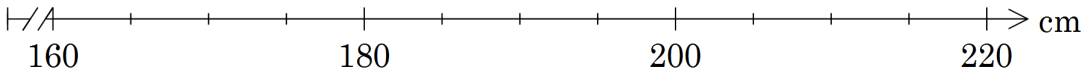
b) For each statistic listed in your table comment on what it suggests about the groups. E.g. a higher mean suggests the group is heavier.

c) Summarise the results from part b).

3. Compare the groups using box plots on the axes below.

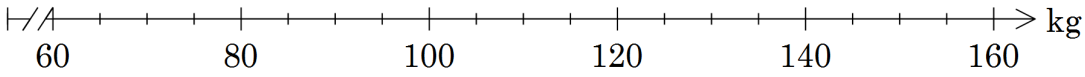
a) Draw box plots for the heights of both groups.
Use [Analysis | Trace] to get accurate values to plot.

Height boxplot: rowers & basketballers



b) Draw box plots for the weights of both groups.

Weight boxplot: rowers & basketballers



4. For comparing data discuss the relative strengths of statistics and box plots. I.e. Which is more convincing to say that one group is more or less than another or to describe how the data is distributed.

Learning notes

Set up the data

Open the Statistics application

- Tap Menu and tap the Statistics button

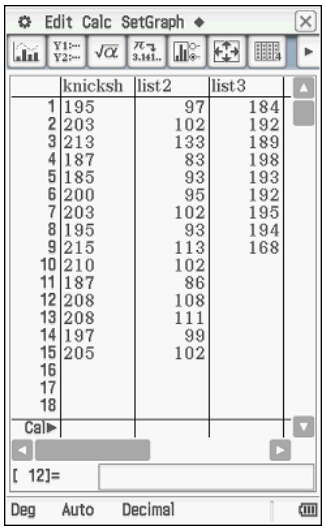
The basketballers data may already be there. If not and you have saved it then open the lists as described in the learning notes for Activity 15 Knick'stistics.

Enter the data

- The screenshot shows basketballers data in lists 1 and 2, the rowers' heights in list3. The rowers weights are in list4

Calculate statistics

- Select [Calc | One-Variable]
- Select the appropriate list for the XList
- Select 1 for the frequency
- Tap OK
- Repeat for the other lists



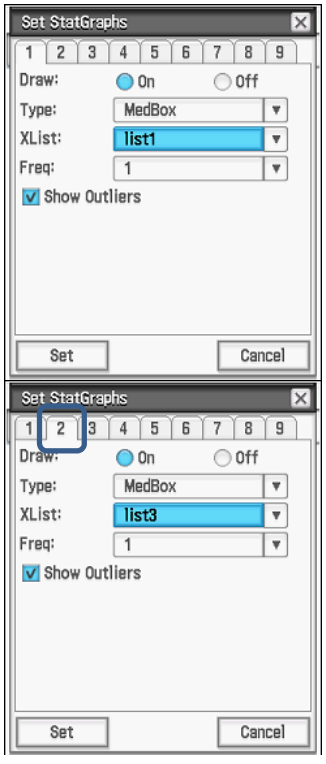
In the previous Activity you drew graphs. To draw more than one graph at the same time turn on multiple Statgraphs.

Draw multiple boxplots on the same graph

- Tap
- Set up Statgraph1 to draw a boxplot for the basketballers heights
  Draw: On
  Type: MedBox
  XList: list1
  Freq: 1
- Tap Set
- Set up Statgraph2 to draw a boxplot for the rowers' heights
  Tap 2 to select Statgraph2
  Draw: On
  Type: MedBox
  XList: list3
  Freq: 1
- Tap Set

Draw graphs

- Tap
- Tap OK



Activity 18 Reaction times

Aim: Display grouped data and calculate summary statistics.

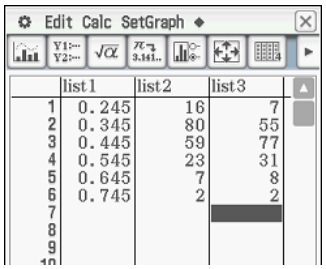
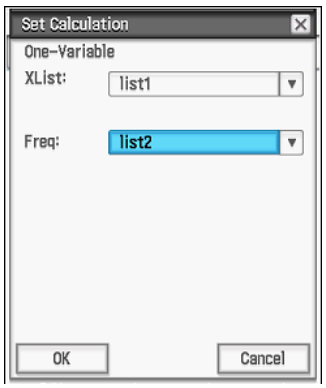
The table summarises reaction times for a data sample downloaded from the Census At School website.

Reaction Time (s)	Frequency	
Class Interval	Dominant hand	Non-dominant hand
0.2 - 0.29	16	7
0.3 - 0.39	80	55
0.4 - 0.49	59	77
0.5 - 0.59	23	31
0.6 - 0.69	7	8
0.7 - 0.79	2	2

1. Which estimate is more reasonable for the mean reaction time of the dominant hand? 0.3, 0.4, 0.5

2. Which estimate is more reasonable for the inter-quartile range of the reaction time of the dominant hand? 0.05, 0.1, 0.2, 0.4

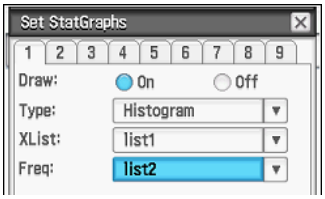
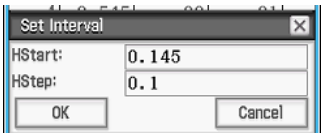
In order to calculate statistics from this data it is necessary to make assumptions about the data. Assume that all values in an interval are the same and equal (on average) to the middle of the interval.

Enter the data • Open Statistics • In list1 enter the mid-point of each interval • In list2 enter the frequencies for dominant hand • In list3 enter the frequencies for non-dominant hand	
Calculate statistics • Select [Calc | One Variable] • Set XList: list 1 and Freq: list2 for the dominant hand or list3 for the non-dominant hand. • Tap OK	

3. Complete the table by reading the values from your ClassPad calculations.

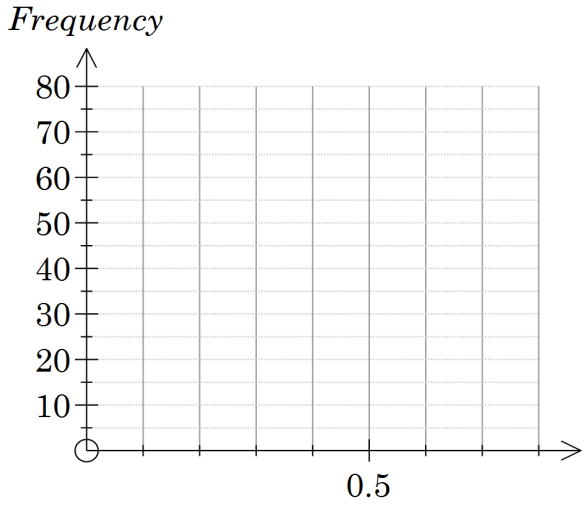
	Dominant hand	Non-dominant hand
a) Mean		
b) Minimum		
c) Lower Quartile		
d) Median		
e) Upper Quartile		
f) Maximum		
g) Range		
h) Inter-quartile range		
i) Standard deviation		

4. Draw histograms for the reaction times on your ClassPad.

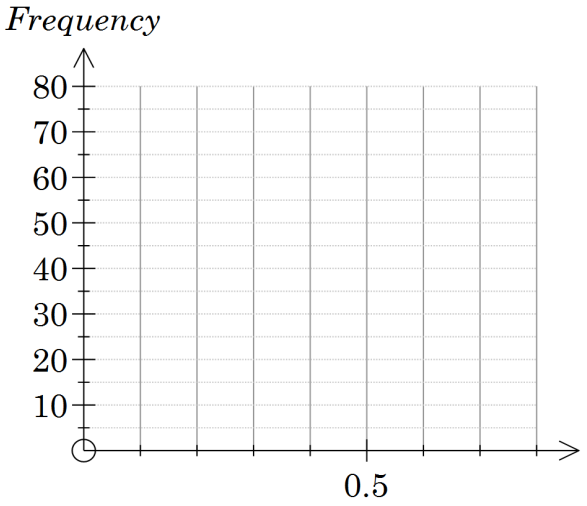
Set up to draw graph • Select [SetGraph | Setting] • Tap on StatGraph1 • Set parameters Draw: On Type: Histogram XList: list1 Freq: list2 • Tap Set	
• Tap to draw the graph • Set Interval Set HStart and HStep as shown • Tap OK Note for non-dominant hand alter Frequency to list3.	

a) Copy the graphs to the following grids.
Select [Analysis | Trace] to read off values

Dominant hand reaction time

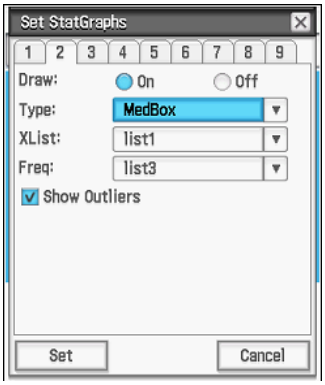


Non-dominant hand reaction time

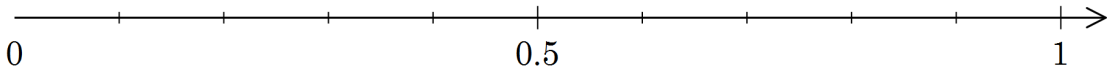


b) Comment upon the differences between the reaction times of dominant and non-dominant hands according to the graphs.

5. Draw box and whisker plots for the reaction times on your ClassPad.

Draw multiple boxplots on the same graph • Tap  Set up Statgraph1 to draw a boxplot for the basketballers heights • Draw: On Type: MedBox XList: list1 Freq: list2 • Tap Set	
Set up Statgraph2 to draw a boxplot for the rowers heights • Tap 2 to select Statgraph2 • Draw: On Type: MedBox XList: list1 Freq: list3 • Tap Set **Draw graphs** • Tap  • Tap OK	

a) Copy the graphs to the following grid.
Select [Analysis | Trace] to read off values.

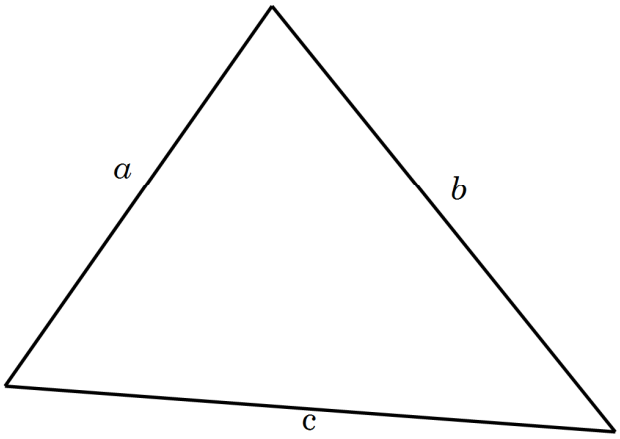


b) Comment upon the differences between the reaction times of dominant and non-dominant hands according to the box plots.

Chapter 6 Applications of trigonometry

Activity	ClassPad applications	Key concepts
Right-angled triangles	Geometry	Solve problems involving right triangles
Right-angled triangles II	Main	Algebraic methods for solving right triangles
Window dressing	Geometry	Solve non-right triangles

Heron's rule



$$A = \sqrt{s(s-a)(s-b)(s-c)}$$

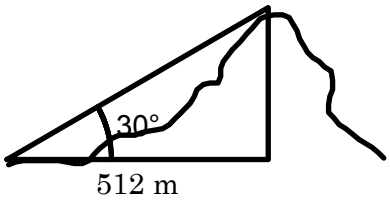
where $s = \dfrac{a+b+c}{2}$

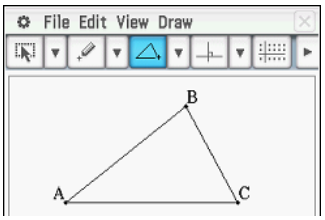
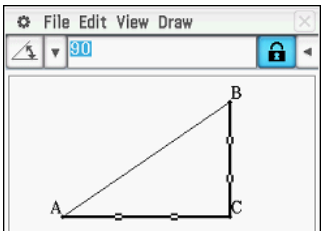
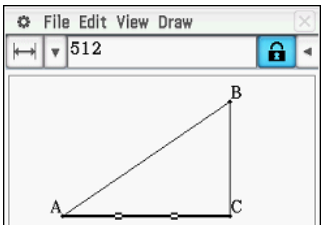
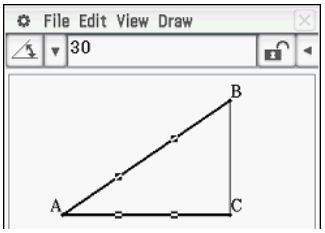
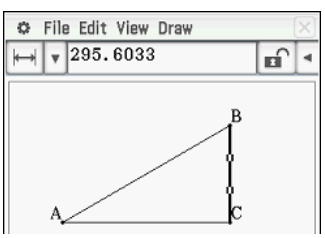
Activity 19 Right-angled triangles

Aim: Use Geometry to solve problems with right triangles.

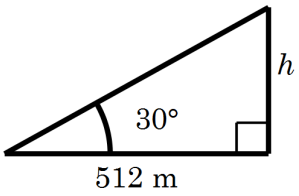
Hiker Jim is resting in his climb of Mt Magnificent. From his map he knows he is 512 m from the summit and measures the angle to the summit as 30°. How much higher is the summit?

A rough sketch



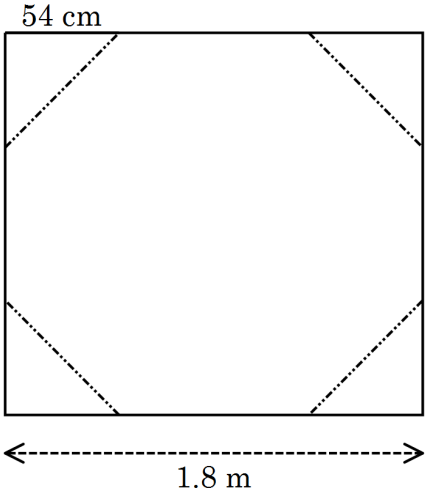
Open Geometry • Tap Menu, tap Geometry • Select [Edit | Clear all] **Draw the triangle** • Select and tap △, the triangle tool • Tap and drag to draw the triangle	
Set the measurements • Tap ▶ to go round the corner • Tap two sides, enter 90 in the measurement box and tap 🔓 to constrain • Tap in open space then tap the base and enter 512 in the measurement box • Tap 🔓 to constrain	 
• Tap hypotenuse and enter 30 in the measurement box • Tap 🔓 to accept	
Read distance • Tap in open space • Tap on opposite side (BC in diagram) • Read the value in the measurement box	

Write out a full solution

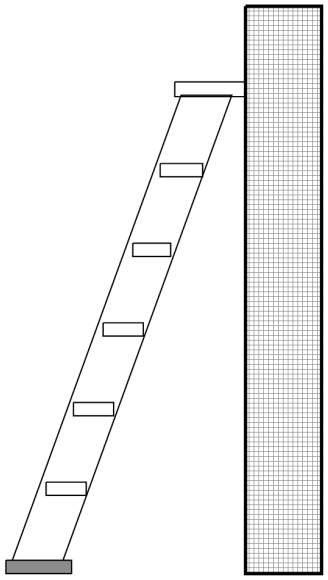
Working	Explanation for step in working
	Labelled diagram Include all given information and label the unknown with a symbol.
$\tan 30° = \frac{h}{512}$	Write an equation (if required)
$h = 295.6033$	Record the answer (from your calculator)
The mountain is 296 m high (to the nearest metre)	Round the answer and include the units. For a word problem answer with a sentence.

Write full solutions for the following problems.

1. The corners of a square piece of board are to be cut off to make an octagonal table. The square has sides 1.8 metres long. The triangles are cut 54 cm from the corner at an angle of 45 ˚. How long are the cuts?

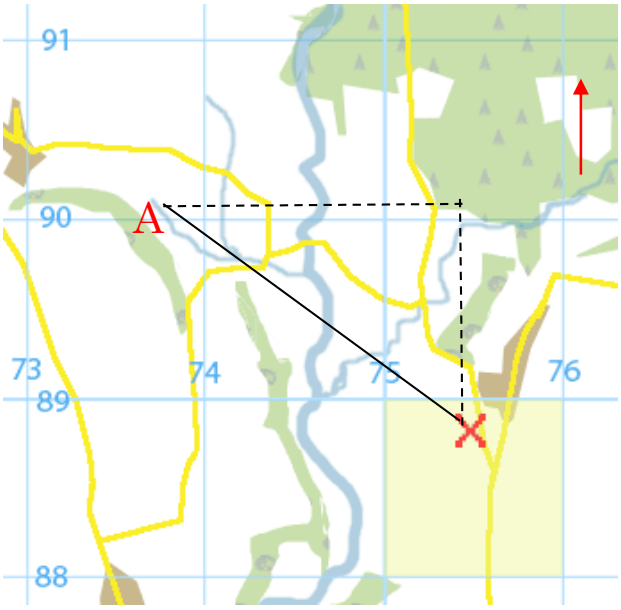


2. What angle does the 2 metre ladder make with the ground when the base of the ladder is 0.6 metres from a vertical wall?



3. Point X lies 256 m from point A and 31˚ South of East from A.

How far East and how far South of A is point X?

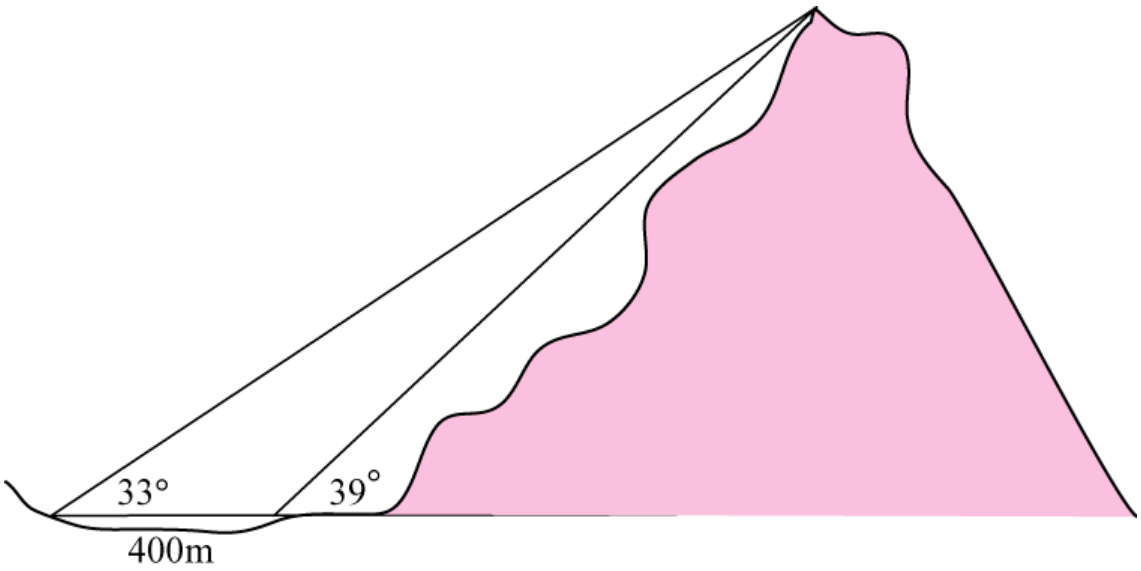


.

EXTENSION

4. Tom loves walking and is preparing to climb a mountain.

   Tom measures the angle of elevation to the top of the mountain at 33°.
   400 m closer to the mountain Tom measures the angle of elevation again.
   It is now 39°.



How high is the mountain?
Note: You are not expected to write an equation.

Learning Notes

Refer to earlier activities for more general instructions regarding use of the Geometry Application.

The use of scale diagram is encouraged in this activity because of its application to a wider range of problems and the emphasis on visualising the problem.

Your teacher may want you to be using an algebraic approach, i.e. writing an equation and then solving it. Having written an equation as in the example the answer can still be obtained from the diagram and the solution is complete.

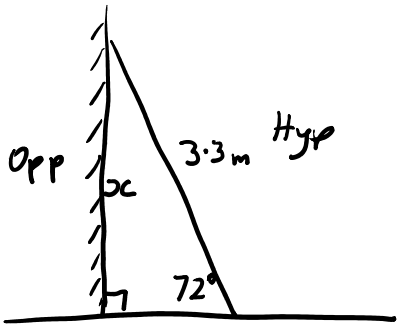
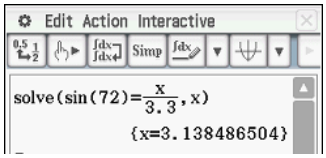
The next activity uses algebraic methods.

Activity 20 Right-angled triangles II

Aim: Solve right-angled triangle problems.

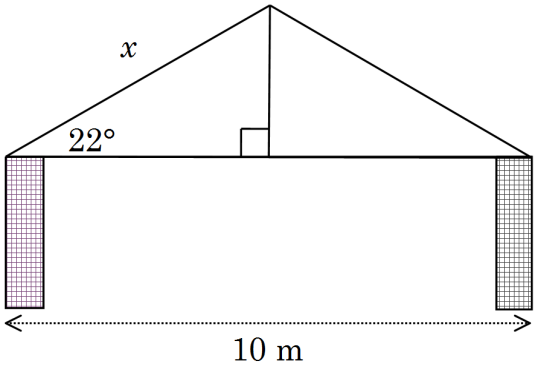
A 3.3 metre ladder is leaning up against a wall. It makes an angle of 72° with the floor. How high up the wall does the ladder reach?

Solution:

Step and explanation	Working
Draw and label a diagram.	
Choose the appropriate equation. Use the trig equation involving two measurements you know and the one you want to find.	$\sin\theta = \frac{O}{H}$
Substitute values.	$\sin 72° = \frac{x}{3.3}$
Solve the equation.	
Write answer appropriately rounded with units.	$x = 3.1$ m (1 d.p.)
Check answer is reasonable.	Close to but less than 3.3 m is reasonable

The three questions following ask you to use different methods to solve the equation. It is valuable to use each method and then decide which is quicker and easier for you to use.

1. A carpenter is building a roof. It is to have a pitch of 22° and span walls 10.0 m apart.



a)

(i) Write a full solution to calculate x, the length from the apex to the outside of the wall.

(ii) Is a 6 m length long enough to reach from the apex of the roof to the outside of the wall?

b) How high is the apex above the wall?

2. What is the size of the smallest angle in a right-angled triangle with sides 1.49 m, 1.24 m and 82 cm?

a) Draw a diagram.

b) Create the diagram in Geometry.
Activities 2, 13 and 14 contain detailed instructions regarding working in the Geometry Application.

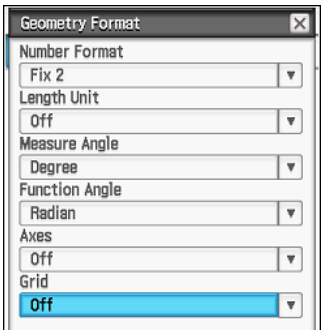
Setup

- Make sure Measure Angle is set to degrees and Grid is off
- Select [File | New]

Make a rough sketch of the figure

Constrain lengths and angles

Make measurements



c) Write a full solution.

3. James's boat is tethered to a point 3.1 m above the boat. The rope when fully stretched is 9.6 m long. What is the angle between the stretched rope and the horizontal?

   a) Draw a diagram

   b) Build and use an eActivity to solve the equation.
   See Learning notes for detailed instructions.

   c) Write a full solution.

Learning Notes

Q3

Build eActivity

- Tap Menu, tap the eActivity button
- Select [Insert | Strip(2) | NumSolve]

Enter the equation

- Press Keyboard
- Tap Trig , tap sin
- tap θ, enter) and press =
- tap ▪/▫
- Tap abc, tap ⬆ and tap O
- Tap in bottom of fraction
- Tap ⬆ and tap H
- Press EXE
- Press Keyboard
- Tap in strip and enter a label such as sine

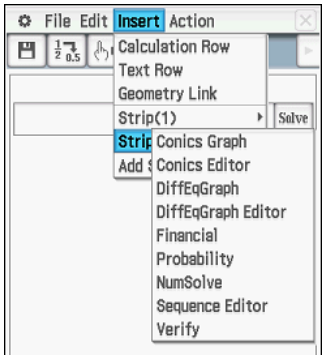
Create two more NumSolve strips for cosine and tangent.

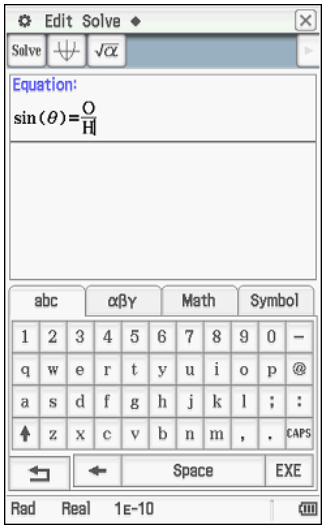
Save your eActivity

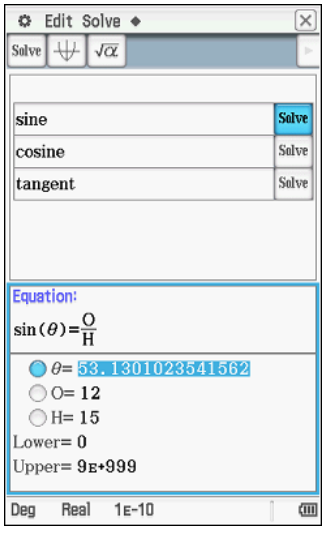
- Select [File | Save]
- Check the box next to main (or create a new folder)
- Enter a name for the eActivity
- Tap Save

Use e-Activity to solve problem

- Tap Solve (next to equation you wish to use). Substitute the two values you know
- Set the lower limit to 0 as we want positive numbers for a length or size of an angle
- Tap the radio button next to the unknown quantity
- Tap Solve at the top of the screen
- Read off your answer







Activity 21 Window dressing

Aim: Solve non-right-angled triangles.

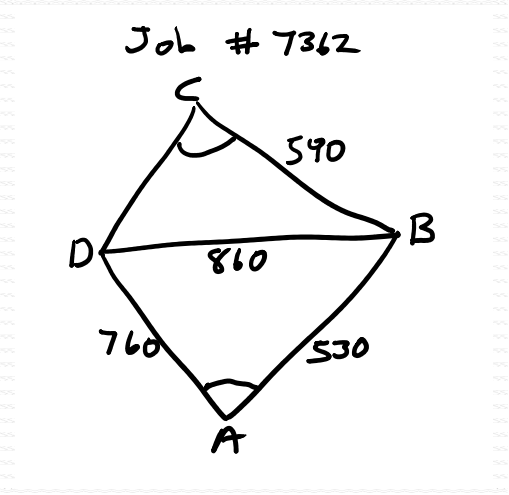
Geometry problems can often be solved by drawing a scale diagram. If using pencil, compass and protractor we may need to be careful to draw the diagram sufficiently accurately. With ClassPad we can draw accurate scale diagrams.

1. Norman has measured up a window for which glass is to be cut.

   This is his rough sketch.

   All lengths are in millimetres.

   Angles A and C are equal.



   Use Geometry to determine the:

   (Refer to Learning notes for detailed instructions)

   a) size of angle A (or ∠BAD);

   b) size of angle ABD;

   c) length of DC;

   d) length of diagonal AC;

   e) area of the whole window;

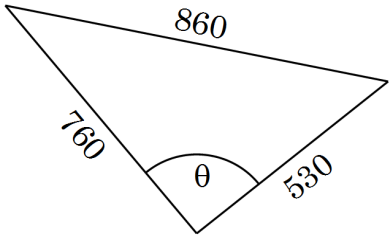
   f) cost of the glass given the glass costs $196.50 per square metre.

Your teacher may well want you to use trigonometric formulae in solutions of such problems.

Trigonometric formulae for all triangles	
Area of a triangle	$\text{Area} = \frac{1}{2}ab\sin C$
Sine rule	$\frac{\sin A}{a} = \frac{\sin B}{b}$
Cosine rule	$c^2 = a^2 + b^2 - 2ab\cos C$

2. With reference to this triangle

a) Label the triangle appropriately to use the cosine rule to explain why $860^2 = 760^2 + 530^2 - 2\times 760\times 530\cos\theta$



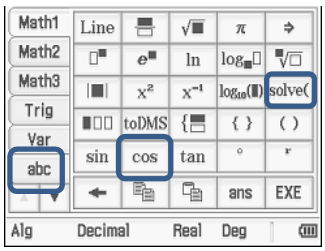
b) Enter $860^2 = 760^2 + 530^2 - 2\times 760\times 530\cos\theta$ in main and solve for θ.

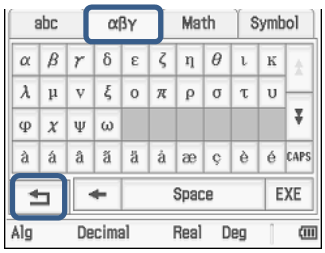
Enter the equation

- Tap Main $\sqrt{\alpha}$
- Press Keyboard (if required)
- Tap solve(
- Tap Math1 (if required)
- Tap cos (also available in Trig)
- Tap abc, tap αβγ
- Tap θ (or use another variable)
- Press)

Specify the variable to solve for

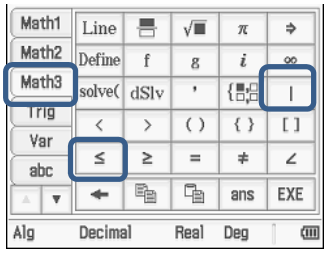
- Press ,
- Tap θ
- Press)



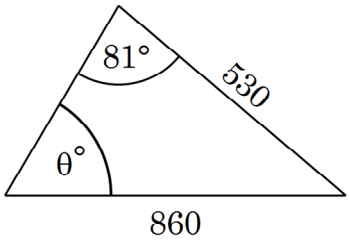


Specify the domain (the angle must be between 0 and 180)

- Tap ↩ (go back in the keyboard menu)
- Tap Math3
- Tap |
- Enter $0 \le \theta \le 180$
- Enter Press EXE.



3. Label the triangle appropriately in order to use the sine rule to explain why



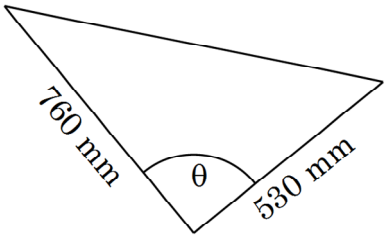
a) $\frac{\sin 81°}{860} = \frac{\sin \theta}{530}$

b) Enter this equation in main and solve for θ.

4. This triangle has area 1995 cm^2.

a) Label the triangle appropriately in order to explain why

$1995 = \frac{1}{2} \times 53 \times 76 \times \sin \theta$



b) Enter this equation in main and solve for θ.

EXTENSION:

Add the trigonometric formulae used in this investigation to the eActivity you created in Activity 20 *Right triangles*.

5. Use the eActivity to solve Questions 2 - 4.

Learning notes

A solution is more than an answer. As a minimum a solution requires:

- A labelled diagram;
- An equation with the known values substituted;
- The answer with units and appropriately rounded.

For solving equations you have used three methods. It is advisable to use the method that is most efficient for you for each question and this is likely to vary with the problem. The table gives an indication of advantages and disadvantages of each method.

Method	Advantages	Disadvantages
Using solve in Main	• You have already written the equation.	• When finding angles ClassPad's output can be confusing.
Geometry	• Drawing a matching scale diagram acts as a check. • Useful when a number of things need to be done based on one diagram.	• Can only constrain (set) lengths and angles. For example it is no help doing Question 4.
eActivity	• Easy data entry, just substitute values. • Formula is displayed. • Strip help can be added.	• Limited to a single equation. • Won't handle the ambiguous case (not asked for in this unit), i.e. finds the nearest valid answer to the initial value entered. • Pay attention to the domain for solutions.

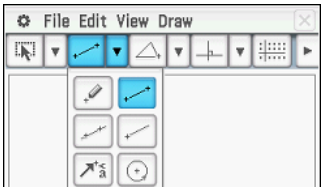
Q1 Instructions for using Geometry

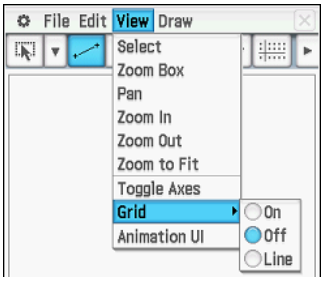
Setup

- Tap Menu, tap the Geometry button
- Select [Edit | Clear All] and tap OK to clear any drawing
  (Or select [File | New])

You may also like to

- Toggle the axes and grid off
  Tap ⊞ to cycle through options
- Turn the Integer grid off
  [View | Grid | Off]



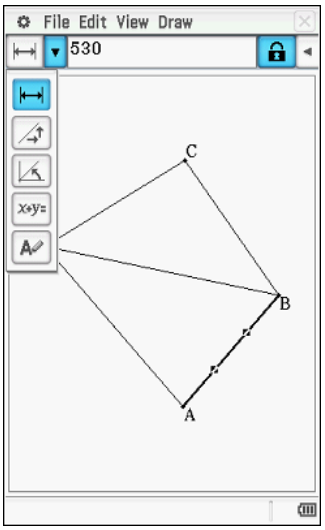


Make a rough sketch of the figure

- Tap [ ] to select the line segment tool
- Tap on the screen at approximately one end of a line
- Tap at the other end position
- Repeat for the other lines

Constrain lengths

- Tap [▶] to go round the corner
- Tap on a line segment (AB on the sketch) to select it
- Tap in the measurement box
- Select [ ] the distance tool
- Enter 530 and tap [ ]
- Tap in open space
- Repeat for the other lengths given



Determine angle A

- Tap in open space
- Select lines AB and AD
- Select [ ] and read measurement

Constrain top angle

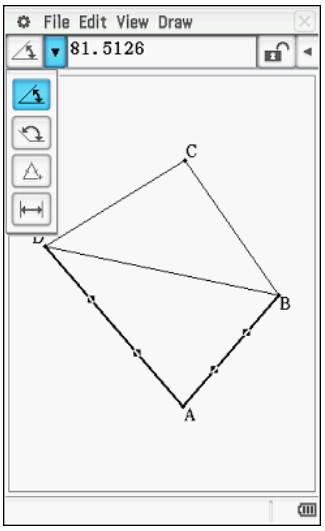
- Tap in measurement box and highlight angle measure in degrees
- Select [Edit | Copy]
- Tap in open space
- Select lines BC and CD
- Tap in measurement box
- Select [Edit | Paste]
- Tap [ ]

Measure side

- Tap in open space
- Tap on line
- Read distance ([ ]) in measurement box

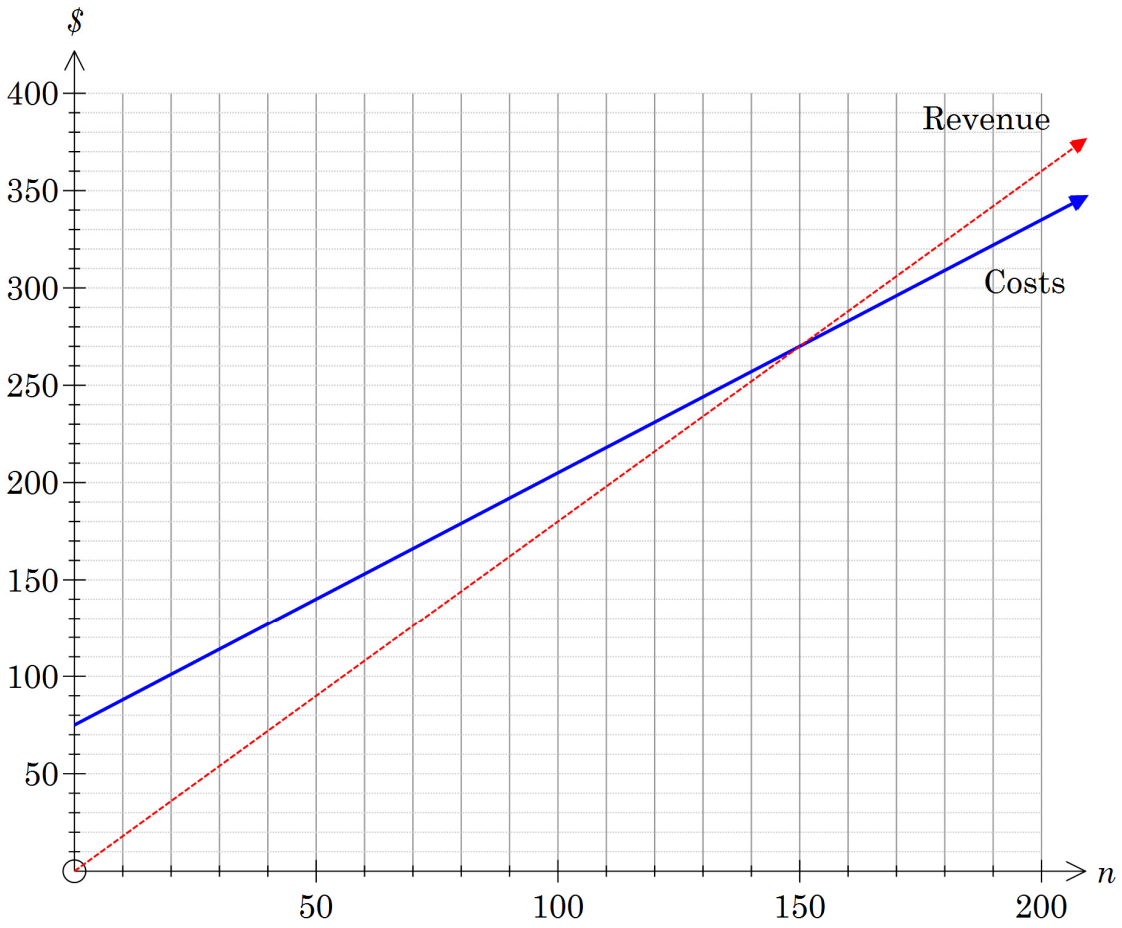
Measure area

- Tap in open space
- Tap on each line bounding the window
- Read Area ([ ]) in measurement box



Chapter 7 Linear equations

Activity	ClassPad applications	Key concepts
Solving equations	Main	Algebraic methods for solving equations.
Features of straight lines	Main Geometry Graph&Table	Identify features of straight line graphs.
Deluxe taxi fares	Main	Substitution and solving equations.
Simultaneous equations	Graph&Table	Solve systems of equations graphically
Book club	Graph&Table	Solve systems of equations in context
Income tax	Spreadsheet Main	Piece-wise functions

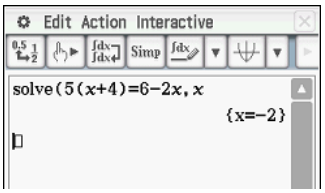


Activity 22 Solving equations

Aim: Solve equations in Main.

To solve an equation with a single variable e.g. $5(x+4)=6-2x$

- Tap Main $\sqrt{\alpha}$
- Select [Action | Advanced | solve]
- Enter the equation
- Enter ,x (If this is omitted ClassPad will try to solve for x)
- Press EXE

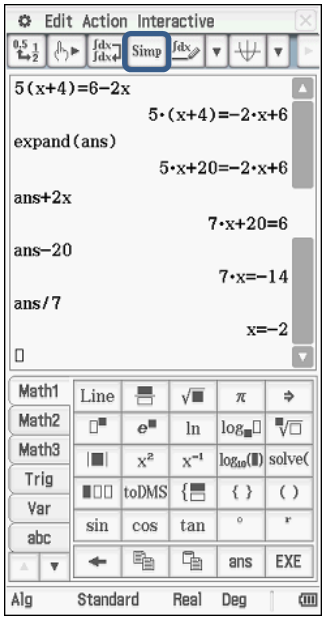


However you will sometimes be asked to solve equations algebraically or without use of ClassPad.

A full algebraic solution	The steps
$5(x+4)=6-2x$	Expand brackets
$5x+20=6-2x$	Get the x's together
$7x+20=6$	Subtract 20 from both sides
$7x=-14$	Divide both sides by 7
$x=-2$	

You can use ClassPad to check your algebra.

- Tap Main $\sqrt{\alpha}$
- Enter the equation
  (or you can highlight it from the previous line)
- Press EXE
- Select [Action | Transformation | expand]
  Simplify will often work too. Tap Simp
- Press EXE
- Press +, enter 2x and press EXE
- Press -, enter 20 and press EXE
- Press /, enter 7 and press EXE



The aim with each step is make the equation simpler.
If you try something that doesn't work just go back and try again.

Solve each equation on your ClassPad without using the solve command. Then complete written **algebraic** solutions.

1. $25-2x=17$

2. $2(4a-3)=5a+1$

3. $\frac{2y-4}{3}=y+1$

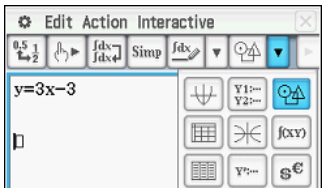
Activity 23 Features of straight lines

Aim:. Identify features of straight lines.

This activity has instructions for using a split window. This enables data to be easily transferred from one window to the other by dragging. An equation can be dragged into Geometry or Graph&Table and a line can be dragged from Geometry back into Main. This supports seeing linear functions in different ways.
It is recommended you follow the instructions even though you may well be able to do the questions in other ways.

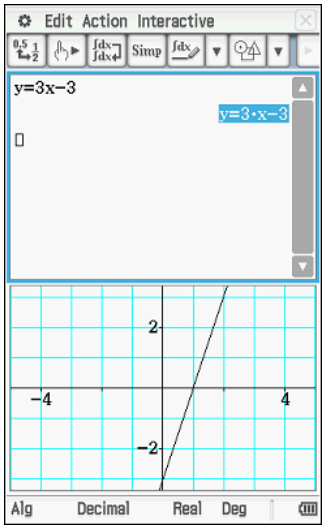
Setup

- Tap Main $\sqrt{\alpha}$
- Select [ ] from the Application pull-down menu to open a Geometry window
- Select [File | New] (if required)
- Tap [ ] until the axes and scale are showing
- Tap in the Main window



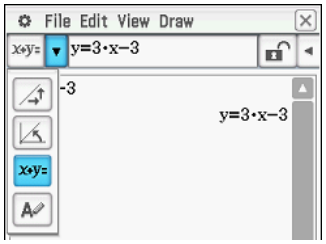
Draw graph

- Enter the equation $y = 3x - 3$ in Menu
- Highlight the equation
- Drag into Geometry window



Read properties of the line

- Tap [▶] to go round the corner
- Tap on the line
- Select [ ] to measure the slope
- Select [x•y=] to see the equation
  The equation is displayed in slope-intercept form. In this example it is the same as the equation you typed in Main.



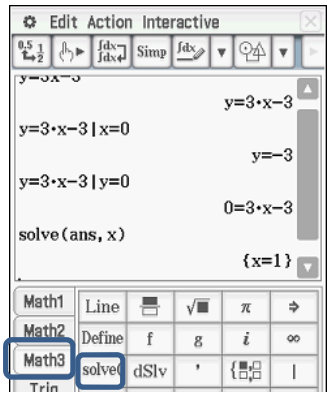
Intercepts
Can sometimes be read from the graph

To calculate *y*-intercept

- Tap in Main window
- Copy equation, press [Keyboard], tap [Math3] tap | enter x=0
- Enter solve(ans,y) (if required)

Calculate *x*-intercept

- As for y-intercept but substitute y=0



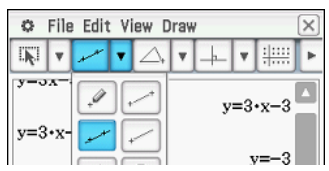
1. Complete the table:

Equation	Slope is positive ／ or negative ＼	Slope	*y*-intercept	*x*-intercept
$y = 3x - 3$	+	3	-3	1
$y = 7 - 0.3x$				
$x + y = 5$				
$2y - 3x + 6 = 0$				
$x = 4y + 3$				
$y = 3.2$				
		2.2	5	
			10	-5

Find the equation of line between (–2, –1) and (3, 2)

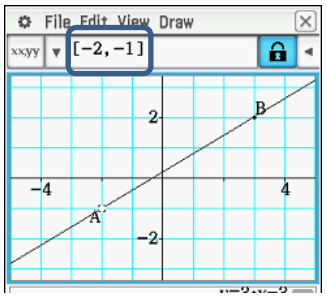
Draw line

- Tap in the Geometry window
- Select [line] to draw a line
- Tap near one of the coordinates
- Tap near the other



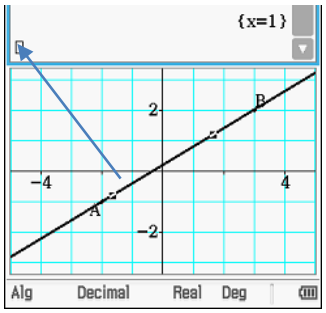
Constrain coordinates

- Tap ▶ to go round the corner
- Tap on point A (one of the points)
- Tap in measurement box
- Enter the exact coordinates
- Tap 🔓
- Tap in open space
- Tap on B, the other point, and fix the coordinates



Select the line and drag into the Main window

- Tap in open space
- Tap on line
- Drag into the Main window command line.
  The equation will now be shown.



2. Complete the table.
   (You do not need to redraw the figure. You can just refix the coordinates.
   If 🔓 is displayed the coordinates are locked. Tap 🔓 to enable editing.)

Points	Slope	Equation of line	y-intercept
(–2, –1) and (3, 2)	0.6	$y = 0.6x + 0.2$	0.2
(1, 3) and (6, 8)			
(3.2, 1.8) and (4, –0.6)			
(2, 6) and (2, –5)			
(10, 0) and (0, 5)			

Learning notes

The equation of a straight line is most likely review of previous work. If not, you should summarise your findings, i.e. in the equation of a line where is the slope and where is the y-intercept?

Activity 24 Deluxe Taxi fares

Aim: Evaluate expressions by substitution and rearrange formulas.

1. Deluxe Taxis: \$4 per kilometre and \$2.50 flagfall.

   a) Explain why a trip of 8 km will cost \$34.50.

   b) What is the cost of a 12.5 km trip?

   c) How many kilometres can a passenger travel for \$50?

2. The cost C for travelling a distance of d kilometres is $C = 4d + 2.5$.
   Repeat Question 1 by entering this formula in main and following the instructions below.

Enter the formula

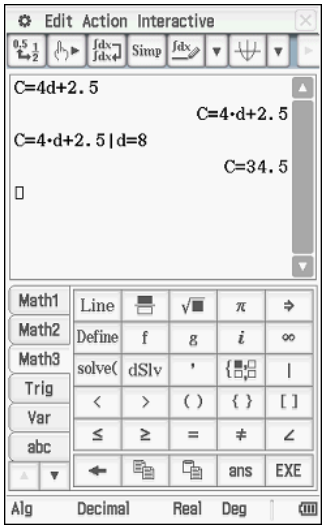
- Taps Main $\sqrt{\alpha}$
- Press [Keyboard] to open the keypad
- Tap [abc], tap ⬆, tap C, press [=] , press [4], tap d and complete the formula, Press [EXE]

Copy the formula

- Highlight the answer
- Drag to the next line or tap [⎘] to copy the formula, tap on the next line and tap [⎘] to paste the formula

Substitute $d = 8$

- Tap [⮌] tap [Math3]
- Tap |
- Enter d=8 and press [EXE]

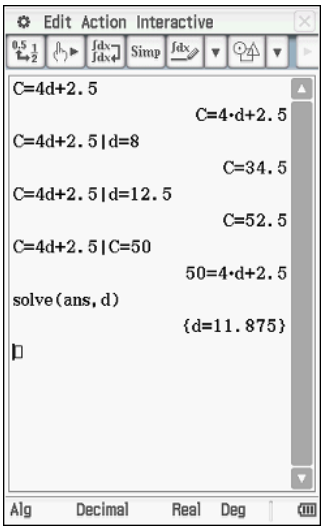


Substitute $d = 12.5$

- Press [EXE] to repeat the calculation
- Edit the substitution to d=12.5 then press [EXE]

Substitute $C = 50$ and **solve** for d.

- Press [EXE] to repeat the calculation
- Edit the substitution to C=50 then press [EXE]
- Tap [solve(] or Select [Action | Advanced | Solve], tap [ans] or drag in the equation from the previous answer, press [,] tap d and press [EXE]



3. Use the methods from Question 2 to calculate:

a) what would Ben expect to pay for a taxi ride of:

(i) 6.3 km;

(ii) 32.4 km?

b) how far can Ben go for:

(i) $10;

(ii) $78?

4. Most taxi's will also charge a fee for waiting time. This only applies if the taxi is stationary for more than two minutes and Deluxe Taxis charge 55c per minute.
The formula now becomes $C = 4d + 2.5 + 0.55m$ where m is the number of minutes of waiting time.

   Edit the formula in Main, then use the methods from Question 2 to calculate answers and write full solutions.

   a) What would Ben expect to pay for a taxi ride of 6.3 km with 10 minutes waiting time?

   b) How far can Ben travel for $20 with a 5 minute wait?

   c) How long can Ben wait if his journey is 8.5 km and he has $50?

5. Fuel prices have rapidly increased and the taxi board has authorized a new fare schedule.

Flag fall	$4.30
Cost per km	$4.71
Wait time	$0.60 per minute

   a) Write a new formula for the cost of the taxi fare.

   b) Use your ClassPad to calculate answers and then write full solutions:

      (i) What would Ben expect to pay for a taxi ride of 6.3 km with 10 minutes waiting time?

      (ii) How far can Ben go for $20 with a 5 minute wait?

      (iii) How long can Ben wait if his journey is 8.5 km and he has $50?

Learning notes

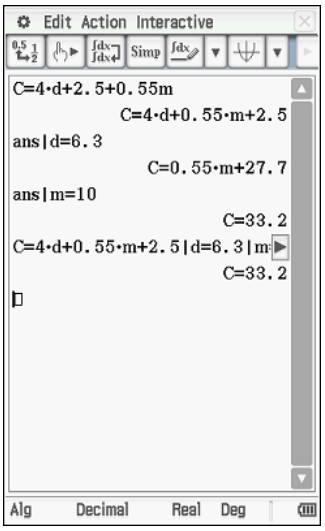
To Edit the formula

- Tap [paste] to paste the formula
- Enter + 0.55m
- Tap |
- Enter d = 6.3
- Tap |
- Enter m = 10
- Press EXE

Both substitutions can also be done on the one line

You may want to copy the new formula to use later.

- Highlight the equation
- Tap [copy] from the keyboard



Full solutions

Writing solutions is more than giving a number for an answer. To provide a full written solution to problems like these you should:

- Write the formula
- Substitute the known values
- Evaluate or solve the expression
- Round the answer appropriately for the problem and write the answer in a sentence.

Example 1

What would Ben expect to pay for a taxi ride of 8km?

$C = 4d + 2.5$	Write the formula
$= 4 \times 8 + 2.5$	Substitute
$= 34.5$	Evaluate
Ben's trip costs \$34.50	Write a sentence.

Example 2

How many kilometres can Ben go for \$50?

$C = 4d + 2.5$	Write the formula
$50 = 4d + 2.5$	Substitute
$d = 11.875$	Solve for d
Ben can travel 12 km to the nearest kilometre.	Write a sentence.

Activity 25 Simultaneous equations

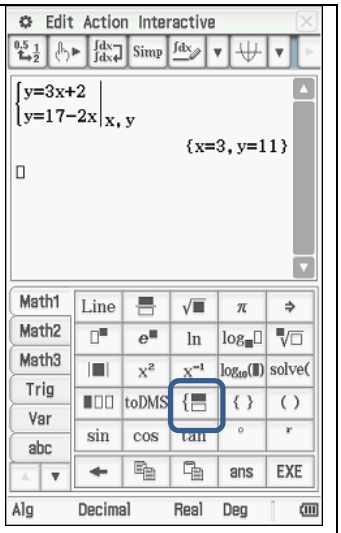
Aim: Use a variety of methods to solve pairs of simultaneous equations.

In this Activity different methods for solving simultaneous equations are explored. They each have advantages depending upon the exact type of equation. After completing the activity decide what your preferred method is.

Solve simultaneous equations using 2D template

To solve $\begin{aligned} y &= 3x+2 \\ y &= 17-2x \end{aligned}$ **for x and y:**

- Tap $\sqrt{\alpha}$ (Main)
- Press Keyboard
- Tap Math1
- Tap $\{\square\}$
- Enter the equations as shown as we are solving for x and y
- Press EXE



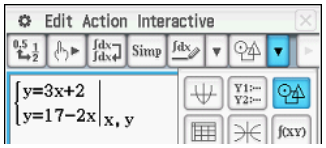
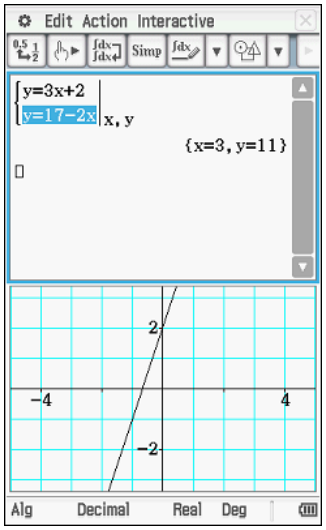
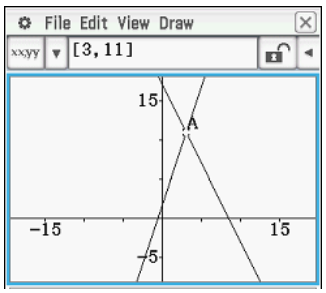
1. Solve the following pairs of simultaneous equations

a) $\begin{aligned} y &= 4x-6 \\ 3x &= 2y+7 \end{aligned}$

b) $\begin{aligned} 3x+7y &= 4 \\ 2x-7y &= 6 \end{aligned}$

c) $\begin{aligned} 5b+1 &= 2a \\ a &= 2b+8 \end{aligned}$

Solve simultaneous equations graphically in Geometry

Open a Geometry window • Tap Main $\sqrt{\alpha}$ • Select [ ] from the Application pull-down menu to open a Geometry window • Select [File | New] (if required)	
Draw lines • Highlight the first equation • Drag into the geometry window • Highlight second equation in main window • Drag into the geometry window If both lines and the intersection point isn't visible in the geometry window then select [View |Zoom to Fit] • Tap on one line and then tap on the other line • Select [Draw | Construct | Intersection]	
Locate intersection point • Tap in open space • Tap on the point of intersection • Tap [▶] to go round the corner • Read the coordinates	

2. Sketch graphs for each pair of lines and state the solution to the pair of simultaneous equations.

a)

$y = 4x - 6$

$3x = 2y + 7$

b)

$3x + 7y = 4$

$2x - 7y = -9$

c)

$5y + 1 = 2x$

$x = 2y + 8$

Note: you can change the equation in the measurement box.

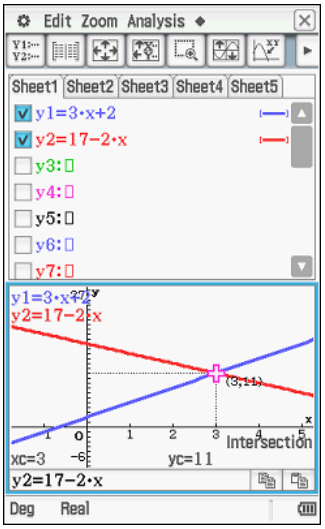
Solve simultaneous equations graphically in Graph&Table

Draw the graphs

- Open Graph&Table
- Enter the equations
- Make sure both equations are ticked
- Tap [graph] to graph

Locate the point of intersection

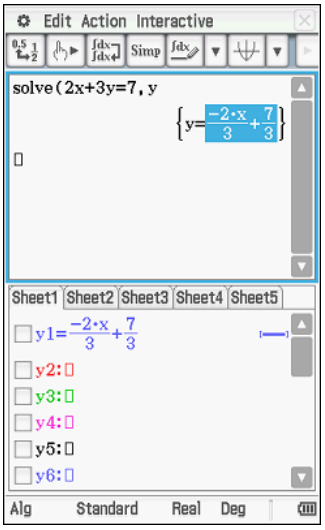
- Adjust the view window [zoom] as required
- Select [Analysis | GSolve | Intersection]



If equations are **not** in the form $y =$, use this method to rearrange the equation.

For example in Main

- Select [Action | Advanced | solve]
- Enter the equation 2x+3y=7
- Enter ,y and press [EXE]
- Highlight the result (excluding the y=), select [Edit | Copy]
- Paste the result into a graph equation (Alternatively highlight then drag and drop the expression into Graph&Table)



3. Solve the following systems of equations using the above method.

a)

$$y = 2x - 9$$
$$y = 27 - 4x$$

b)

$$y = -4x + 14$$
$$y = 6x - 6$$

c)

$$x + y = 1$$
$$y = 2x + 3$$

Solve simultaneous equations algebraically in Main (substitution method)

You may be asked to solve problems like this (simple numbers) without ClassPad.

In this example an equation is of the form $y=$ so we will substitute for y

Substitute for y into the first equation

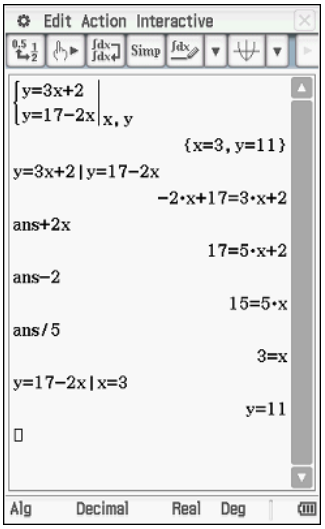
- Highlight the first equation and drag to a new line (or enter the equation)
- Press Keyboard
- Tap Math3
- Tap |
- Highlight the second equation and drag to end of new line
- Press EXE

Solve for x

- Do the same things to both sides of the equation until x is isolated

Determine y

- Highlight one of the equations and drag to a new line
- Tap | and enter x=3 (your answer from above)
- Press EXE



The solution as it would then be written on paper as

$$y = 3x + 2 \quad \ldots 1$$
$$y = 17 - 2x \quad \ldots 2$$

$-2x + 17 = 3x + 2$ substitute equation 2 into equation 1

$$17 = 5x + 2$$
$$15 = 5x$$
$$x = 3$$

$$y = 3 \times (3) + 2 = 11$$

$$x = 3, y = 11$$

4. Write out solutions for the following simultaneous equations.

a) $y = 4x - 6$
$x = 2y + 5$

b) $x = y - 4$
$3x - 2y = -8$

c) $x = 2y + 1$
$2y = 5x - 4$

Activity 26 Book club

Aim: Use graphs to solve simultaneous equations.

Jen and Ahjoy are friends who enjoy reading books together.
Jen reads 20 pages per day (she is highly organised).
Ahjoy starts off slowly but then reads more pages per day as the book gets exciting.

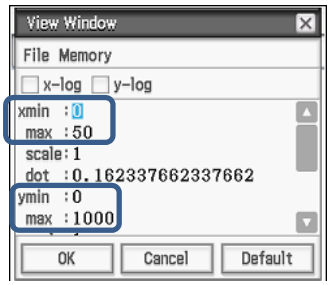
1. Write a formula for the number of pages (P) Jen has read n days after starting to read a book.

2. Enter your formula into ClassPad's Graph&Table Application.

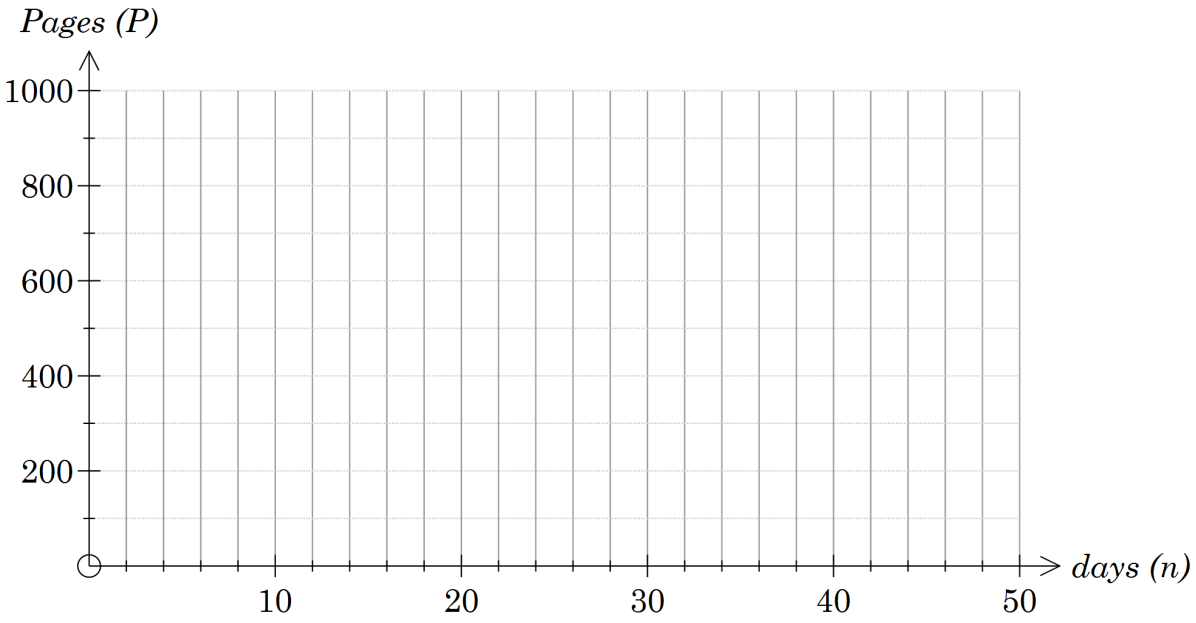
Enter formula
- Open Graph&Table
- Enter the function as y1

Adjust the view window
- Tap , set the values for xmin and max, ymin and max to match the scale in the grid below
- Tap OK

Draw the graph
- Tap



Draw the graph on the grid below.



3. Ahjoy estimates his progress in reading a book with the formula $P = \frac{4n^2 - 3n + 180}{5}$.

   Enter this function into ClassPad as $y2 = (4x^2 - 3x + 180) / 5$

   Copy the graph to the above grid.

4. Use your graph to estimate when Jen and Ahjoy will be at the same place in the book.

5. Their next book is 800 pages long. If they want to finish at the same time, how many days later does Ahjoy need to start reading?

6. Another of their "must read" books is a 1000 page doorstopper.

   If they want to finish at the same time, how many days earlier does Ahjoy need to start reading?

Learning Notes

Book club requires solving a pair of equations simultaneously. This is an extension of the course in that one of the equations is not a straight line. However the graphical method of solution will work whenever you are able to draw a graph.

Q1 Jen's formula is a linear function with gradient being the number of pages she reads each day and y-intercept 0. To enter the equation into Graph&Table you must use y and x rather than P and n.

Q4 Select [Analysis | Trace] and use the left and right arrow keys to see where the graphs intersect.
Or select [Analysis | G-Solve | Intersection]

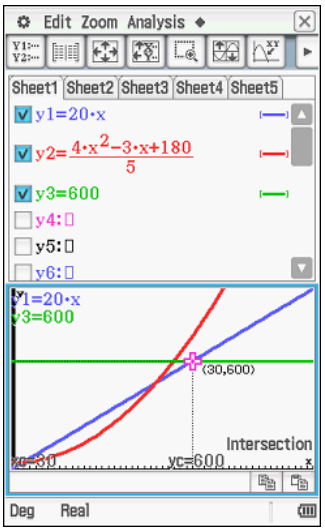
Q5 Use trace and look for how long before each reaches 600 pages
or
Draw another graph y3=600 and locate the intersections
or
Select [Analysis | x-cal/y-cal | x-cal] and calculate x when y is 600.

Draw horizontal line

- Enter a new function e.g. y3=600
- Draw the graph

Find point of intersection

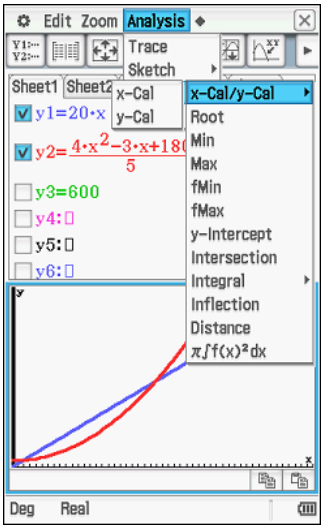
- Select [Analysis | G-Solve | Intersection]
- If there are more than 2 graphs
  Use up and down arrows to select first function and press EXE
  Use up and down arrows to select second function and press EXE

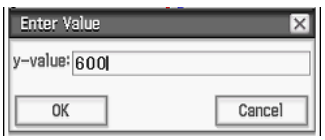


Use x-cal to calculate an x-value

With the graphs drawn.

- Select
  [Analysis | G-Solve | x-cal/y-cal | x-cal]
- Press up or down arrow to select graph
- Press EXE
- Enter the y value
- Tap OK





Activity 27 Income tax

Aim: Solve problems involving piecewise linear functions.

Tax rates 2013-14

Taxable income	Tax on this income
0 – $18,200	Nil
$18,201 – $37,000	19c for each $1 over $18,200
$37,001 – $80,000	$3,572 plus 32.5c for each $1 over $37,000
$80,001 – $180,000	$17,547 plus 37c for each $1 over $80,000
$180,001 and over	$54,547 plus 45c for each $1 over $180,000

Source: http://www.ato.gov.au/Rates/Individual-income-tax-rates/

Part A: Spreadsheet

1. Use the table to calculate the tax on incomes of
   a) $14 250
   b) $18 201
   c) $91 798
   d) $32 310

2. Construct a spreadsheet to calculate the tax on any income. An important idea is to choose the appropriate rule (tax bracket). In the spreadsheet this is through the use of if statements.

Open to the spreadsheet

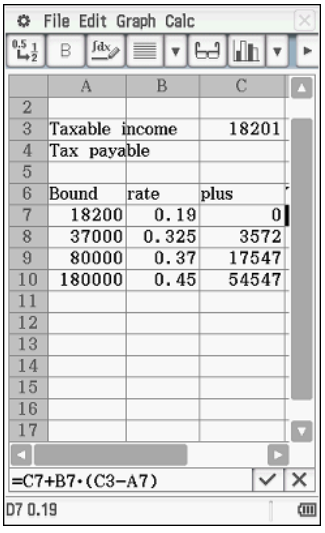
- Tap Menu, tap Spreadsheet

Enter headings

- Tap in A1 and enter *Tax Calculator*
- Tap in A3, enter *Taxable income*
- Tap in A4, enter *tax payable*
- Tap in A6, enter *bound*
  The lower bound of the tax bracket
- Tap in B6, enter *rate*
  the rate in the particular tax bracket
- Tap in C6, enter *plus*
- Tap in D6, enter *tax*

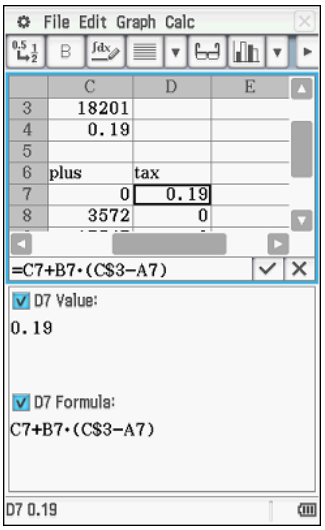
Enter data from table

- In cells A7 to C10 enter the numbers shown. These are in the tax table above.



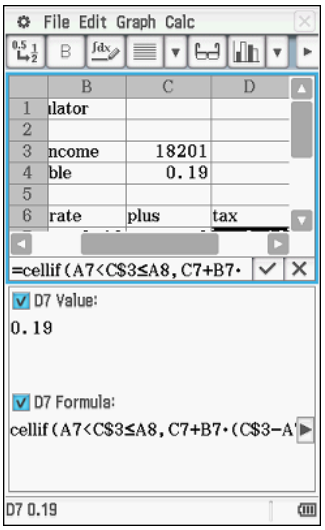
Enter formulas

- Tap in C3 and enter 18 201
  This is in the $18 200 to 37 000 bracket.
- Tap in D7, enter =C7+B7*(C$3-A7)
  this is the tax due: 19c.
- Check that this works by entering other amounts in this range.
- Tap in D7, select [Edit | Fill Range] enter D7:D10



Modify formulas

- Tap in D7, edit the formula to
  =cellif(A7<C$3≤A8,C7+B7*(C$3-A7),0)
  This is saying if the taxable income (C3) is between A7 and A8 then calculate the tax
- Repeat for the other formula cells in column D so the tax is only calculated when the amount is in that bracket.
- The formula in D10 should be:
  =cellif(A10<C$3,C10+B10*(C$3-A10),0)
  since incomes over $180000 do not have an upper bound on their tax bracket.



Display taxable income

- Tap in C4, enter the formula =sum(D7:D10)

Use your spreadsheet to complete the table

Name	Taxable income	Tax payable
a) Alessia	$26 065	
b) Bruce	$126 340	
c) Christine	$76 922	
d) Dylan	$16 980	
e) Edna	$40 694	
f) Fletcher	$234 560	

Part B: Piecewise function

ClassPad enables us to define different rules for different inputs as the tax table requires.

3. If the taxable income is $\$x$

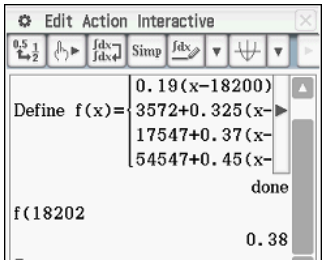
   a) Explain why the expression $3572+0.352(x - 37\,000)$ gives the tax due when the taxable income is between 37 000 and 80 000.

   b) Write similar expressions for the tax due on incomes between

      (i) 18 200 and 37 000

      (ii) 80 000 and 180 000

Define a tax function as a piecewise function

Select and enter the piecewise function • Tap Main $\sqrt{\alpha}$ • Press Keyboard • Tap Math3	
Enter function • Tap Define, enter f(x)= • Tap $\{\square,\square\}$, tap $\{\square,\square\}$ another three times so there are 5 lines • Enter the function as shown • Press EXE	$\begin{cases} 0, & x\leq 18200 \\ 0.19(x-18200), & 18200<x\leq 37000 \\ 3572+0.325(x-37000), & 37000<x\leq 80000 \\ 17547+0.37(x-80000), & 80000<x\leq 180000 \\ 54547+0.45(x-180000), & \square \end{cases}$
Calculate tax on 18202 • Enter f(18202) and press EXE	

c) Use your function to complete the table

Name	Taxable income	Tax payable
(i) Gillian	$261 065	
(ii) Hadi	$18 000	
(iii) Ita	$19 100	
(iv) Jack	$20 000	
(v) Kate	$87 694	
(vi) Lam	$111 560	

4. What does the graph of tax paid against taxable income look like?

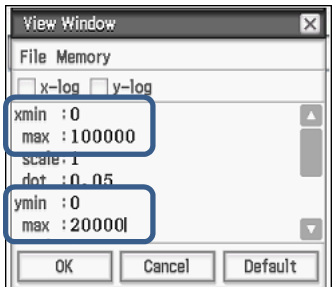
Open a graph window

- On the main screen type f(x)
- Open a graph window from the pull down menu

Set the view window

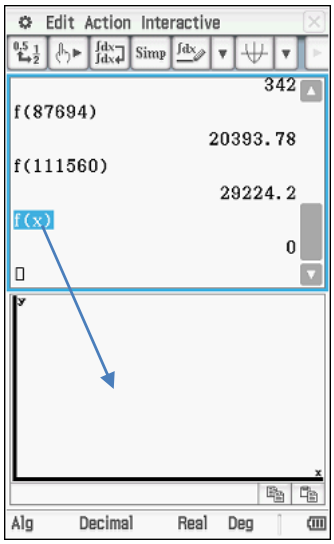
Consider income up to $100 000 and tax to $20 000

- Tap
- Set values as shown
- Tap OK

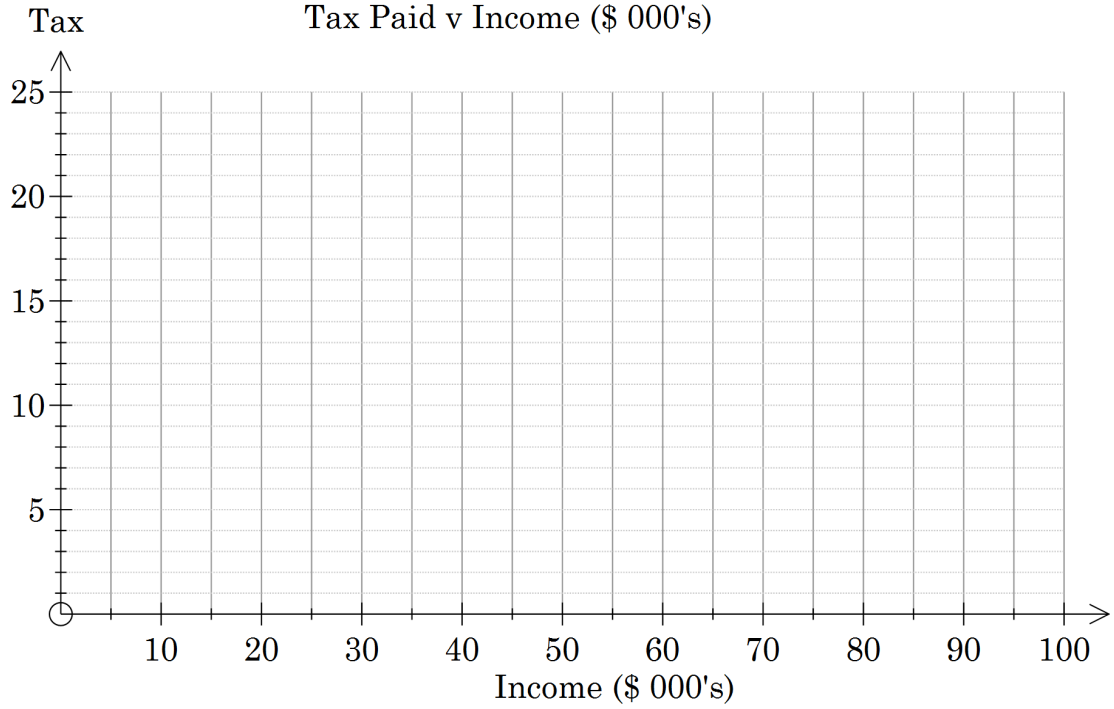


Draw graph

- Highlight f(x) and drag into graph window
- Select [Analysis | Trace] and use left and right arrows to locate any points of interest, such as where the slope changes and to assist with plotting the graph reasonably accurately.



a) Transcribe the graph from your ClassPad to the grid below.



b) At what points does the slope change?
Why?

Learning notes

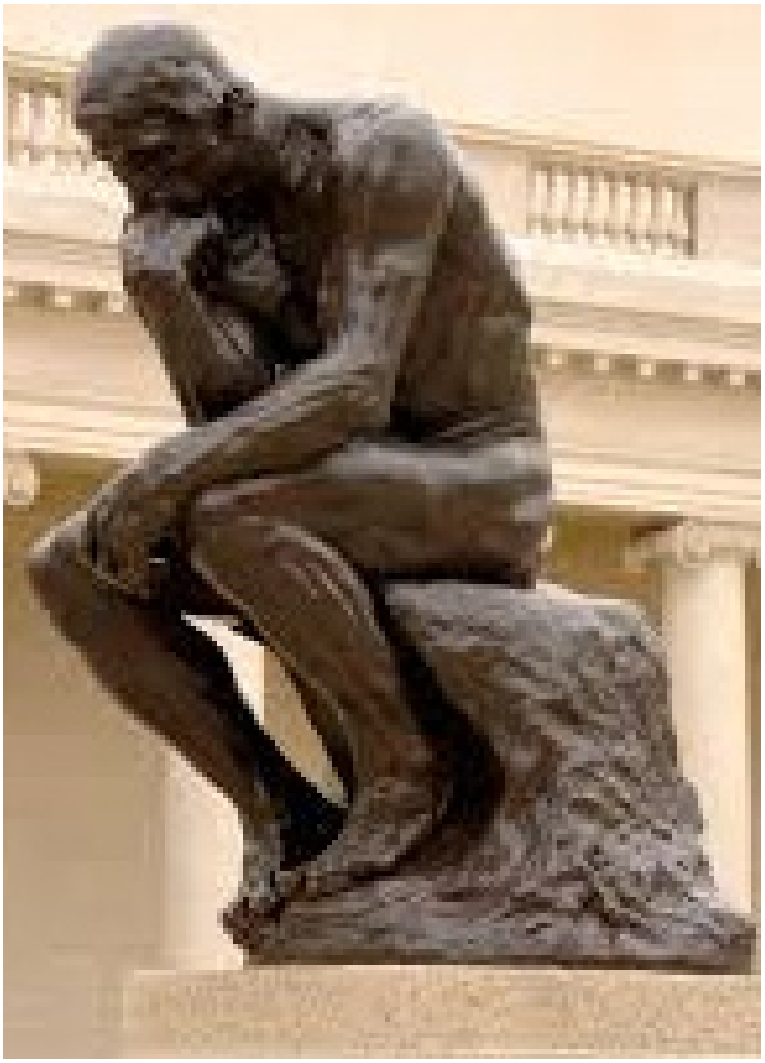
Most people pay tax each time they are paid. Tax returns are about making appropriate adjustments and for most people that means a small refund as a little more has been taken out than they need to pay.

Q3 c) You may like to explore the percentage of income that is paid in tax. You may have heard people on high incomes complaining about the amount of tax they need to pay. For example Kate pays $20 393.78 tax on a taxable income of $87 694. This is about 23%, much less than the marginal rate of 37%.

Chapter 8 Problems

The Activities in this chapter go beyond the standard course. They are useful in extending your ClassPad skills and are interesting applications or extensions of the course content. Doing these will help you apply your knowledge to new situations and will be useful preparation for Units 3 and 4.

Activity	ClassPad applications	Key concepts
Phone costs	Main	Use and understand function notation, solve linear equations
Moderating marks	Statistics	Adjusting school marks to match the centre and spread of the exam marks



Activity 28 Phone costs

Aim: Use and interpret function notation.

Suzie's pre-paid account with *FourMobile* has $250 value. The table below shows how Suzie is charged for her calls.

Local rates per minute (?)	
Call rate per minute or part thereof	$ 0.89
Flagfall rate per call	$ 0.39

1. Study Suzie's call records listed in the following table.

Date	Time	Phone Number	Duration	Call minutes
1/3/12	4:17		6:54	7
1/3/12	4:24		18:25	19
1/3/12	5:11		0:05	1
1/3/12	5:11		0:42	1
2/3/12	5:12		12:15	13
2/3/12	6:12		2:00	2
4/3/12	3:59		17:01	18
4/3/12	7:05		1:12	2
4/3/12	7:29		21:34	22

a) How many calls has Suzie made?

b) What is the total number of call minutes Suzie will be charged for?

c) What is the cost of Suzie's calls, (including flagfall and rate per minute costs)?

d) How much of the $250 credit does Suzie have left?

The credit remaining on this $250 plan is a function of the number of calls, n and the number of call minutes, m.

$$C(n,m) = 250 - 0.39n - 0.89m\,.$$

For example after 20 calls and 100 call minutes the remaining credit is

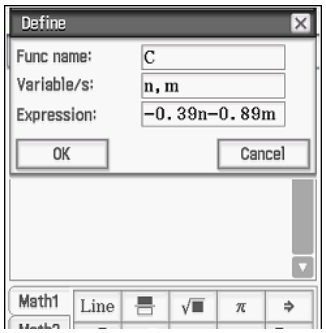
$$C(20,100) = 250 - 0.39\times 20 - 0.89\times 100 = \$153.20\,.$$

2. Complete the table.

	Number of calls	Call minutes	Credit remaining ($)
$C(10,250)$			
$C(50,150)$			
	72	175	
$C(32,\quad)$		220	
$C(\quad, 200)$			$56.40

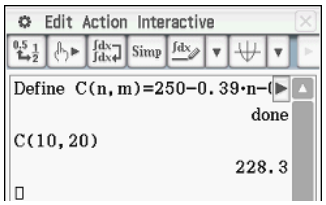
Define the function in ClassPad

- Tap Main $\sqrt{\alpha}$
- Select [Interactive | Define]
- Use the Keyboard to enter
  - C for Func name
  - n,m for the variables
  - 250–0.39n–0.89m for the expression
- Tap OK



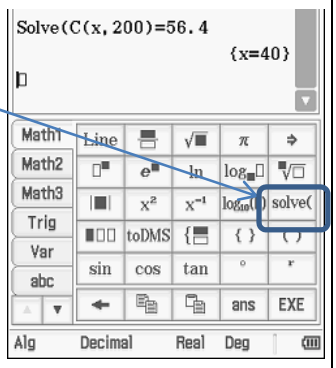
Calculate a function value

- Enter the function name, open bracket, enter each input separated by a comma and close bracket
  e.g. enter C(10,20) to find credit after 10 calls and 20 call minutes



Solve

- Tap solve(from the Keyboard tab or select [Interactive | Advanced | solve]
- Enter the equation and the variable you want to solve for
  e.g. How many calls has Suzie made if she has $56.40 credit left and has used 200 minutes of talk time?



3. Use your ClassPad function to answer the following:

   a) What is the credit remaining after 72 calls and 240 call minutes?

   b) What is the credit remaining after 16 calls and 250 call minutes?

   c) Suzie checks her balance and notices it is \$45.26 and that she has made 64 calls. How many call minutes has Suzie made?

4. Record your ClassPad display for the following inputs:

   a) $C(10,m)$

   b) $C(x,y)$

   c) $C(10,2m)$

   d) $C(x,2y)$

5. Suzie's remaining credit will also take into account charges for standard national SMS texts (t) and excess data charges (d).

Standard national SMS	\$ 0.29
Excess data usage fee (per MB)	\$ 2.00

   a) Write the function rule for

   $C(n,m,t,d) =$

   b) Modify or redefine your ClassPad function and complete the table.

	Number of calls	Call minutes	SMS	Excess Data Mb)	Remaining Credit (\$)
$C(10,150,75,0)$					
$C(10,90,350,3)$					
	72	175	21	4	
$C(32,100,60,\quad)$					\$107.12
	21		73	0	\$43.53

EXTENSION

FourMobile would want call minutes calculated automatically. It would be calculated using the integer part of a number function.

On Classpad int returns the largest integer smaller than or equal to the input. For example int(7.3) returns 7.

6. Determine the value for each of the following function statements and compare with your answers to Q1.

   a) int(6.54+.99)

   b) int(18.25+.99)

   c) int(0.05+.99)

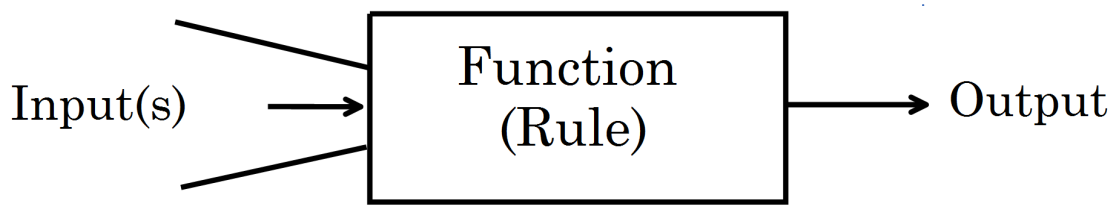
   d) int(0.42+.99)

   e) int((12+15/60)+.99)

   f) int(2.00+.99)

Learning Notes

Mathematical functions involve one or more inputs that generate one output or value. For example y-values of a function graph depend upon x
In three dimensions a z-value is likely to be a function of x and y.



The Credit function in this investigation depends upon two factors, number of calls and call minutes. This assists in providing a realistic context to explore function notation and to appreciate that functions produce a single output.

Activity 29 Moderating marks

Aim: Compare data sets and adjust for comparability.

The table shows marks for a class of students. The first mark is determined by the teacher while the second mark for each student is their exam mark.

Mark	Student																
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
School	65	43	78	91	82	65	71	54	61	36	88	69	58	65	79	45	62
Exam	57	45	69	84	77	61	67	57	53	35	75	65	52	62	71	41	55

How did the class' exam marks compare to the school mark? This activity will enable you to answer this type of question more precisely using mean or median for central tendency, and standard deviation or inter-quartile range for spread.

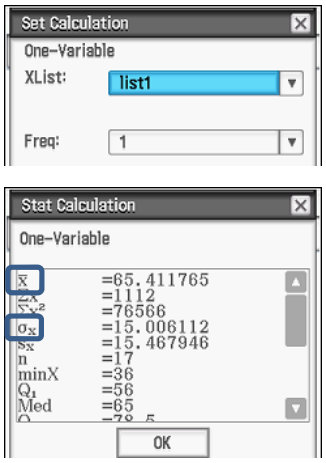
1. Enter the data into Statistics app in ClassPad.

Calculate summary statistics

- Open Statistics
- Select [Edit | Clear all] to clear the lists.
- Enter the data for school mark in list1 and exam mark in list2.
- Select [Calc | One-Variable]
- Select the appropriate list for XList
- Select 1 for frequency
- Tap OK

  $\bar{x}$ is the mean

  σ_x is the standard deviation



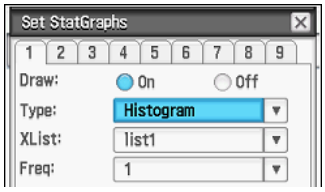
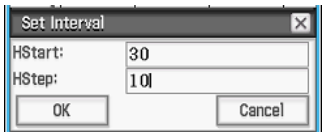
a) Complete the following table.

	ClassPad symbol/formula	School marks	Exam marks
Mean	$\overline{x}$		
Median	Med		
Standard deviation	σ_x		
Inter-quartile range	$IQR = Q_3 - Q_1$		

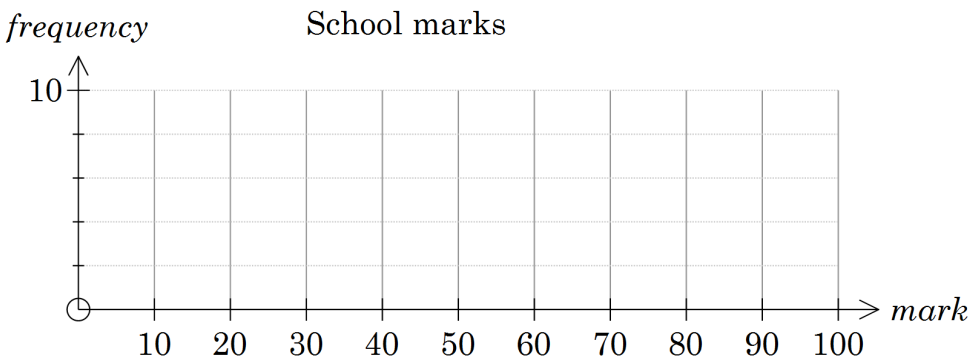
b) Use the statistics in part a) to argue that the class' school marks are generally better than their exam marks.

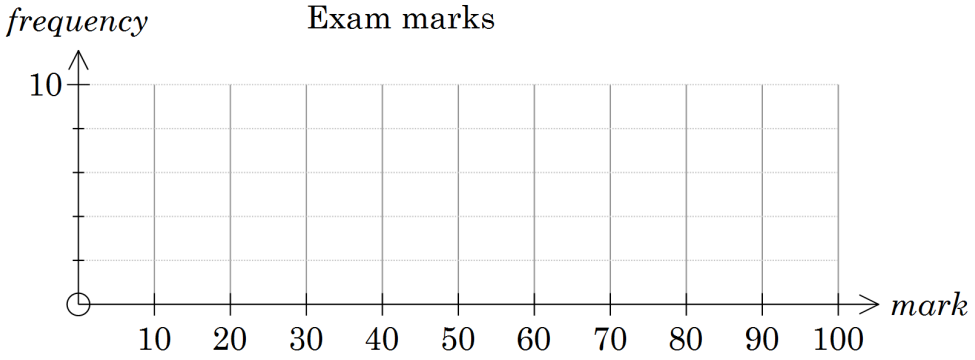
c) State which set of marks is more spread and justify your answer.

2. Compare histograms for school and exam marks:

Construct histogram Continuing from earlier work • Tap  • For StatGraph1 set the parameters as shown and tap SET.	
• Tap  to draw the graph. • Set interval Hstart and Hstep and tap OK. • Select [Analysis | Trace]	
Press the left and right arrows to read off the height and left hand boundary of each column. Use these values to plot your histogram.	

a) Draw the histograms generated on your ClassPad.





b) Mark on your graphs the "middle" of each distribution.

c) What comparison between the two sets of marks do the histograms suggest?

3.

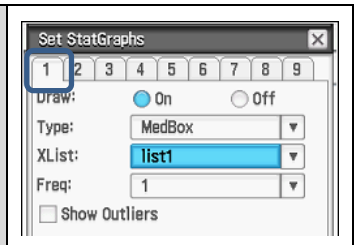
a) Construct boxplots of the school and exam marks on your ClassPad and transcribe the plots to the number line below.

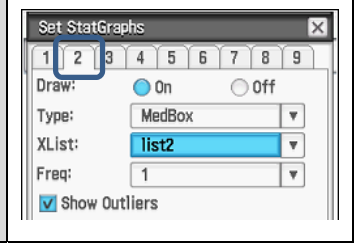
Construct boxplots

- Tap
- For StatGraph1 set Type: to MedBox and tap SET.
- Tap to draw the graph.

Draw a second boxplot on the same graph.

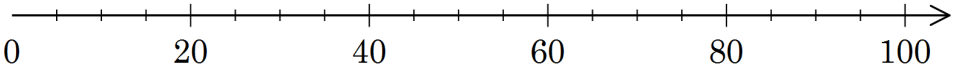
- Tap
- Set the parameters for StatGraph2.
- Tap to draw the graphs.
- Select [Analysis | Trace]
- Press the arrows to read off the values required to plot your boxplots.





Exam marks

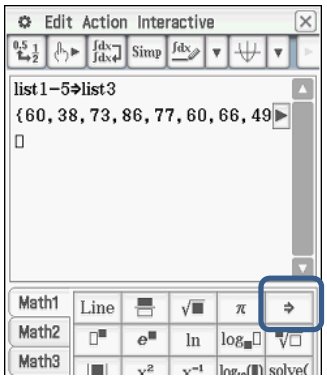
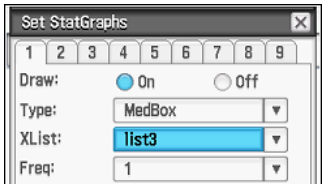
School marks



b) Which plot has the higher median?

In Year 12 school marks are often "moderated" by the exam. While the "moderation" process is complex the aim is to adjust each student's school mark so that the mean of the "adjusted" marks have the same mean and spread as the exam marks for the class.

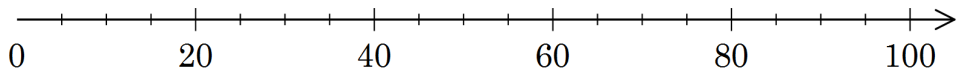
4. Adjust school marks to have the same mean as the exam and store in list3.

Subtract 5 from each of the school marks and store in list3 • Tap Main $\sqrt{\alpha}$ • Press Keyboard • Tap abc enter list1, press (−) press 5 • Tap ⮌ tap ⇒ • Tap abc enter list3 and press EXE	
Redraw boxplot • Tap • For StatGraph1 set XList: to list3 • Tap to draw the graph.	

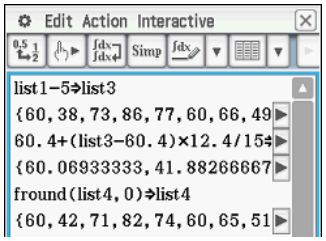
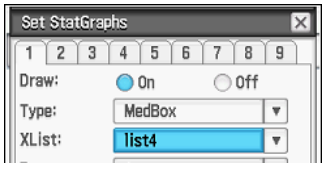
a) Redraw the boxplots. For list 1 and list 3. What has changed?

Exam marks

School marks - 5



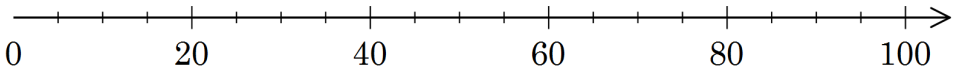
Adjust the spread (standard deviation) to match the exam marks and store in list4.

• Enter $60.4+(\text{list3}-60.4)\times\frac{12.4}{15}\Rightarrow \text{list4}$ • This gives decimal answers • Enter fround(list4,0)=>list4 to round values to whole numbers (0 decimal places)	
Change list for boxplot • In statgraph1 select list4 instead of list1 • Redraw the boxplots	

b) Redraw the boxplots for lists 1 and 4. How do they compare now?

Exam marks

Mod School marks



c) Enter the values from list4 into the moderated school mark row of the table.

	Student																
Mark	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
School	65	43	78	91	82	65	71	54	61	36	88	69	58	65	79	45	62
Exam	57	45	69	84	77	61	67	57	53	35	75	65	52	62	71	41	55
Moderated school mark																	

Which students did comparatively better in the exam than during the year? I.e. their exam mark was higher than their moderated school mark.

5. In another school the marks have been summarised into class intervals.

		Frequency	
Interval	Mid Interval	School mark	Exam mark
31 - 35	33	2	0
36 - 40	38	1	0
41 - 45	43	5	4
46 - 50		17	12
51 - 55		35	28
56 - 60		48	48
61 - 65		39	45
66 - 70		24	28
71 - 75		9	13
76 - 80		3	3
81 - 85		1	1
86 - 90		0	1
91 - 95		1	0

a) Complete the column Mid Interval in the above table.

b) Calculate summary statistics and complete the following table.

• Open Statistics • Select [Edit | Clear all] to clear the lists. • Enter the Mid Interval in list1 • Enter school marks in list2 • Enter exam marks in list3 • Select [Calc | One-Variable] • Select list1 for XList • Select appropriate list for frequency (list2 for school marks, list3 for exam marks)	

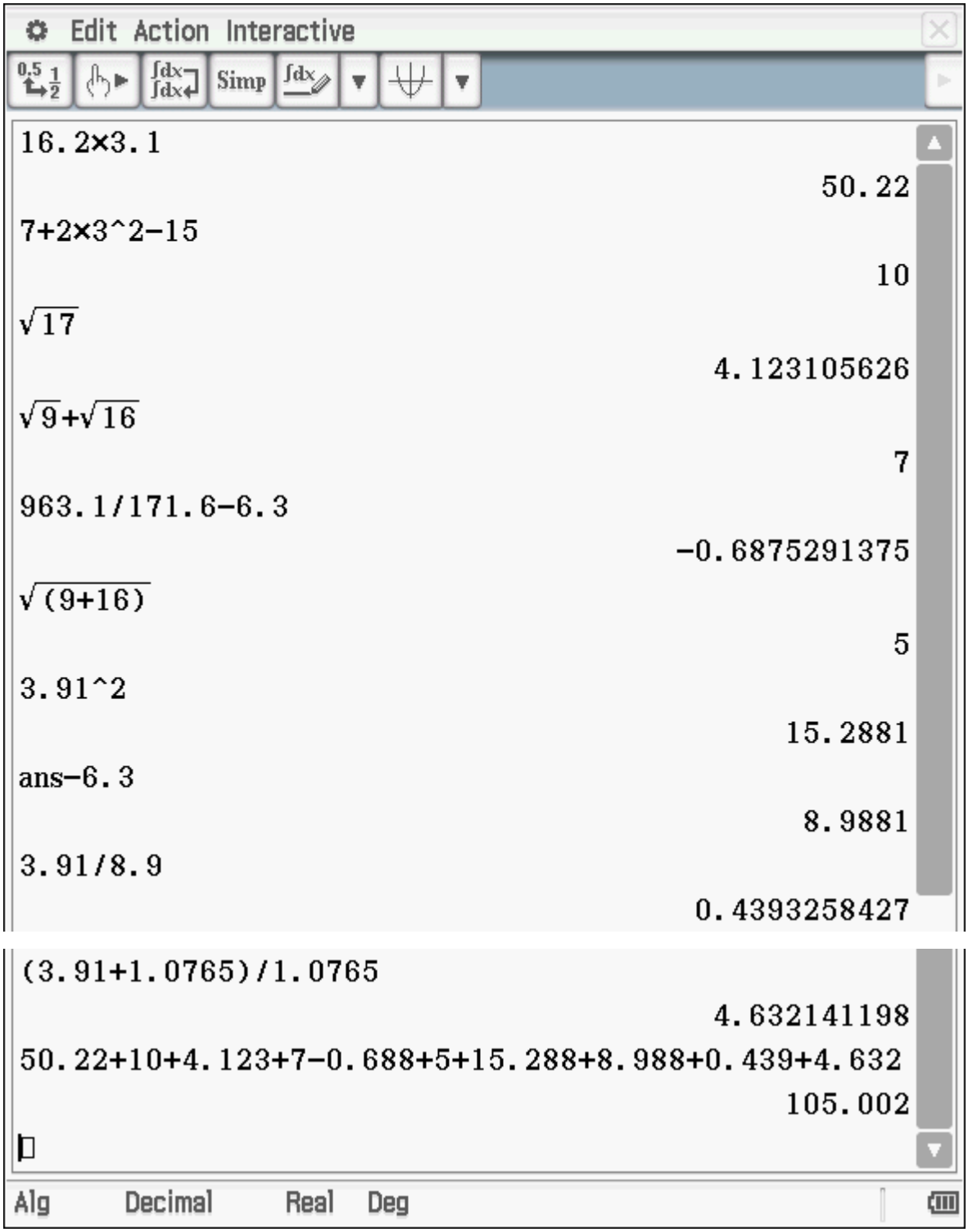
	ClassPad symbol/formula	School marks	Exam marks
Mean	$\bar{x}$		
Standard deviation	σ_x		

c) Did the students generally get better school or exam marks? Justify your answer.

d) Which set of marks is more spread?
Justify your answer.

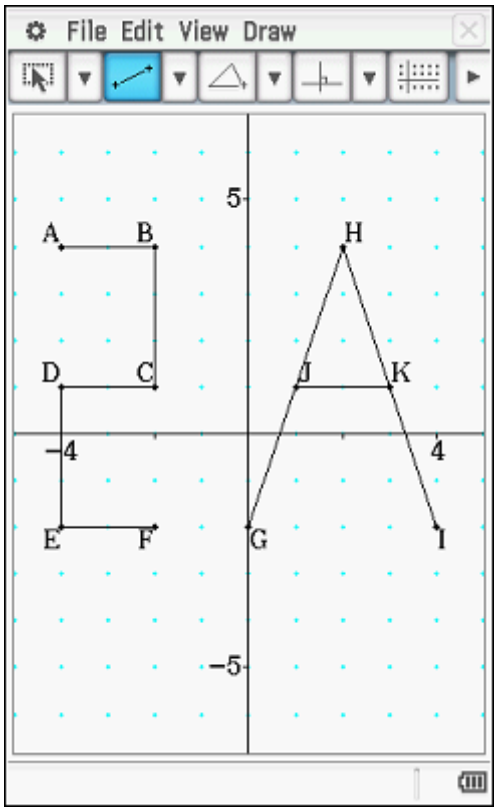
Solutions

Activity 1 Basic calculations quiz



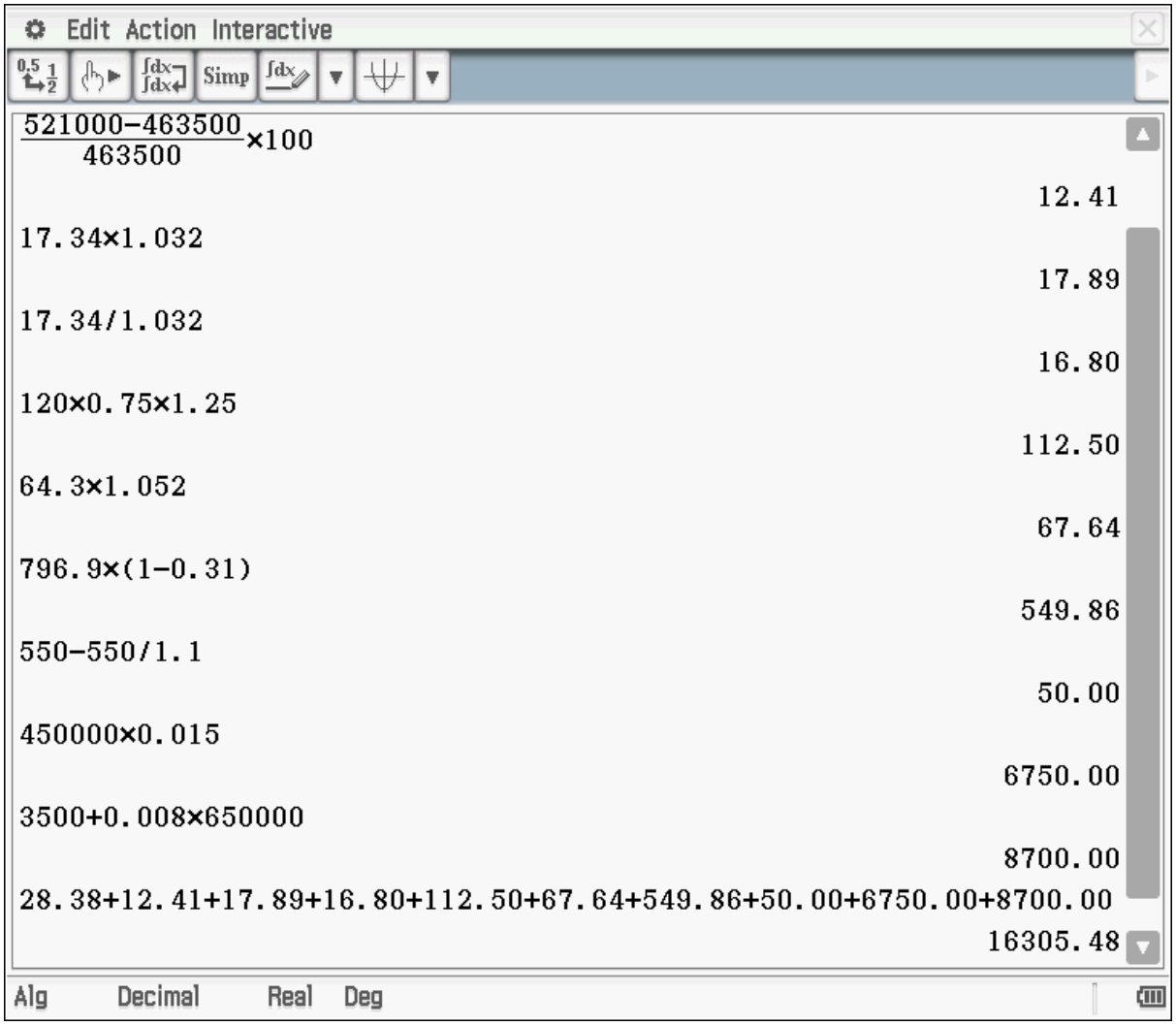
Activity 2 Connect the dots

1. Answers will vary
2. The point moves to the origin
3. 2A



4. (6 ,0) →(7, 2) → (6, 1) → (3, 1) → (–2, 4) → (–2.5, 3.75) → (7, –2) → (0, –6) →(–7, –2) → (–6, –1) → (–3, –1) → (2, –4) → (2.5, –3.75) → (–7, 2) → (0, 6) is a possible answer.

Activity 3 Percentages quiz



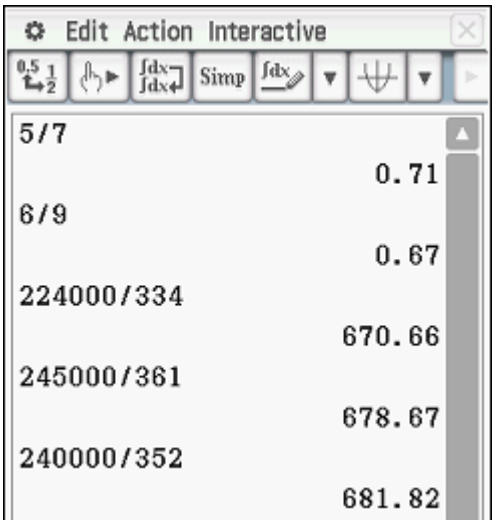
Activity 4 Best buys

1.

a) 0.71

b) 0.67

c) Round 5



2.

a) $670.66

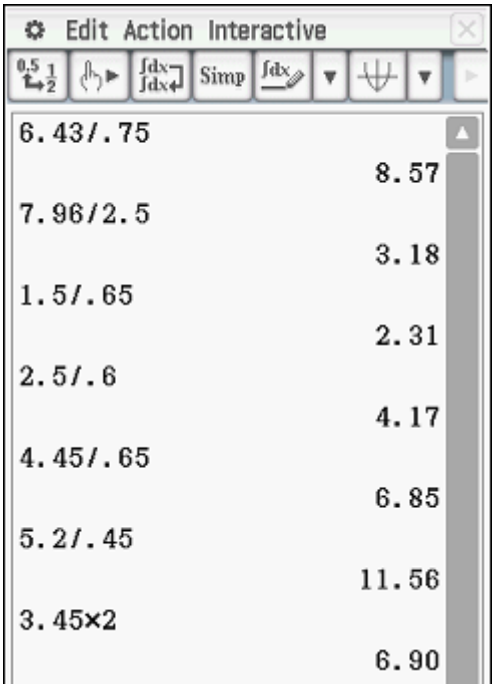
b) $671.23

c) $681.82

d) Block A is cheapest

3.

Item	*Quantity*	*Price*	*Price per unit*
Cooking Oil	750 ml	$6.43	$8.57 / L
Fruit Juice	2.5 L	$7.96	$3.18 / L
Chocolate bar	65 g	$1.50	$2.31 / 100g
Flavoured Milk	600 ml	$2.50	$4.17 / L
Bread	650 g	$4.45	$6.85 / kg
Peanut Butter	450 g	$5.20	$1.16 / 100g
Flour	2 kg	$6.90	$3.45 / kg



Activity 5 Maddy's boots

1.

a) Cell C4 changes value.

b) Cell A6 changes value.

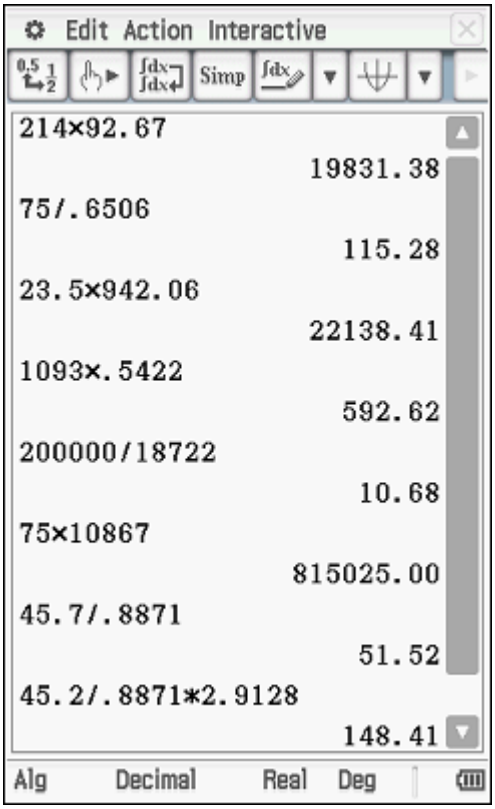
2.

A$	Other currency
A$214	19831.38 Yen
A$115.28	75 Euros
A$23.50	22138.41 won
A$1093	592.62 Pound sterling
A$10.68	200 000 Vietnamese dong
A$75	815025 rupiah

3. $51.52

4. Answers will vary depending upon current rates.

5. $148.41



Activity 6 Maxine's car

1.

a) 15.4 litres

b) $25.41

2.

a) B2×B4/100

b) Same

3. $16.70

4.

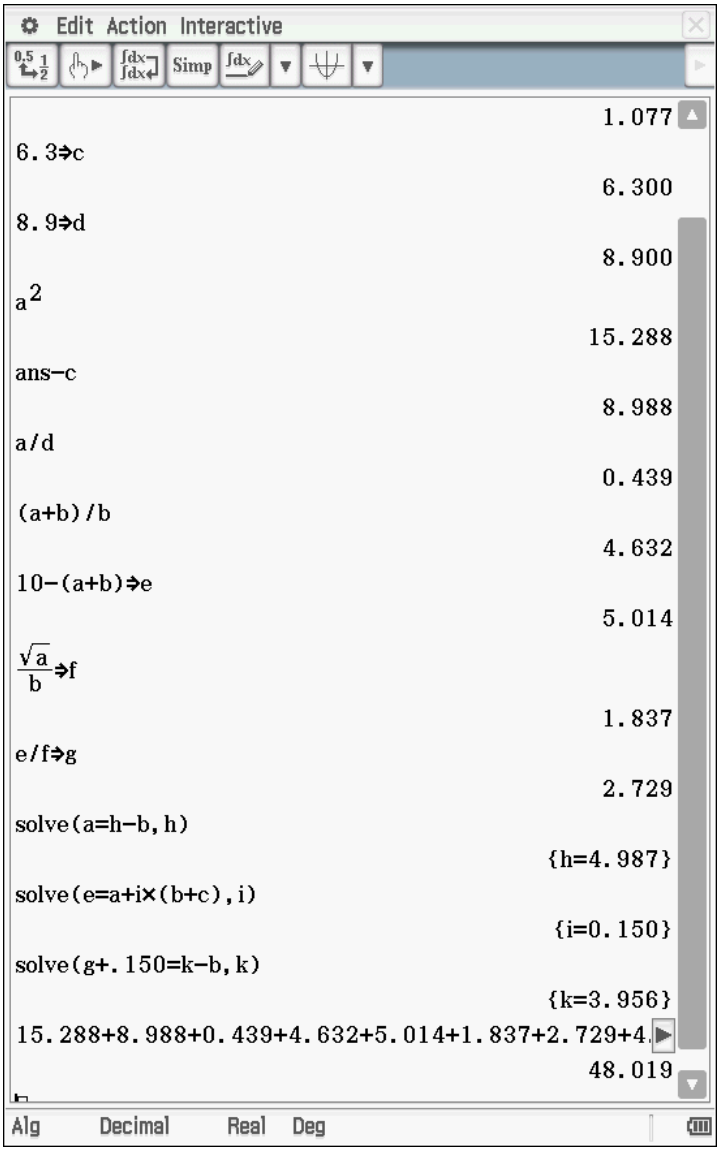
a) $60.36

b) She cannot afford it as her budget allows only $50 per week,

5. Answers will vary.

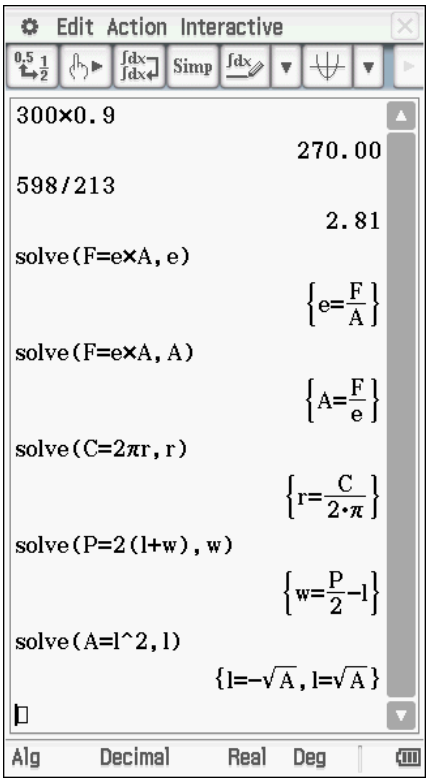
Activity 7 Algebra quiz

1. 15.288
2. 8.988
3. 0.439
4. 4.632
5. 5.014
6. 1.837
7. 2.729
8. 4.987
9. 0.150
10. 3.956



Activity 8 Currency trade

1. US$270
2. A1$ is 2.81 ringgit
3.
   a) $e = \frac{F}{A}$
   b) $A = \frac{F}{e}$
4.
   a) C9: =C7 × C8
   b) C14: =C12/C13
   c) C19: =C17/C18
5.
   a) $r = \frac{C}{2\pi}$
   b) $w = \frac{P}{2} - l$
   c) $l = \sqrt{A}$

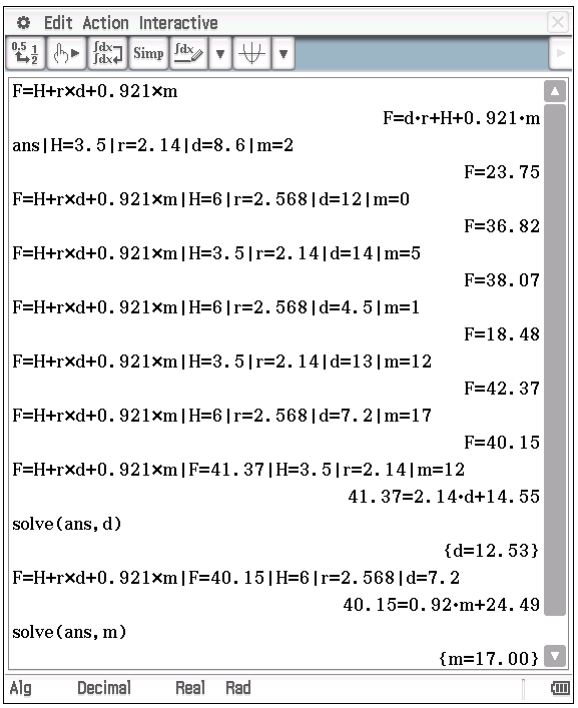


Activity 9 Taxi charges

1. $2.568 or $2.57

2.

Day/night	hire charge H	per km rate r	kms travelled d	minutes waiting m	maximum fare F
day	$3.50	$2.14	8.6	2	$23.75
night	$6.00	$2.568	12	0	$36.82
day	$3.50	$2.14	14	5	$38.07
night	$6.00	$2.568	4.5	1	$18.48
day	$3.50	$2.14	13	12	$42.37
night	$6.00	$2.568	7.2	17	$40.15

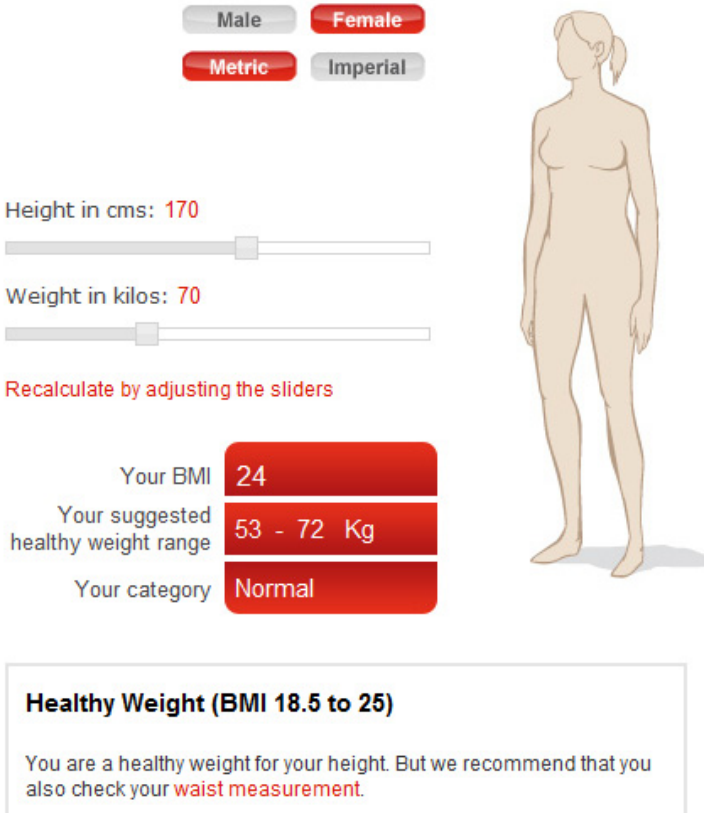


Activity 10 Body mass index

1. Answers will vary
2. Answers will vary. An example is shown.
3.

File Edit Graph Calc

	A	B	C	D	E	F
1	BMI calculator					
2			height in…		0.01	
3			weight i …		2	
4		weight				
5	height	63	65	67	69	71
6	1.7	22.	22.	23.	24.	25.
7	1.71	22.	22.	23.	24.	24.
8	1.72	21.	22.	23.	23.	24.
9	1.73	21.	22.	22.	23.	24.
10	1.74	21.	21.	22.	23.	23.
11	1.75	21.	21.	22.	23.	23.



4.

Height	Weight	BMI
1.78 m	75 kg	24 (23.7)
164 cm	62 kg	23
1.66 m	51	18.5
1.84	85kg	21

Activity 11 Matrix arithmetic

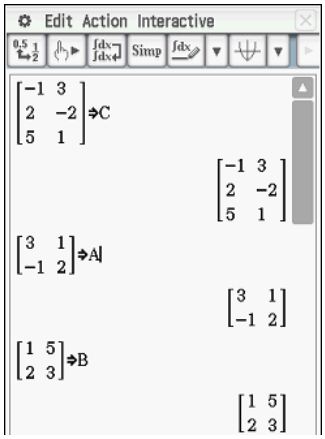
1.

a) $\begin{bmatrix} 4 & 6 \\ 1 & 5 \end{bmatrix}$

b) $\begin{bmatrix} 9 & 3 \\ -3 & 6 \end{bmatrix}$

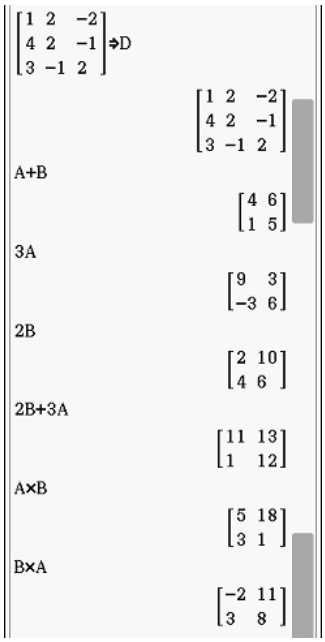
c) $\begin{bmatrix} 2 & 10 \\ 4 & 6 \end{bmatrix}$

d) $\begin{bmatrix} 11 & 13 \\ 1 & 12 \end{bmatrix}$



e) Not possible *invalid dimension*
The matrices have different sizes, i.e. C has 3 rows and A has 2 rows.

f) Not possible *invalid dimension* The matrices have different sizes.

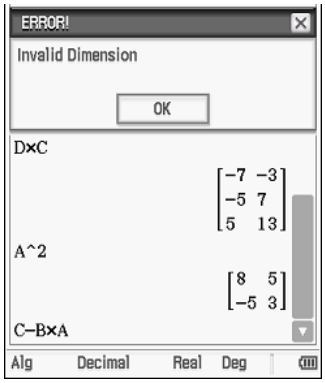


g) $\begin{bmatrix} 5 & 18 \\ 3 & 1 \end{bmatrix}$

h) $\begin{bmatrix} -2 & 11 \\ 3 & 8 \end{bmatrix}$

i) BC seen as a single variable. B×C is not possible.

j) $\begin{bmatrix} -7 & -3 \\ -5 & 7 \\ 5 & 13 \end{bmatrix}$



k) Not possible *invalid dimension*. The number of columns in the first matrix is not the same as the number of rows in the second matrix.

l) $\begin{bmatrix} 8 & 5 \\ -5 & 3 \end{bmatrix}$

m) Not possible *invalid dimension* B×A is a 2×2 matrix whereas C is 3×2.

Activity 12 Premiership table

1.

a)

	Won	Drawn	Lost
Chelsea	7	3	2
Tottenham Hotspur	6	2	4
Arsenal	10	1	2
West Ham United	3	4	6
Crystal Palace	2	1	10
Fulham	3	1	9

b) 6

c) 3

2.

a) 5

b) 0

c) 11

3.

a) $\begin{pmatrix} 7 & 3 & 2 \\ 6 & 2 & 4 \\ 10 & 1 & 2 \\ 3 & 4 & 6 \\ 2 & 1 & 10 \\ 3 & 1 & 9 \end{pmatrix} + \begin{pmatrix} 5 & 2 & 3 \\ 7 & 0 & 3 \\ 4 & 5 & 2 \\ 4 & 3 & 2 \\ 5 & 1 & 3 \\ 2 & 2 & 6 \end{pmatrix} = \begin{pmatrix} 12 & 5 & 5 \\ 13 & 2 & 7 \\ 14 & 6 & 4 \\ 7 & 7 & 8 \\ 7 & 2 & 13 \\ 5 & 3 & 15 \end{pmatrix}$

b) The results of the six teams over both periods.

4.

a) 9

b) 4

5.

a) $\begin{bmatrix} 9 & 6 & 6 \\ 12 & 6 & 4 \end{bmatrix}$

b) The results between Christmas and the end of the season.

6. Arsenal has 37, Tottenham has 27

7.

a) $\begin{bmatrix} 37 \\ 27 \end{bmatrix}$ b) $\begin{bmatrix} 70 \\ 69 \end{bmatrix}$

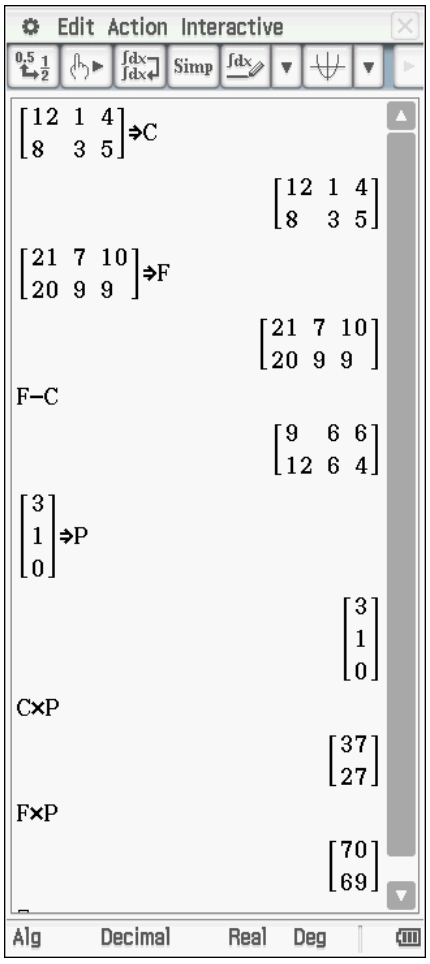
8. The number of points each team has at that point in the season.

9.

a) Add elements in the same row and column together. It only makes sense if each matrix has the same number of rows and columns.

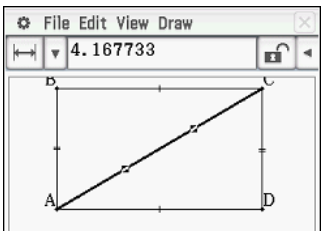
b) Subtract elements in the same row and column.

c) Go across a row in the first matrix and down the column in the second. Multiply each pair together and then add.



Activity 13 Pythagoras

1. 4.17 m



2.

a) draw a point

b) draw a line

c) draw a triangle

d) draw an isiceles triangle

e) draw a circle. Need to tap once for the centre point and again for a point on the circle.

f) draw a parallelogram

g) draw a rhombus

h) draw a trapezium

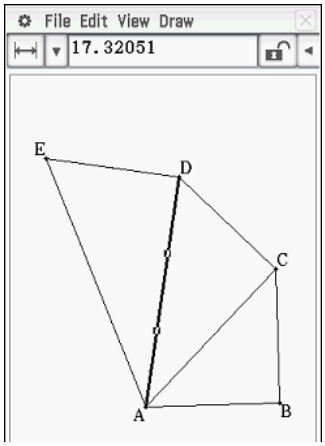
i) draw a regular polygon. Specify the number of sides.

j) draw a perpendicular line

k) draw a line to cut an angle in half, bisects the angle.

l) rotate the selected object

3.



a) AD = 17.3 cm and AE = 20 cm

b)

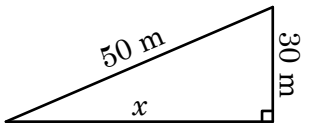
(i) BE = 25.3 cm

(ii) Area of ADE = 86.6 cm^2

(iii) Area ABCDE = 207.3 cm^2

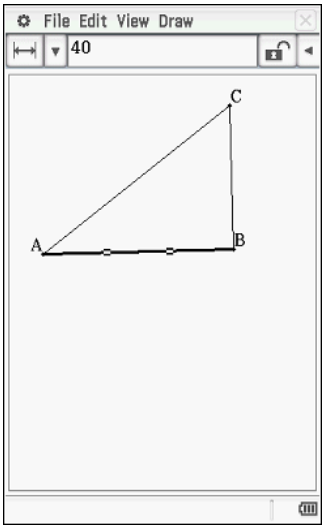
4.

a)



$$x = 40$$
$$x^2 + 30^2 = 50^2$$
$$x = 40$$

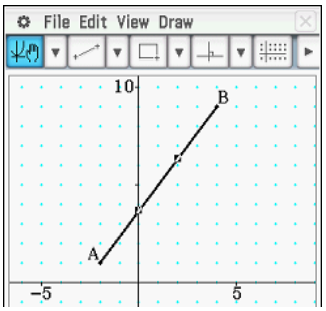
The kite would be 40 m from Luc.



b)

$$6^2 + 8^2 = x^2$$
$$x = 10$$

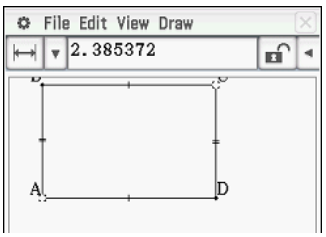
The points are 10 units apart.



c)

$$x^2 = 2^2 + 1.3^2$$
$$x = 2.385$$

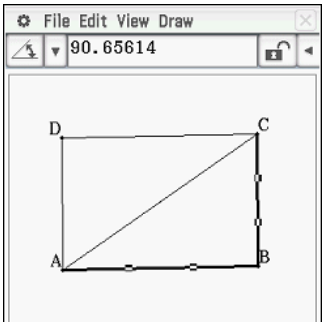
The long route is 3.3 units and is 0.9 units longer (1 decimal place)



d) If it is a right angle then Pythagoras' theorem will work

Does $20.6^2 + 30.5^2 = 37.0^2$?

No. It is close and the angle is 90.7°, off by less than 1°.



Activity 14 Measurement formulas

1.

a) 378 cm^3

b) 295 cm^2

2. 4.16 m^3

3. 134+261.8+452.4+718.3+2827.4 = 4390 cm^3 (nearest 10 cm^3)

4.

a)

(i) 254 cm^2

(ii) 382 cm^3

b)

(i) 1018 cm^2

(ii) 3054 cm^3

c) ¼ as it has four times the area to cover

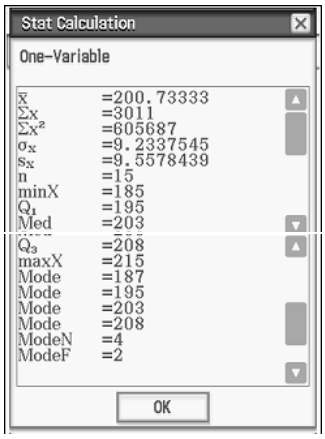
d) The ratio of the volumes is 8:1

Activity 15 Knicks'tistics

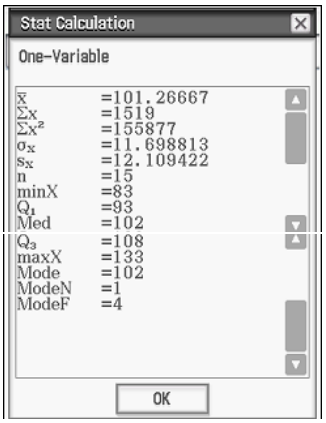
1.

	Height	Weight
Mean	201 (nearest cm)	101 (nearest kg)
Median	203	102
Maximum	215	133
Range	215 – 185 = 30	133 – 83 = 50
Inter quartile range	208-195 = 13	108 – 93 = 15

Height



Weight



2. 3011 cm or 30.11 m. The total of all the scores is $\sum x$.

3. Total weight is 1519 kg or 1.5 tonnes. This is more than 1 tonne.

4. 15 players. n=15.

5. Answers will vary.

   a) These results are for a height of 175 cm and weight 75 kg.

	Height	Weight
Mean	199 (nearest cm)	100 (nearest kg)
Median	201.5	100.5
Maximum	215	133
Range	215 – 175 = 40	133 – 75 = 58
Inter quartile range	208 – 191 = 17	105 – 93 = 12

   b) The range is most affected in the above example.

Activity 16 Knicks'tistics II

1.

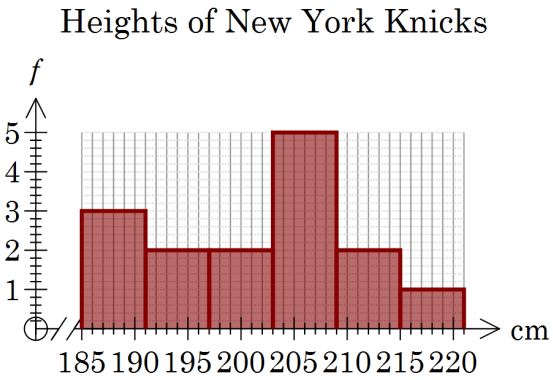
Heights

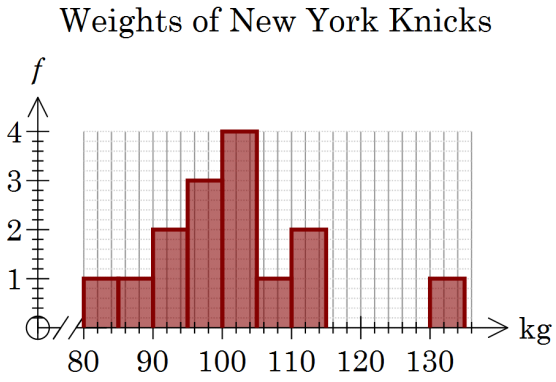
Interval		Frequency
Start	End	
185	190	3
191	196	2
197	202	2
203	208	5
209	214	2
215	220	1

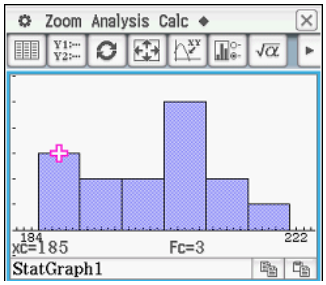
Weight

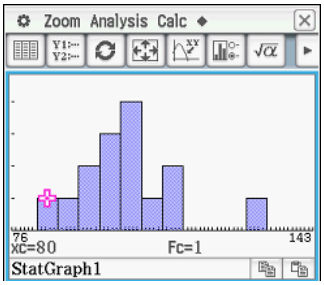
Interval		Frequency
Start	End	
80	84	1
85	89	1
90	94	2
95	99	3
100	104	4
105	109	1
110	114	2
> 115	-	1

2.









3.

a) One player is very heavy.

b) Looking at the distribution the middle is approximately in the middle of the bars.

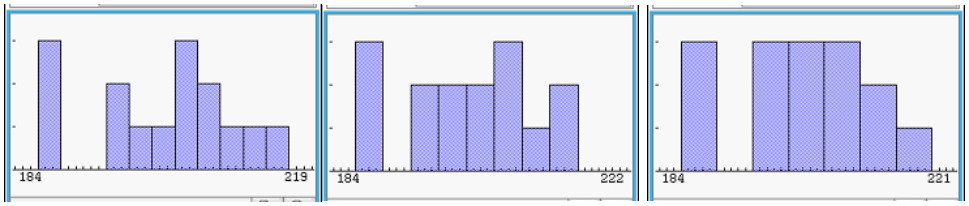
c) Height 185 – 210 cm, weight : 90 – 115 kg

d) The data is clumped apart from one player who is very heavy. The histograms suggest the distribution is similar to a bell shaped curve.

4.

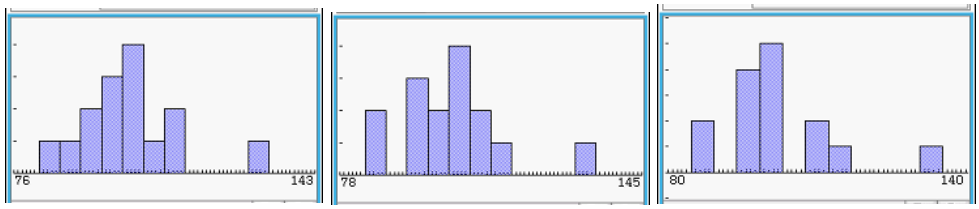
a) Heights starting at 185 cm with interval width of

3 4 5



b) Weights using 5 for the interval width and starting at

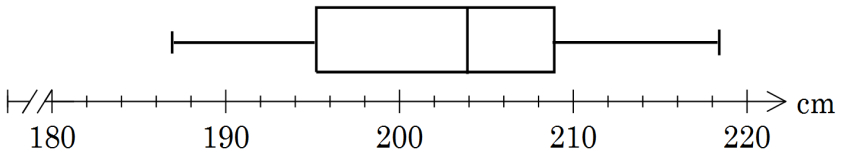
80 82 83



5.

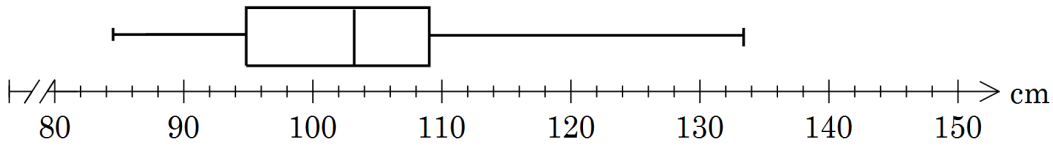
a)

Box Plot: Heights of NY Knicks roster



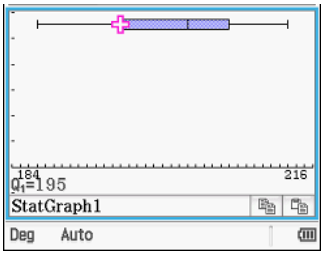
b)

Box Plot: Weights of NY Knicks roster

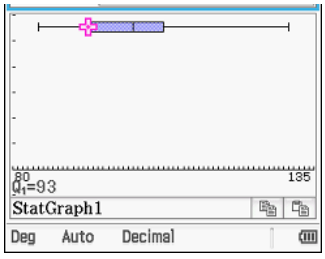


Screen shots from ClassPad

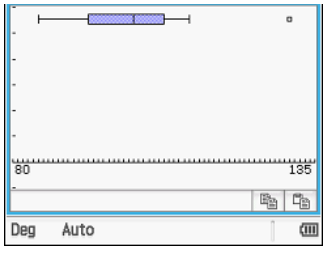
Height



Weight



Weight - show outliers



Activity 17 Rowers v Knicks

1.

a)

	Heights in cm	
	Basketballers	Rowers
Mean	200.7	189.4
Median	203	192
Maximum	215	198
Range	30	30
Inter-quartile range	13	8
Standard deviation	9.2	8.4

b) Mean: basketballers are taller.
Median: basketballers are taller.
Maximum: the tallest person is a basketballer
Range: similar difference between smallest and tallest for each group.
IQR: basketballers are greater suggesting a greater variation or spread of heights
Standard deviation: basketballers greater suggesting greater spread of heights.

c) The basketballers are generally taller, and more varied (or spread) in their heights.

2.

a)

	Weights in cm	
	Basketballers	Rowers
Mean	101.3	86.4
Median	102	90
Maximum	133	94
Range	50	39
Inter quartile range	15	7
Standard deviation	11.7	11.5

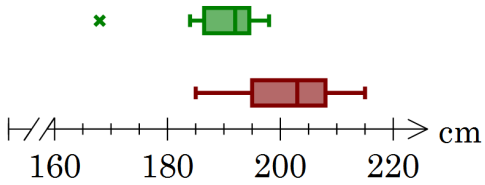
b) Mean: basketballers are heavier.
Median: basketballers are heavier.
Maximum: the heaviest person is a basketballer

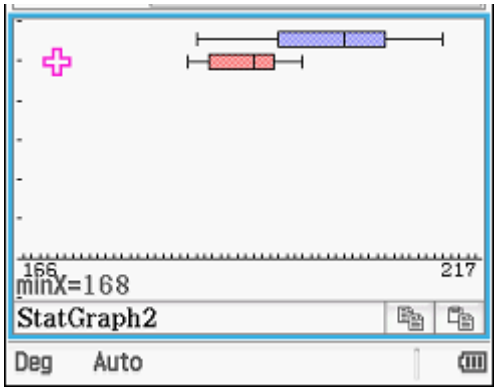
Range: a greater difference between lightest and heaviest for the basketballers.
IQR: basketballers are greater suggesting a greater variation or spread of weights
Standard deviation: basketballers greater suggesting greater spread of weights.

c) The basketballers are heavier with a greater spread of weights.

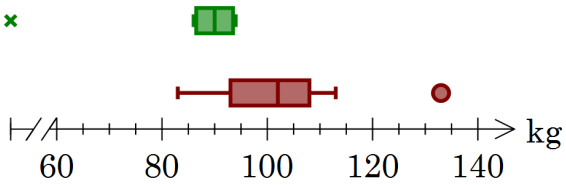
3.

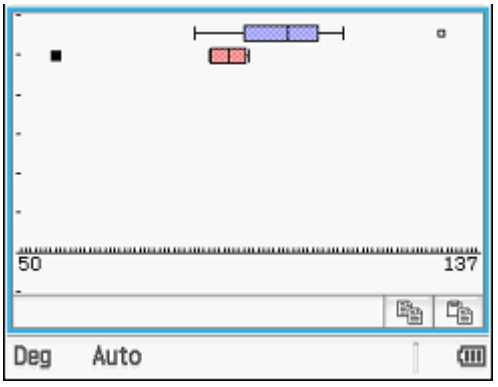
Height: rowers & basketballers





Weight boxplot: rowers & basketballers





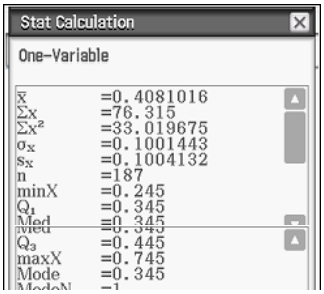
4. The side by side boxplots show the differences effectively as a picture. The summary statistics are often more difficult to use to justify a comparison.

Activity 18 Reaction times

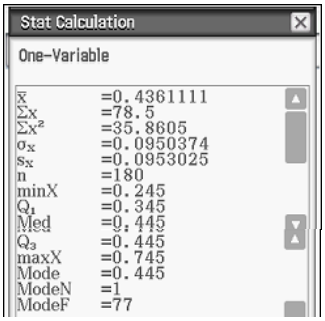
1. 0.4
2. 0.1
3.

Statistic		Dominant hand	Non-dominant hand
a)	Mean	0.408	0.436
b)	Minimum	0.245	0.245
c)	Lower Quartile	0.345	0.345
d)	Median	0.345	0.445
e)	Upper Quartile	0.445	0.445
f)	Maximum	0.745	0.745
g)	Range	0.5	0.5
h)	Inter-quartile range	0.1	0.1
i)	Standard deviation	0.1	0.095

Dominant hand

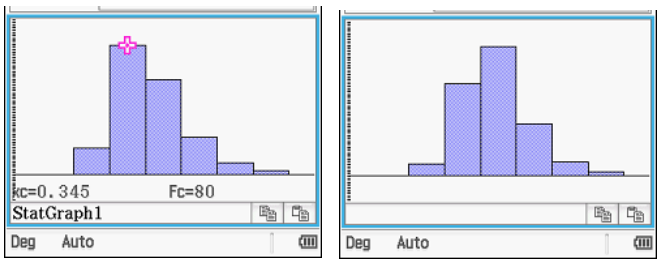


Non-dominant hand



4.

a)



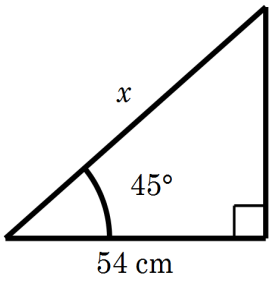
b) The histogram shows a shift to the right with the non-dominant hand. That is the dominant hand is faster.

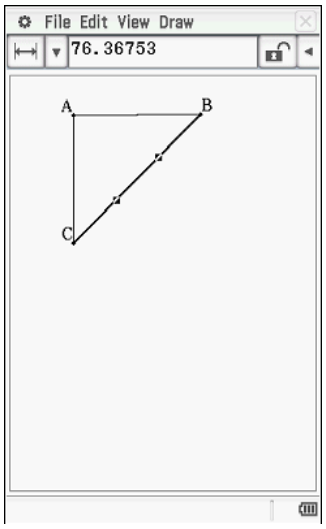
5.

The boxplots suggest no difference in reaction times.

Activity 19 Right-angled triangles

1.



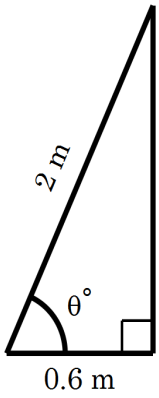


$$\sin 45° = \frac{54}{x}$$

$$x = 76.368 \text{ cm}$$

The cut is 76.4 cm long.

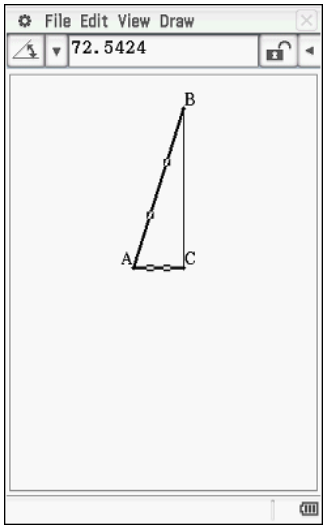
2.



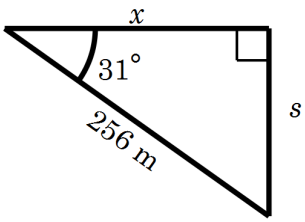
$$\cos\theta° = \frac{0.6}{2}$$

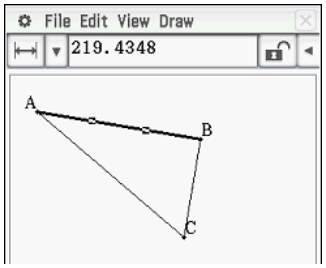
$$\theta = 72.54$$

The ladder is making an angle of 73˚ to the ground. (nearest degree)



3.

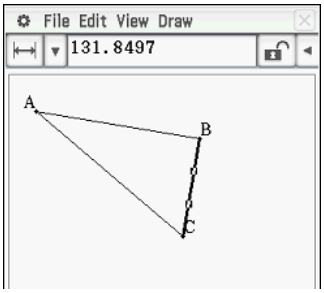




$$\sin 30° = \frac{s}{256}$$

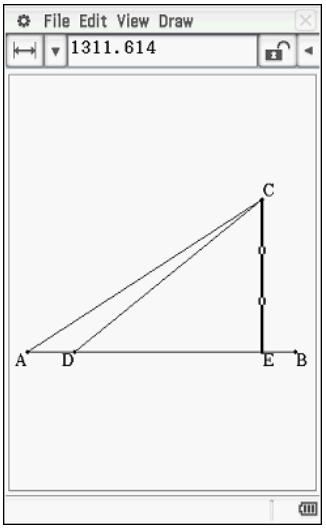
$$\cos 31° = \frac{x}{256}$$

$$s = 131.85, x = 219.435$$



X is 131 m South and 219 m East of A (to the nearest metre)

4. The mountain summit is 1300 m higher



Activity 20 Right-angled triangles II

1.

a)

$$\cos\theta = \frac{A}{H}$$

$$\cos 22° = \frac{5}{x}$$

$$x = \frac{5}{\cos 22} = 5.39$$

The distance from the apex to the outside of the wall is 5.39 m,. i.e. a 6m length timber is long enough.

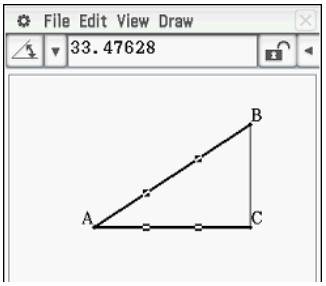
b)

$$\tan 22° = \frac{h}{5}$$

$$h = 2.02$$

The apex is 2.02 m above the wall.

2.

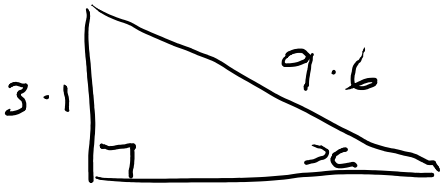


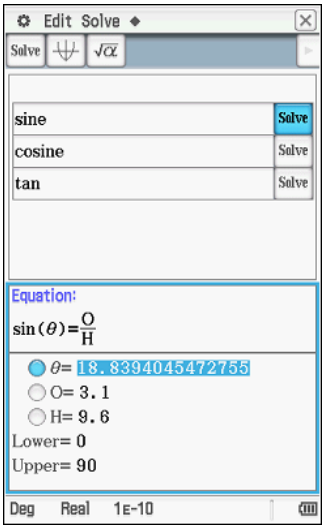
$$\tan\theta = \frac{O}{A}$$

$$\tan\theta = \frac{0.82}{1.24}$$

$$\theta = 33.5°$$

3.





$$\sin x° = \frac{3.1}{9.6}$$

$x = 18.8°$ (1 dec. place)

(Solution from eActivity)

Activity 21 Window dressing

1.

a) 81.5°

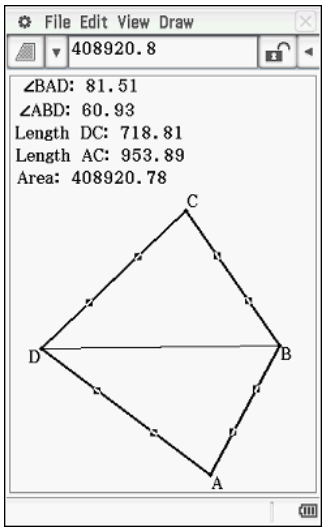
b) 60.9°

c) 71.9 cm

d) 95.4 cm

e) 4089 cm²

f) $80.35

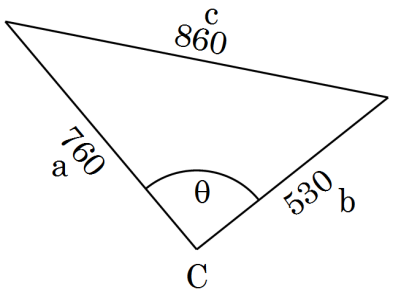


2.

a) $c^2 = a^2 + b^2 - 2ab\cos C$

$86^2 = 76^2 + 53^2 - 2\times 76\times 53\cos\theta$

b) $\theta = 81.5°$

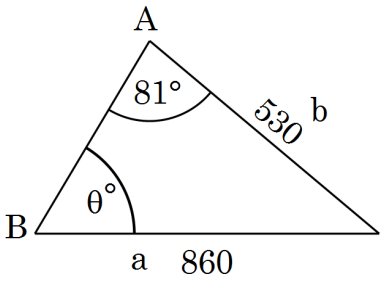


3.

a) $\dfrac{\sin A}{a} = \dfrac{\sin B}{b}$

$\dfrac{\sin 81°}{860} = \dfrac{\sin\theta}{530}$

b) 37.5 °

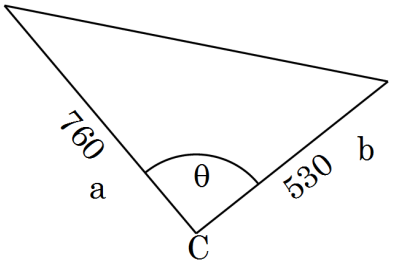


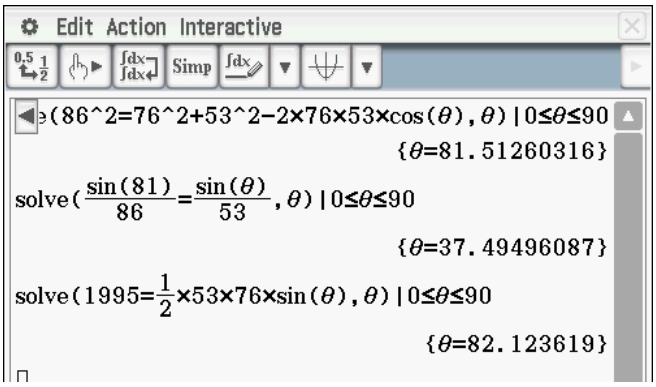
4.

a) $Area = \frac{1}{2}ab\sin C$

$1995 = \frac{1}{2}76\times 53\times \sin\theta$.

b) $\theta = 82.1°$





Activity 22 Solving equations

1.

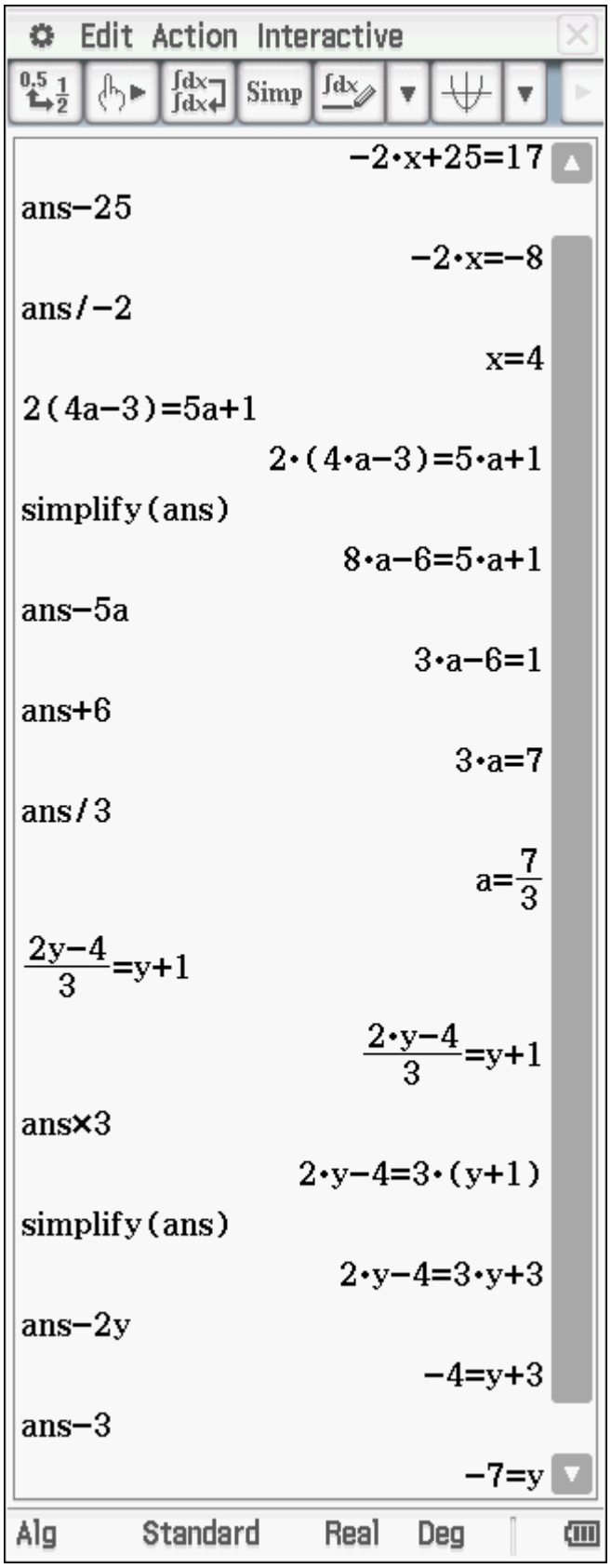
$$25 - 2x = 17$$
$$-2x = 8$$
$$x = -4$$

2.

$$2(4a - 3) = 5a + 1$$
$$8a - 6 = 5a + 1$$
$$3a - 6 = 1$$
$$3a = -7$$
$$a = \frac{-7}{3}$$

3.

$$\frac{2y - 4}{3} = y + 1$$
$$2y - 4 = 3(y + 1)$$
$$2y - 4 = 3y + 3$$
$$-4 = y + 3$$
$$y = -7$$



Activity 23 Features of straight lines

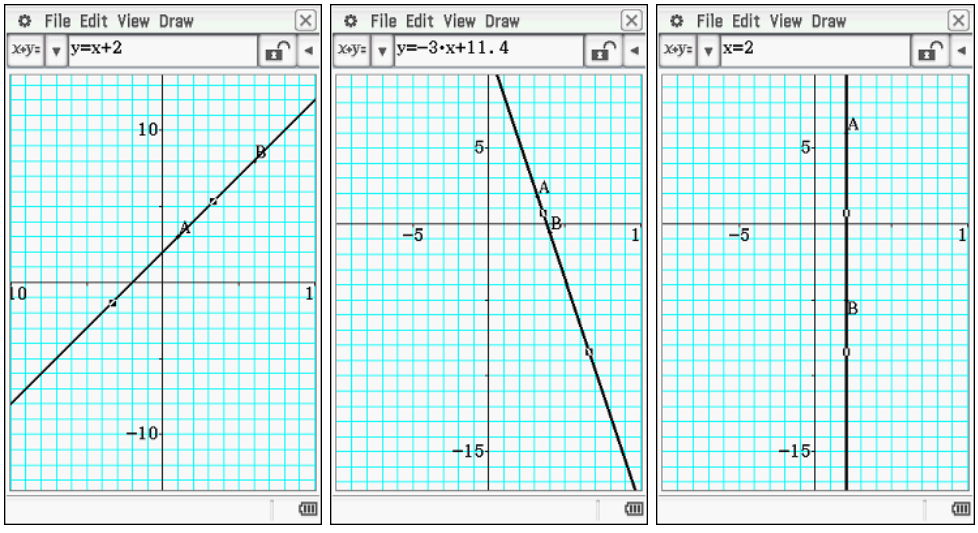
1.

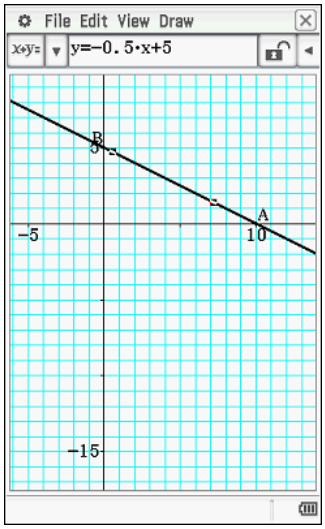
Equation	Slope (sign)	Slope	y-intercept	x-intercept
$y = 3x - 3$	+	3	-3	1
$y = 7 - 0.3x$	-	-0.3	7	23.3
$x + y = 5$	-	-1	5	5
$2y - 3x + 6 = 0$	+	1.5	-3	2
$x = 4y + 3$	+	0.25	-0.75	3
$y = 3.2$	0	0	3.2	none
$y = 2.2x + 5$	+	2.2	5	-2.27
$y = 2x + 10$	+	2	10	-5

2.

Points	Slope	Equation	y-intercept
(-2, -1) and (3, 2)	0.6	$y = 0.6x + 0.2$	0.2
(1, 3) and (6, 8)	1	$y = x + 2$	2
(3.2, 1.8) and (4, -0.6)	-3	$y = -3x + 11.4$	11.4
(2, 6) and (2, -5)	undefined	$x = 2$	none
(10, 0) and (0, 5)	-0.5	$y = -0.5x + 5$	5

Screenshots for Q2:





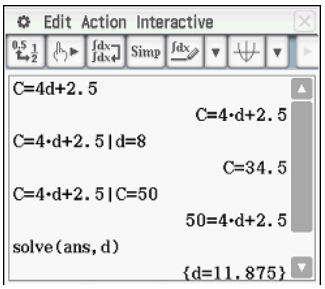
Activity 24 Deluxe Taxi fares

1.

a) The trip will cost 2.50 + 8 times 4, i.e. $34.50

b) $52.50

c) 12 km (nearest km)



2. As for Q1

3.

a)

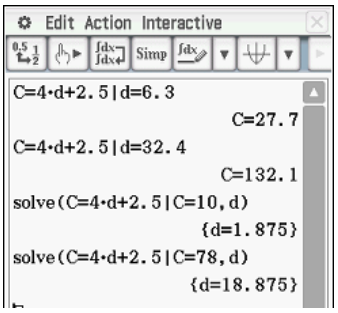
(i) $27.70

(ii) $132.10

b)

(i) 2km (nearest km)

(ii) 19 km (nearest km)

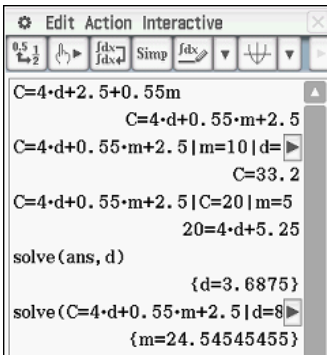


4.

a) $33.20

b) 4 km (nearest km)

c) 25 minutes (nearest min)



5.

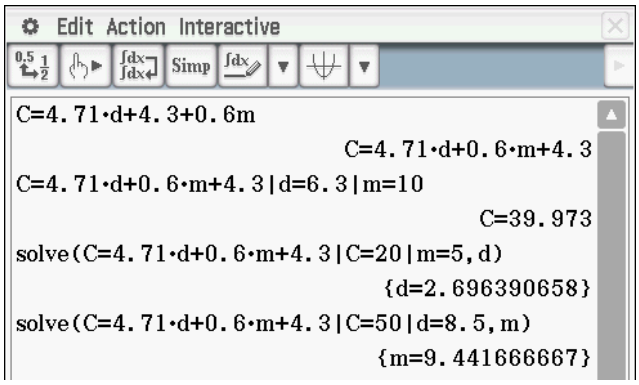
a) $C = 4.3 + 4.71d + .6m$

b)

(i) $39.95 (for cash)

(ii) 3 km (nearest km)

(iii) 9 minutes (nearest min)



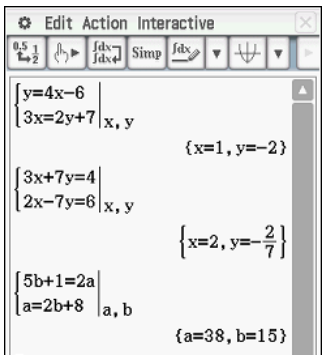
Activity 25 Simultaneous equations

1.

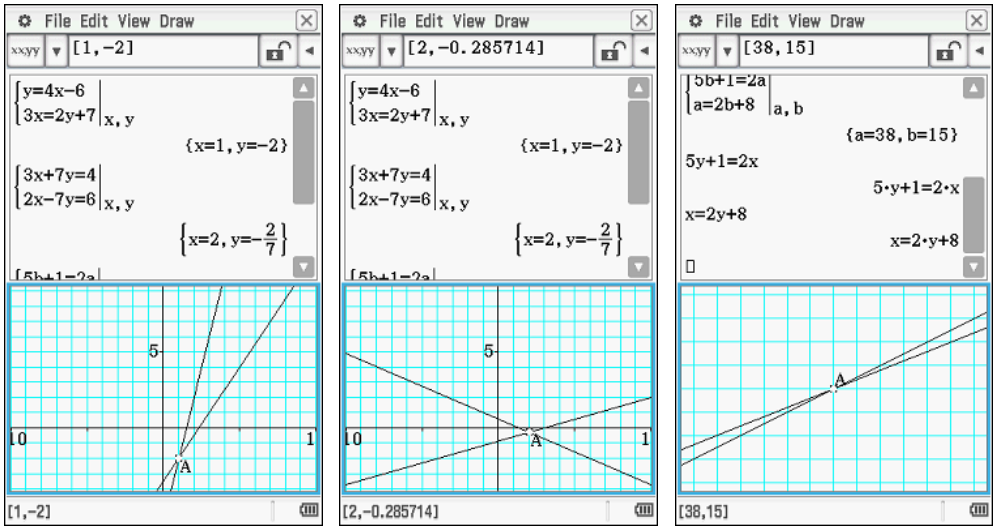
a) $x = 1, y = -2$

b) $x = 2, y = \dfrac{-2}{7}$

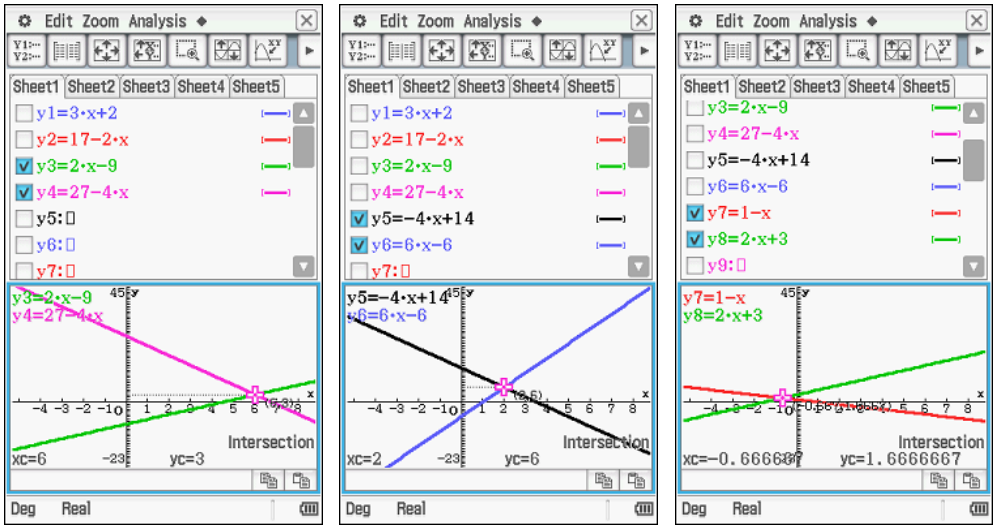
c) $a = 38, b = 15$



2. Same as Q1.



3. a) $x = 6, y = 3$ b) $x = 2, y = 6$ c) $x = -0.67, y = 1.67$



4.

a) $y = 4x - 6$ ... 1

$x = 2y + 5$ ... 2

sub 2 into 1

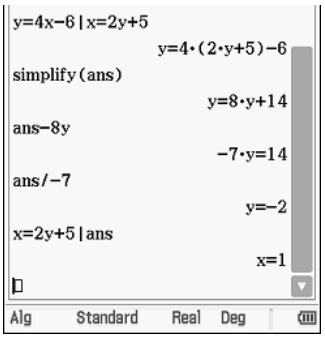
$y = 4(2y + 5) - 6$

$y = 8y + 14$

$-7y = 14$

$y = -2$

$x = 2(-2) + 5 = 1$



b) $x = y - 4$ ... 1

$3x - 2y = -8$ ... 2

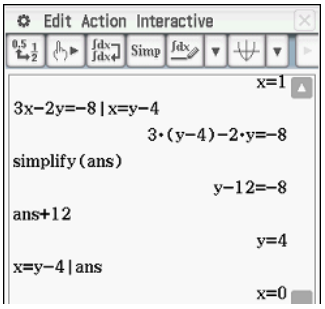
sub 1 into 2

$3(y - 4) - 2y = -8$

$y - 12 = -8$

$y = 4$

$x = 3(4 - 4) = 0$



c) $x = 2y + 1$ ... 1

$2y = 5x - 4$ ... 2

sub 1 into 2

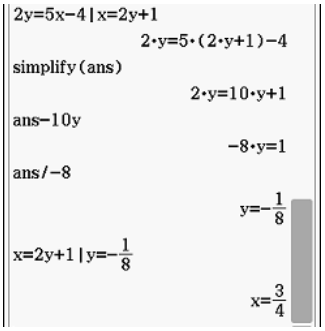
$2y = 5(2y + 1) - 4$

$2y = 10y + 1$

$-8y = 1$

$y = -\frac{1}{8}$

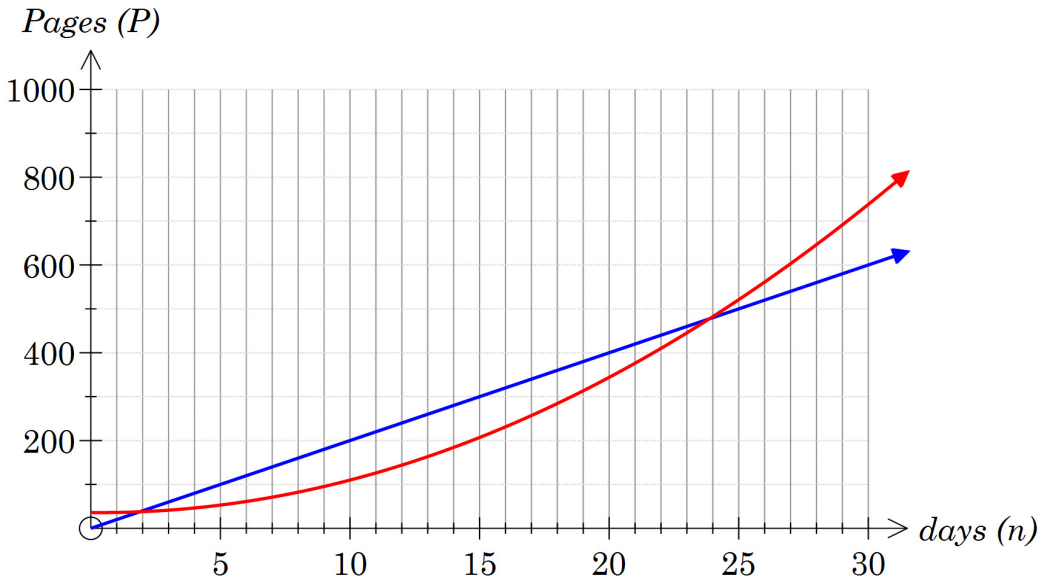
$x = 2\left(-\frac{1}{8}\right) + 1 = \frac{3}{4}$

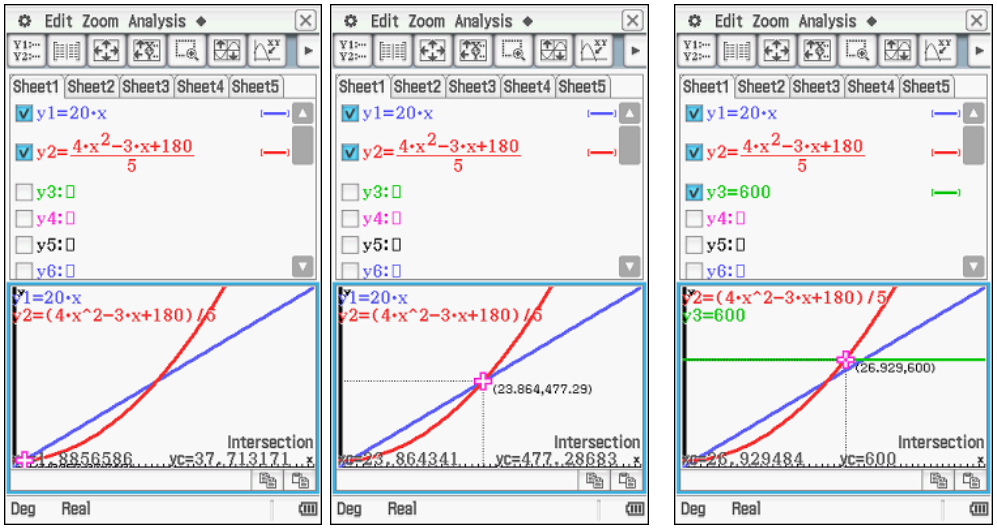


Activity 26 Book club

1. $P = 20n$

2.





4. After 2 days and 24 days.

5. Jen takes 40 days. Ahjoy finishes on the 32nd day. So Ahjoy starts 8 days later.

6. Jen takes 50 days. Ahjoy finishes on the 36th day. So Ahjoy starts 14 days later.

Activity 27 Income tax

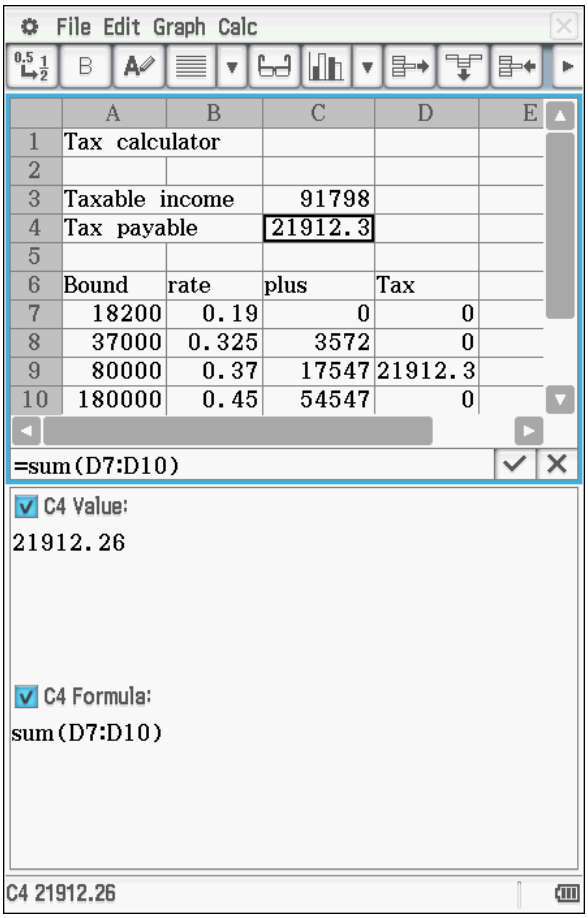
1.

a) $0

b) $0.19

c) $21 912.26

d) $2680.90



2.

Name		Taxable income	Tax payable
a)	Alessia	$26 065	$1494.35
b)	Bruce	$126 340	$34692.80
c)	Christine	$76 922	$16546.65
d)	Dylan	$16 980	0
e)	Edna	$40 694	$4772.55
f)	Fletcher	$234 560	$79099

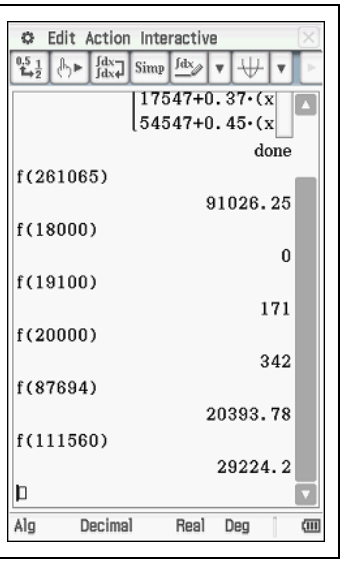
3.

a) The amount in excess of $37000 is ($x$-37000).
The tax on this is 32.5 cents in the $ or 0.325(x-37000).
The total tax is $3572 plus 0.325($x$-37000)

b) i) $0.19(x - 18200)$ ii) $17547+0.37(x-80\ 000)$

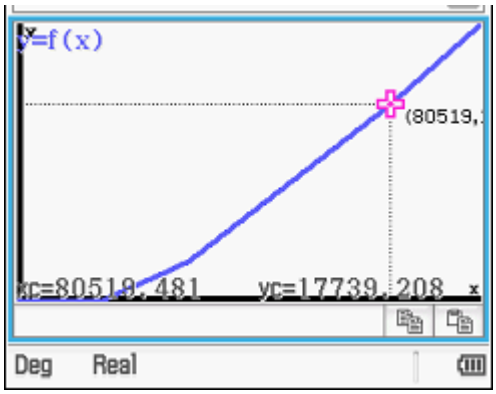
c)

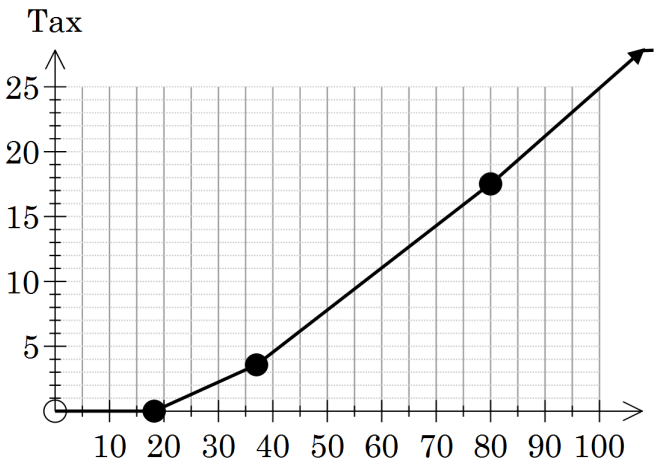
Name	Taxable income	Tax payable
(i) Gillian	$261 065	$91 026.25
(ii) Hadi	$18 000	$0
(iii) Ita	$19 100	$171
(iv) Jack	$20 000	$342
(v) Kate	$87 694	$20393.78
(vi) Lam	$111 560	$29224.20



4.

a) The graph is made up of straight lines (pieces)





b) the slope changes at 18 200, 37 000 and 80 000
This is because the rate changes at these amounts.

Activity 28 Phone costs

1.

a) 9

b) 85

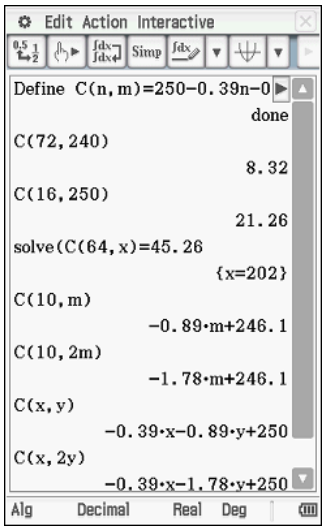
c) \$79.16

d) \$170.84

2.

	Number of calls	Call minutes	Credit remaining (\$)
$C(10,250)$	10	250	\$23.60
$C(50,150)$	50	150	\$97
$C(72,175)$	72	175	\$66.17
$C(32,220)$	32	220	\$41.72
$C(40,200)$	40	200	\$56.40

3.



a) \$8.32

b) \$21.26

c) 202

4.

a) $-0.89m + 246.1$

b) $-0.39x - 0.89y + 250$

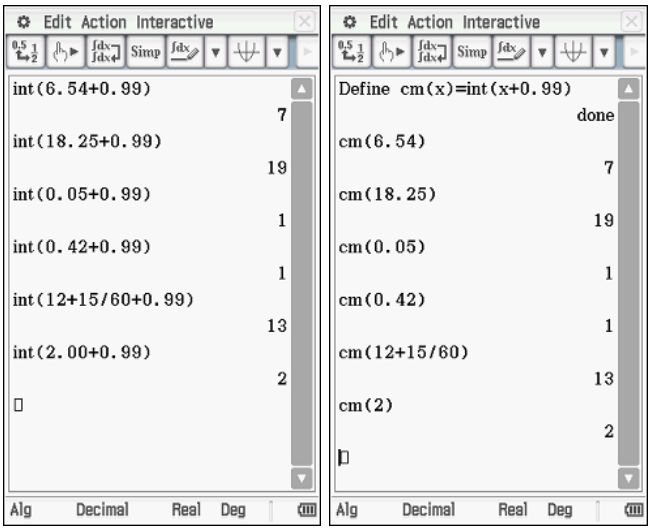
c) $-1.78m + 246.1$

d) $-0.39x - 1.78y + 250$

5. $C(n,m,t,d) = 250 - 0.39n - 0.89m - 0.29t - 2d$

	Number of calls	Call minutes	SMS	Excess Data Mb)	Credit remaining (\$)
$C(10,150,75,0)$	10	150	75	0	\$90.85
$C(10,90,350,3)$	10	90	350	3	\$58.50
$C(72,175,21,4)$	72	175	21	4	\$52.08
$C(32,100,60,12)$	32	100	60	12	\$107.12
$C(21,199,73,0)$	21	199	73	0	\$43.53

6. From Learning notes: use of int function to determine minutes and define a call minutes function.



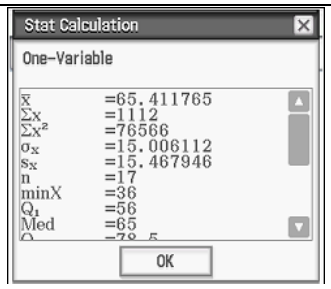
7. Define cm(m)=int(m+0.99)
Note: The function $C(n,m) = 250 - 0.39n - 0.89(\text{int}(m) + 0.99)$ would enable m to be entered as a decimal rather than being rounded up first.

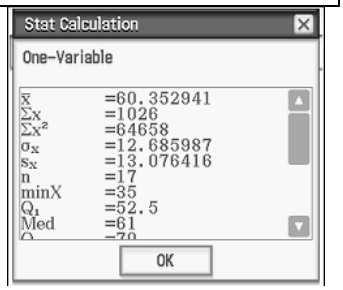
Activity 29 Moderating marks

1.

a)

	School mark	Exam mark
Mean	65.4	60.4
Median	65	61
Standard deviation	15	12.7
Inter-quartile range	78.5 – 56 = 22.5	70- 52.5 = 17.5



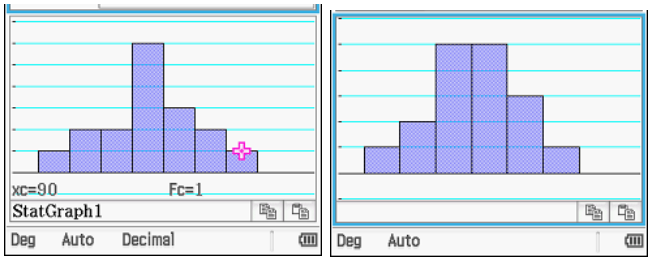


b) Both the mean and median for the exam are lower suggesting the class did less well on the exam.

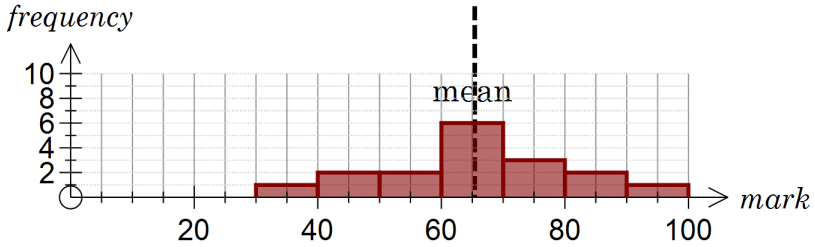
c) The school marks are more spread. The standard deviation is greater as is the inter-quartile range.

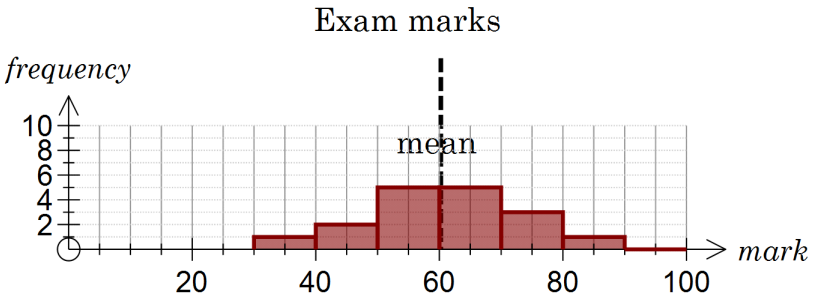
2.

a)

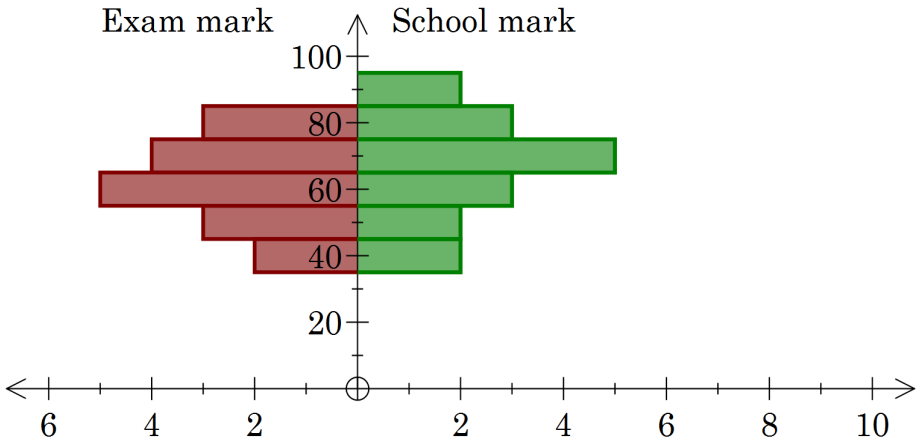


School marks

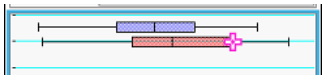




b) This back to back histogram shows the comparison better. School marks are higher and more spread out.



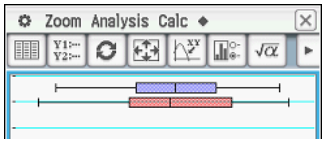
3.

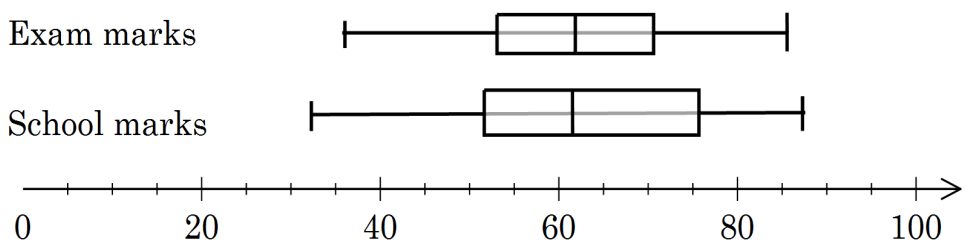
a) 

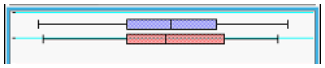
b) School marks

4.

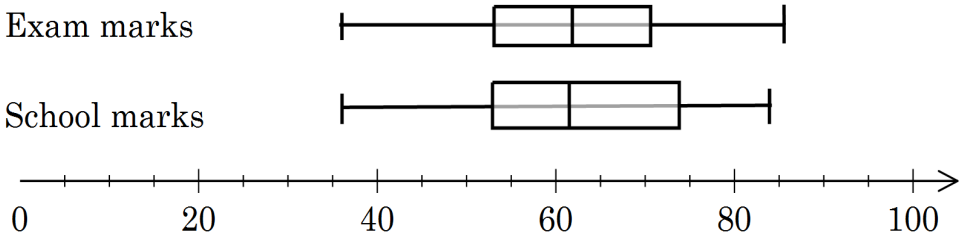
a) The school marks have been moved down, 5 units to the left on the box plot.





b) 

The exam marks and adjusted school marks have a similar middle and spread/



c) Students B, D, E, F, G, H, L and N did comparatively better in the exam.

	Student																
Mark	A	**B**	C	**D**	**E**	**F**	**G**	**H**	I	J	K	**L**	M	**N**	O	P	Q
School	65	43	78	91	82	65	71	54	61	36	88	69	58	65	79	45	62
Exam	57	45	69	84	77	61	67	57	53	35	75	65	52	62	71	41	55
Moderated school mark	60	42	71	82	74	60	65	51	57	36	79	63	54	60	72	44	58

5.

	ClassPad symbol/formula	School mark	Exam mark
Mean	$\bar{x}$	59.1	60.7
Standard deviation	σ_x	8.57	7.77

a) The students did slightly better in the exam as the mean for the group was higher.

b) The school marks are more spread, higher standard deviation and it can be seen in the table as well with lowest school marks in the 30's but lowest exam marks in the 40's.