

Student's Name: _____

Teacher's Name: _____

10

Year 10 Mathematics, 2008

Algebra

Use straightforward algebraic methods and sketch and interpret features of linear graphs

Time: 20 minutes.

Check that you have entered your name and your teacher's name in the top left hand corner of this paper.

You should answer ALL the questions in this paper.

You should show ALL working.

Check that this paper has pages 2 – 4 in the correct order and none of these pages is blank.

YOU MUST HAND THIS PAPER TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

<i>For Assessor's use only</i>		Achievement Criteria	
Achievement		Achievement with Merit	Achievement with Excellence
Plot and interpret simple graphs. Solve linear equations. Describe simple patterns.	<input type="checkbox"/>	Interpret linear graphs. Find terms in patterns. Carry out more complex algebraic manipulations. Solve equations.	<input type="checkbox"/>
Overall Level of Performance (all criteria within a column met)			<input type="checkbox"/>

Make sure you show ALL relevant working for each question.

Assessor's
use only

Half a Marathon

QUESTION ONE

Simplify the following.

(a) $14x - 2y + 3x - y$

(b) $3u^2 \times 2u^4$

(c) $\frac{24m^3}{8m^4}$

(d) If $D = \frac{2bc}{a}$ and $a = 4$, $b = -3$ and $c = 2$, find the value of D .

QUESTION TWO

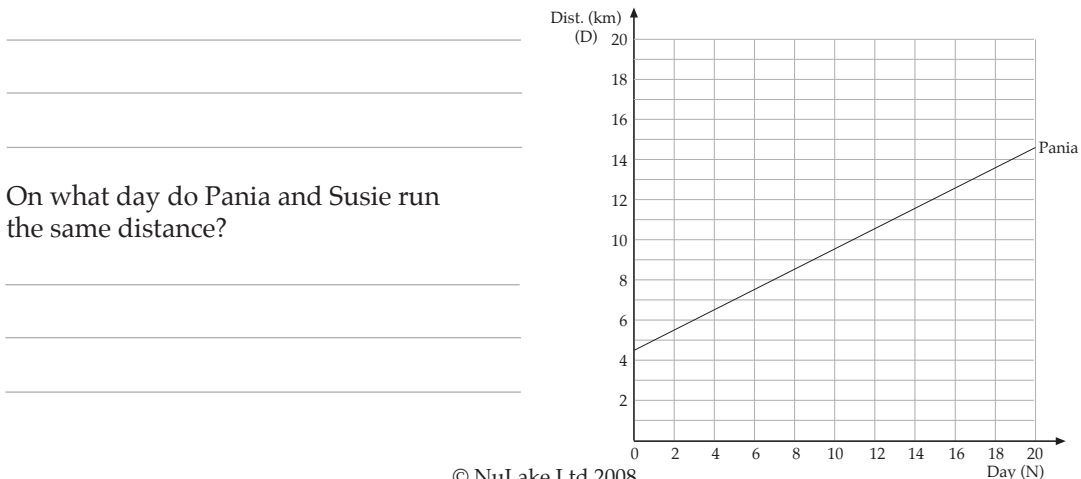
Pania is preparing to run a half marathon (21 km) and has started a fitness program which involves on the first day running 5 km and then 0.5 km more everyday after that.

Day (N)	1	2	3	4	5
Dist. (D) (km)	5	5.5	6	6.5	7

(a) How far will Pania run on Day 8?

(b) If the rule that relates the distance Pania runs on a given day, N is $D = 0.5N + 4.5$, solve the equation $21 = 0.5N + 4.5$, to find out on which day Pania will first run 21 km.

(c) Susie, Pania's friend is also training for the same half marathon, but the rule that relates the distance Susie runs on any day, N is $D = N + 0.5$. Graph Susie's rule on the graph.



(d) On what day do Pania and Susie run the same distance?

QUESTION THREE

Pania has also joined a gym and the cost of her membership depends on how many months (M) she joins for. The cost can be calculated using the formula $C = \frac{100M + 66}{3}$, where C is the cost in dollars.

- (a) How much would a 12 month membership cost Pania?

- (b) Make M the subject of the formula.

- (c) How many months membership could Pania take out for \$525?

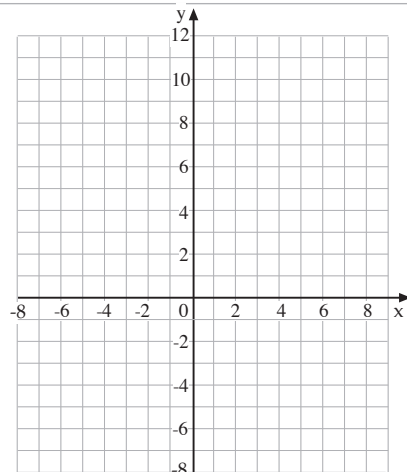
QUESTION FOUR

- (a) Expand $(x - 4)(x + 3)$

- (b) Factorise $x^2 + 9x - 22$

- (c) Two equal sides of an isosceles triangle are three times as long as the shortest side. The perimeter of the triangle is 28 cm. Form an equation and solve it to find the shortest side of the triangle.

- (d) Draw the line $y = \frac{2}{3}x + 1$ on the axes on the right.



ASSESSMENT SCHEDULE Algebra

Mathematics: Use straightforward algebraic methods to solve problems and sketch and interpret features of linear graphs.

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT	Plot and interpret simple graphs. Solve linear equations. Describe simple patterns. Carry out simple algebraic manipulations.	ONE (a)	$17x - 3y$	A1	CAO okay.	Achievement: Three or four of Code A1 plus three or four of Code A2.
		ONE (b)	$6u^6$	A1	CAO okay.	
		ONE (c)	$\frac{3}{m}$	A1	CAO okay.	
		ONE (d)	-3	A1	CAO okay.	
		TWO (a)	8.5 km	A2	CAO okay.	
		TWO (b)	Day 33	A2	CAO okay.	
		TWO (c)	Linear graph through (0, 0.5) and (20, 20.5).	A2	CAO okay.	
		TWO (d)	$N = 8$	A2	CAO okay.	

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH MERIT	Find terms in patterns. Interpret linear graphs. Carry out more complex algebraic manipulations. Solve equations.	THREE (a)	\$422	M1 A1	Or equivalent. CAO okay.	Merit: Achievement plus Three or four of Code M1 plus two or three of Code M2.
		THREE (b)	$M = \frac{3C - 66}{100}$	M1 A1	Or equivalent. CAO okay.	
		THREE (c)	$M = 15.1$ (15 months)	M2 A2	CAO okay. Or equivalent.	
		FOUR (a)	$x^2 - x - 12$	M1 A1	Or equivalent. CAO okay.	
		FOUR (b)	$(x + 11)(x - 2)$	M1 A1	CAO okay.	
		FOUR (c)	$7x = 28, x = 4$, Shortest side = 4	M2 A2	Must show equat. Or equivalent..	
		FOUR (d)	Linear graph through (0, 1) and (6, 5).	M2 A2	CAO okay.	

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH EXCELLENCE	Solve algebra problems using graphs and manipulation.	FIVE	$80(t + 1.5) = 100t$ $80t + 120 = 100t$ $20t = 120$ $t = 6$ Susie will catch Pania at 1.30 am	A1 A3 M E	Must have an equation. Must use algebra to solve an equation. Must give a time not jus a value for t.	Excellence: Merit plus Code E.

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10

Year 10 Mathematics, 2008

Measurement

Solve problems involving measurement of everyday objects

Time: 20 minutes.

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<i>For Assessor's use only</i>		
Achievement Criteria		
Achievement	Achievement with Merit	Achievement with Excellence
Solve simple measurement problems. Use measurements in calculations and conversions. <input type="checkbox"/>	Solve measurement problems. <input type="checkbox"/>	Plan, carry out and evaluate a measuring task. <input type="checkbox"/>
Overall Level of Performance (all criteria within a column met) <input type="checkbox"/>		

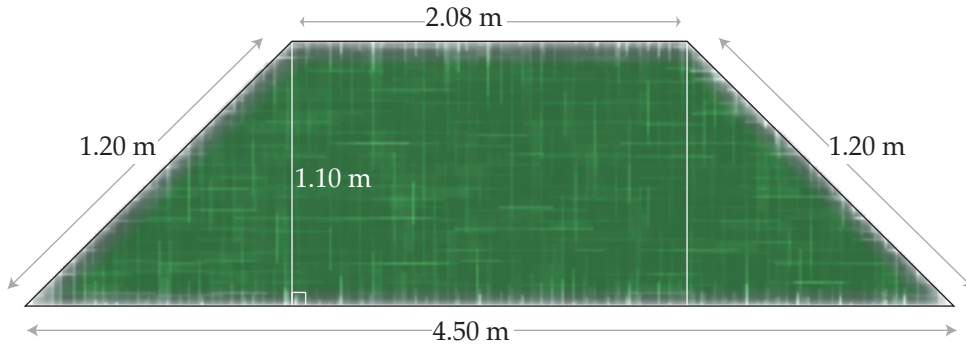
Make sure you show ALL relevant working for each question.

Assessor's use only

The Rooftop Garden

QUESTION ONE

Pete lives in Auckland in an apartment block. He likes to garden so has been given permission to use an area on the roof for a small garden.



- (a) Pete has to place some timber around the edge of this garden. How much edging timber will he need?

_____ Total edging timber = _____

- (b) Pete is considering planting potatoes. He can put in one plant for each 0.3 m^2 of garden. How many potatoes can he plant? The area of a trapezium is $A = h \frac{(a + b)}{2}$.

_____ Area of garden = _____

_____ Potato plants = _____

- (c) Pete has to transport all the soil for the garden to the roof. Luckily the garden is only 0.3 m deep. What volume in cubic metres of soil will Pete need to transport to the roof?

_____ Volume of soil (m^3) = _____

- (d) Pete is allowed to increase his garden by 1.5 m^2 . He would like to add a semicircular garden at the top with a radius of 1.04 metres . Would a garden of this size make Pete's garden too large? You must justify your answer with correct calculations.

_____ Area of semicircle = _____

_____ Decision = _____

- (e) Pete waters his garden each night. The maximum rate he can water the garden at is 6 litres/minute or less and the total water used must be less than 150 litres . It takes $2 \text{ min } 30 \text{ seconds}$ to fill a 10 litre drum. Calculate the rate he is using water at and the maximum time which he can water for and stay under the 150 litre limit.

_____ Rate (litres/min) = _____

_____ Time (150 litres) = _____

QUESTION TWO

Pete’s younger sister Sammy wants to visit Hamilton. Pete is helping select the best bus. The bus timetable shows the buses travelling from Auckland to Hamilton.

Bus number	Depart	Arrive	Stops
1	06:15	08:35	3
2	07:30	10:20	5
3	08:45	11:05	3
4	12:50	15:30	5
5	13:00	15:20	3
6	13:05	16:00	5
7	17:15	19:55	3

Assessor’s use only

She needs to select a bus that travels as fast as possible and leaves Auckland after 9 am.

- (a) Which bus should he select for her? Justify your answer with the time to complete the journey.

Bus = _____

Time (hours) = _____

- (b) What speed in km/h is the bus you selected, travelling at? Hamilton is 135 km away.

Speed (km/h) = _____

QUESTION THREE

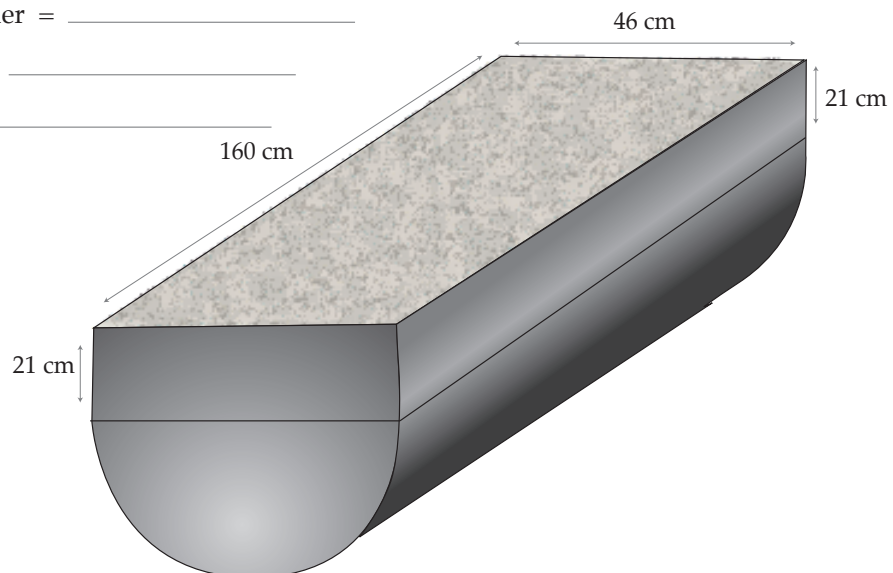
Pete wants to build a worm farm. His uncle has made him a container made up of a cylinder cut in half vertically with a cuboid added on top. The cylinder is 23 cm in radius and it is 160 cm long. The cuboid on top is 21 cm deep. The volume of half a cylinder is $V = 0.5\pi r^2 h$

Calculate the volume of the container in cm^3 .

Vol. of half cylinder = _____

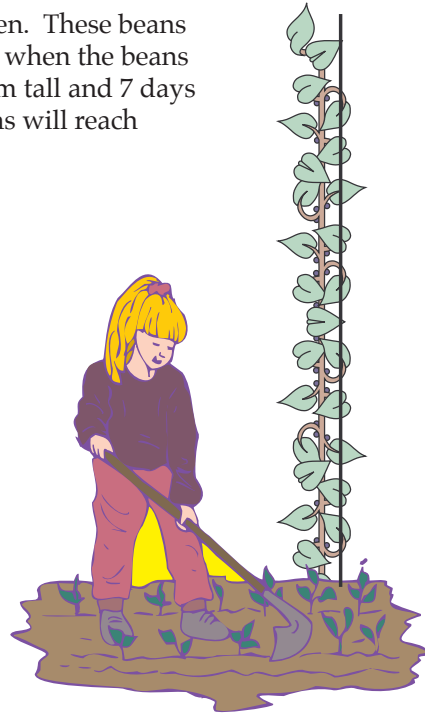
Volume cuboid = _____

Total volume = _____



QUESTION FOUR

Sammy has planted some climbing beans in Pete's garden. These beans climb at the same rate each day. Sammy wants to know when the beans will be 1600 mm tall. On October 10th they were 650 mm tall and 7 days later had reached 1 000 mm. Calculate the date the beans will reach 1600 mm.

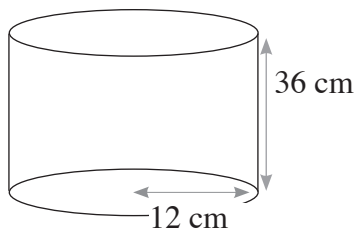


Date at 1600 mm = _____

QUESTION FIVE

Pete must mix up some natural fertilizer for his plants. He has a watering can shaped like a cylinder 12 cm in radius and 36 cm tall. How many litres will this watering can hold? The volume of a cylinder is $V = \pi r^2 h$.

Capacity (litres) = _____



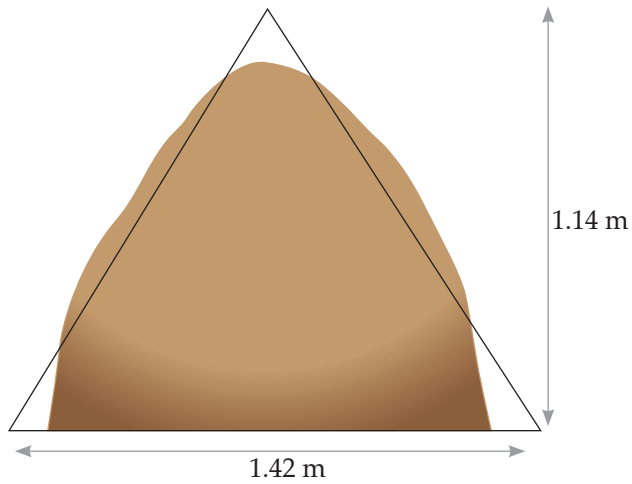
QUESTION SIX

Pete has had a large load of soil delivered for his roof-top garden. The soil is in a mound. He has decided to estimate the volume by representing the mound as a pyramid with a circular base.

The formula for the volume of a pyramid $V_{\text{pyramid}} = \frac{1}{3}\pi r^2 h$.

- (a) The height of his circular pyramid is 1.14 m and the diameter of the base is 1.42 m. Estimate the volume for Pete.

Volume = _____



- (b) What are the advantages and disadvantages of Pete's model to get an estimate of the volume of soil in the mound?

ASSESSMENT SCHEDULE Measurement

Mathematics: Solve measurement problems

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT	Use measurements in calculations and conversions to solve simple problems. Calculation and applications of perimeter and area of simple composite shapes in context. Time calculations and applications. Area and circumference of circles. Calculation of speed. Conversion of time measurements into decimals.	ONE (a)	Edging = 8.98 m	A	CAO okay for achievement. Accept any correct rounding.	Achievement: Four or more of the seven Code A.
		ONE (b)	Area = 3.619 m ² Potatoes = 11	A		
		ONE (c)	Volume = 1.085 7	A		
		ONE (d)	Area Semicircle = 1.70 m ² Too big	A		
		ONE (e)	Rate = 4 litres/ min Time = 37.5 minutes	A		
		TWO (a)	Bus 5 It takes 2 hours 20 minutes	A		
		TWO (b)	Speed = 57.9 km/h	A		

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH MERIT	Solve measurement problems. Applications of harder composite shapes. Applications of surface area of prisms, pyramids. Applications of volumes of cylinders, cones, and pyramids. Conversion between units of area and volume. Applications of speed.	THREE	Volume half cylinder = 132 952 cm ³ Total Volume = 287 512 cm ³	A/M	Accept any appropriate rounding.	MERIT: Achievement plus Two Code M or All three Code M.
		FOUR (b)	Rate = 50 mm/day Another 12 days to grow 600 mm Date 29 th October.	A/M		
		FIVE	Capacity 16.3 litres	A/M		

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH EXCELLENCE	Plan, carry out and evaluate a measuring task.	SIX (a)	Pyramid r = 0.71 m h = 1.14 m Volume = 0.602 m ³	M/E	Ignore 1 minor error that still leads to an acceptable answer.	Excellence: Merit plus Two of Code E.
		(b)	Relevant points such as: Advantages <ul style="list-style-type: none"> • Soil excluded from the pyramid is about the same as extra volume included. • Simplicity of the model. Disadvantages <ul style="list-style-type: none"> • Need same shape on all sides. • Only an estimation. 			

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Year 10 Mathematics, 2008

Number

Solve number problems

Time: 20 minutes.

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<i>For Assessor's use only</i>			Achievement Criteria		
Achievement		Achievement with Merit		Achievement with Excellence	
Solve number problems.	<input type="checkbox"/>	Solve number problems in context.	<input type="checkbox"/>	Solve number problems in context involving several steps or reversing processes.	<input type="checkbox"/>
Overall Level of Performance (all criteria within a column met)					<input type="checkbox"/>

Make sure you show ALL relevant working for each question.

Budgets

QUESTION ONE

- (a) Calculate $3 \div 7$ and round your answer to 4 decimal places. $3 \div 7 =$ _____ (4 dp)
- (b) After school Jed works one and a half hours for four days a week at twelve dollars an hour for thirty-eight weeks a year.
How much money will he earn in **three** years? Income = _____
- (c) Jed pays 19% tax on \$72. How much in tax does he pay? Tax = \$ _____
- (d) 9 out of 24 students in Jolene's class have paid jobs.
What percentage of the students in Jolene's class have paid jobs? Percent with jobs = _____ %
- (e) Share \$40 in the ratio of 3:5 3:5 of \$24 = \$ _____ to \$ _____
- (f) If Jed gets a 15% increase in his wage of \$12 per hour, what will his new hourly rate be? Wage = \$ _____
- (g) Convert the number 4 234 000 000 to standard form.
4 234 000 000 = _____

QUESTION TWO

- (a) The United States government has decided to spend $\$7.00 \times 10^{11}$ to rescue the banking industry. The number of taxpayers in the United States is 138 728 360. How much money does this work out per taxpayer? Round your answer to 2 decimal places.

Rescue package per taxpayer = \$ _____
- (b) The federal government in the United States receives an average of \$18 600 for every taxpayer, but spends \$19 800 per taxpayer. What percentage in excess of its income is the government spending?

Percentage = _____
- (c) The New Zealand government spent \$49 320 000 000 in 2006 and since then has increased expenditure on average by 7.5% per year for each of the two years until 2008. Calculate the expenditure in 2007 and 2008.

Expenditure 2007 = \$ _____
Expenditure 2008 = \$ _____

QUESTION TWO cont...

Assessor's
use only

- (d) Of the money spent by the New Zealand government in 2008, $\frac{1}{5}$ was spent on health, $\frac{1}{6}$ was spent on education and $\frac{3}{8}$ on social welfare. What fraction was spent on all other areas of expenditure?

Fraction spent on other areas = _____

- (e) The New Zealand government spent \$10 000 million in total on three types of benefits in 2008. The ratio of expenditure on

Unemployment : Domestic Purposes : Superannuation = 1:3:16.

How much money is spent on superannuation?

Expenditure on superannuation = \$ _____

QUESTION THREE

The United States federal government spent a total of \$2 350 000 million in 2008 and 18.0% of this went on defence. The population of the United States is 305.5 million.

The New Zealand government spent a total of \$57 000 million in 2008 and 2.7% of this went on defence. The population of New Zealand is 4.3 million.

The exchange rate between the United States and New Zealand's currencies is US\$1 = NZ\$1.63.

Jed calculated that the average person in the United States paid about \$1900 more for defence than the average New Zealander. Jolene said the difference was only \$1165 per person between the United States and New Zealand. Investigate which student is right (if any) and justify your answer with supporting calculations.

ASSESSMENT SCHEDULE Number

Mathematics: Solve number problems.

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT	Solve number problems.	ONE (a)	0.4286	A	CAO okay for all parts. Ignore units. Must be in std form. Needs + or 'up'.	Achievement: Five or more of the seven Code A.
	Numbers into standard form.	ONE (b)	\$8208	A		
	Rounding of numbers.	ONE (c)	\$13.68	A		
	Percentage problems.	ONE (d)	37.5%	A		
	Sharing a quantity in a given ratio.	ONE (e)	\$15 : \$25	A		
	Solving word problems involving integers and decimals.	ONE (f)	\$13.80	A		
		ONE (g)	4.234×10^9	A		

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH MERIT	Solve number problems in context.	TWO (a)	\$5045.83	A/M	Must be in standard form. CAO okay. Accept any correct rounding.	MERIT: Achievement plus Three or four Code M or All five Code M.
	Standard form.	TWO (b)	6.5%	A/M		
	Increasing or decreasing by a given percentage.	TWO (c)	Expend. 2007 = 53 019 000 000 Expend. 2008 = 56 995 000 000	A/M		
	Calculation of percentage change.	TWO (d)	$\frac{31}{120}$	A/M		
	Ratio. Fractions.	TWO (e)	\$8 000 million	A/M		

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH EXCELLENCE	Solve number problems in context involving several steps or reversing processes.	THREE	<p>USA Expenditure on defence = \$423 000 million Per person = \$1384.62 New Zealand dollars = \$2256.92</p> <p>New Zealand Expenditure on defence = \$1 539 million Per person = \$357.91 Difference = \$1899.01 Jed is right in NZ dollars but in US dollars difference \$1165 Jolene is correct.</p>	M E	Needs minimum of two steps with at least a heading or explanation. Any supported conclusion for Jed or Jolene is acceptable. They do not have to pick up that both are right.	Excellence: Merit plus Code E.

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Teacher's Name: _____

10

Year 10 Mathematics, 2008

Trigonometry

Solve right-angled triangle problems

Time: 20 minutes.

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Achievement Criteria					
Achievement		Achievement with Merit		Achievement with Excellence	
Find simple unknown lengths of right-angled triangles using trig ratios and Pythagoras.	<input type="checkbox"/>	Find unknowns of right-angled triangles from words and diagrams using trig ratios and Pythagoras.	<input type="checkbox"/>	Model 2-D situations to find unknowns of a right-angled triangle using trig ratios or Pythagoras.	<input type="checkbox"/>
Overall Level of Performance (all criteria within a column met)					<input type="checkbox"/>

Make sure you show ALL relevant working for each question.

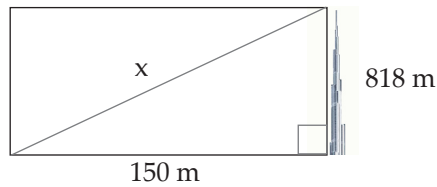
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Tall Buildings

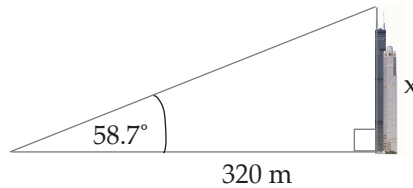
QUESTION ONE

The Burj Dubai is the world's tallest man made structure at 818 metres high.

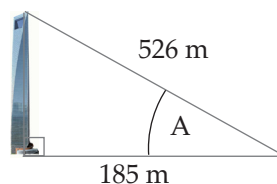
- (a) If you were standing 150 metres away from the base of the Burj Dubai calculate the distance, labelled x in the diagram to the top of the Burj Dubai.



- (b) The angle of elevation to the top of the Sears Tower in the United States from a distance of 320 metres away is 58.7° . Calculate the height of the Sears Tower, labelled x in the diagram.

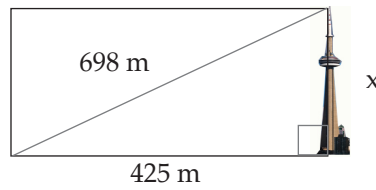


- (c) If you were standing 185 m from the base of the Shanghai World Financial Centre and the distance from where you were standing to the top of the building was 526 m, calculate the angle of elevation, labelled A in the diagram.

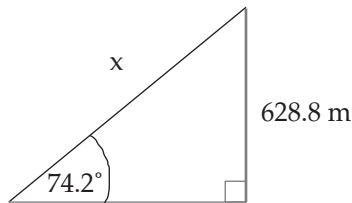


QUESTION TWO

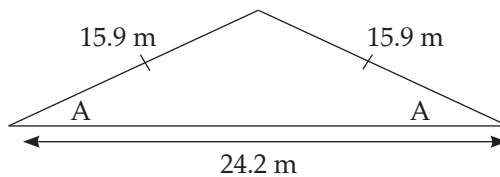
- (a) If you were standing 425 m from the CN Tower in Toronto and the distance from where you were standing to the top of the tower was 698 m, find the height of the CN Tower, labelled x in the diagram.



- (b) The KVLV - TV mast is the tallest guyed mast in the world at 628.8 m. If one of the guys to the top of the mast has an angle of elevation of 74.2° , find the length of the guy, labelled x in the diagram.



- (c) The cross section of the roof of a building is drawn below. Its shape is that of an isosceles triangle. Find the angle of elevation of the roof line, labelled A in the diagram.



ASSESSMENT SCHEDULE Trigonometry

Mathematics: Solve right-angled triangle problems

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT	Find simple unknown lengths of right-angled triangles using trig ratios and Pythagoras.	ONE (a)	Lgth = 831.6 m (1 dp)	A	Ignore units. Or equivalent.	Achievement: Two or three of Code A.
		ONE (b)	x = 526.3 m (1 dp)	A	Ignore units. Or equivalent.	
		ONE (c)	A = 69.4° (1 dp)	A	Ignore units.	

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH MERIT	Find unknowns of right-angled triangles from words and diagrams using trig ratios and Pythagoras.	TWO (a)	x = 553.7 m (1 dp)	A M	Or equivalent. Ignore units.	Merit: Achievement plus Two of Code M or All three Code M.
		TWO (b)	x = 653.5 m (1 dp)	A M	Or equivalent. Ignore units.	
		TWO (c)	A = 40.4° (1 dp)	A M	Or equivalent.	

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH EXCELLENCE	Model 2-D situations to find unknowns of a right-angled triangle using trig ratios or Pythagoras.	THREE	Diff. in building heights = 6.9 m $A = 90^\circ + \tan^{-1}\left(\frac{6.9}{5.3}\right)$ A = 142.5° (1 dp)	A M E	Must have appropriate statements and clear layout. Working required.	Excellence: Merit plus Code E.