Student's Name: _____

Teacher's Name: _____

10

Year 10 Mathematics, 2007

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.

For Assessor's use only	**Achievement Criteria**		
Achievement	**Achievement with Merit**	**Achievement with Excellence**	
Plot and interpret simple graphs. Solve linear equations. Describe simple patterns. ☐	Interpret linear graphs. Find terms in patterns. Carry out more complex algebraic manipulations. Solve equations. ☐	Solve algebra problems using graphs and manipulation. ☐	
Overall Level of Performance (all criteria within a column met) ☐			

Make sure you show ALL relevant working for each question.

Assessor's use only

Mobile Phones

QUESTION ONE

Simplify the following.

(a) $2x - 3 + 5x + 4$

(b) $4pq^2 \times 2p^2q^3$

(c) $\frac{4x^2y}{12x}$

(d) If $h = \sqrt{a^2 + b^2}$ and $a = -6$ and $b = 8$, find the value of h.

QUESTION TWO

Natasha sells mobile phones. The table below represents how much Natasha can earn per week depending on the number of phones she sells. N represents the number of phones sold per week and A the amount in dollars she could earn.

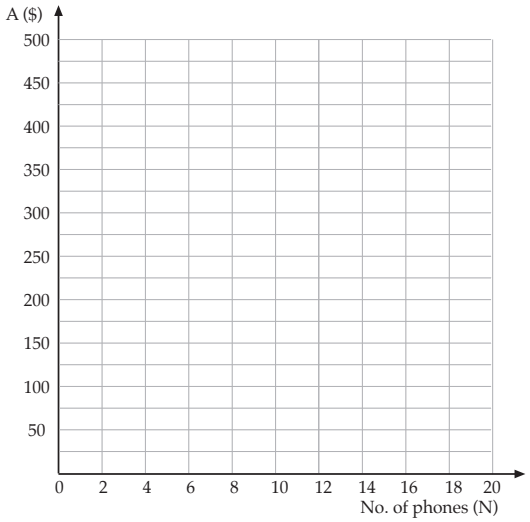
No. of phones (N)	0	1	2	3	4	5	6
Earnings (A)	165	195	225	255	285	315	345

(a) If Natasha sold 10 phones in a week, how much would she earn?

(b) What rule could Natasha use to work out her pay (A) in terms of the number of phones she sells per week (N)?

(c) On the grid provided on the right draw the rule Simon, who also sells phones, but for another company, uses to work out the amount he gets paid each week.

Simon's rule is A = 20N + 100



QUESTION THREE

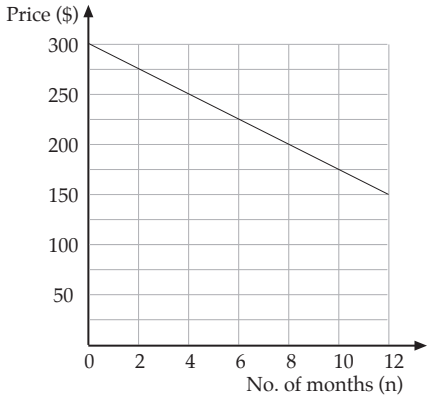
Assessor's use only

(a) Solve the equation $4x + 12 = 72$

(b) Four times a number subtracted from 20 is 12. Form an equation to represent this, but do NOT solve it.

(c) The graph on the right represents the price of a particular model of mobile phone over a 12 month period.

Give the gradient of the line drawn.



QUESTION FOUR

(a) Expand $2x(x - 5)$

(b) Factorise $x^2 - 7x - 18$

(c) Solve the equation $\frac{x}{4} + 2 = -3$

(d) $4(x + 3) = 3x$

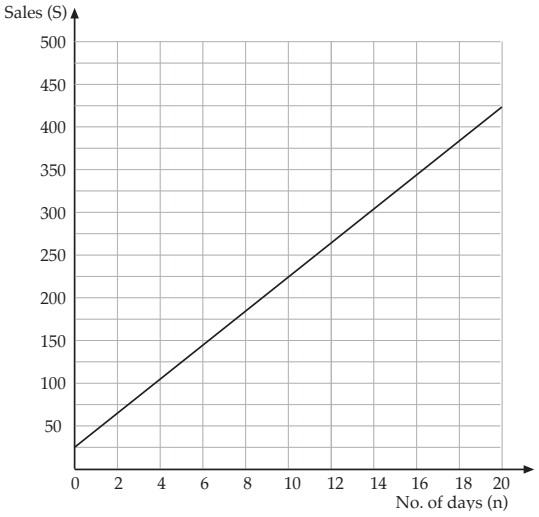
(e) Simplify $(2n^3)^3$

Assessor's use only

QUESTION FOUR cont..

(e) The graph below represents the sales of a particular model of mobile phone for a period of 20 days after its official release.

Write the equation of the graph drawn.



QUESTION FIVE

Natasha has been working in the telecommunications industry 10 more years than Simon. Eight years ago Natasha would have been working in the telecommunications industry for twice as long as Simon.

Form a linear equation and solve it to work out how long Natasha and Simon have been working in the telecommunications industry. Begin by letting x = Simon's age and x + 10 = Natasha's age.

Show ALL working. An answer alone is not sufficient.

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)	$7x + 1$	A1	CAO okay.	**Achievement:** **Two** or three of code A1 **plus** two or three of code A2 **plus** two or three of code A3.
		ONE (b)	$8p^3q^5$	A1	CAO okay.	
		ONE (c)	$\frac{xy}{3}$	A1	CAO okay.	
		ONE (d)	10	A1	CAO okay.	
		TWO (a)	$465	A2	CAO okay.	
		TWO (b)	$A = 30N + 165$	A2	CAO okay. Or equivalent.	
		TWO (c)	Linear graph through (0, 100) and (20, 500).	A2	CAO okay.	
		THREE (a)	$x = 15$	A3	Or equivalent. CAO okay.	
		THREE (b)	$20 – 4x = 12$	A3	Graph correctly drawn.	
		THREE (c)	Gradient $^{-}12.5$	A3	CAO okay. Or equivalent.	

	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.	FOUR (a) FOUR (b) FOUR (c) FOUR (d) FOUR (e) FOUR (f)	$2x^2 - 10x$ $(x - 9)(x + 2)$ $x = ^{-}20$ $x = ^{-}12$ $8n^9$ $S = 20n + 25$	M A1 M A1 M A3 M A3 M A1 M A2	Or equivalent. CAO okay. Or equivalent. CAO okay. CAO okay. Or equivalent. CAO okay. CAO okay. CAO okay. Or equivalent.	**Merit:** Achievement **plus** Four, five or six of Code M.

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH EXCELLENCE	Solve algebra problems using graphs and manipulation.	EIGHT	Let x = Simon so Natasha = x + 10 Twice Simon's length of service eight years ago equals Natasha's service 8 years ago. $2(x - 8) = (x + 10) - 8$ $2x - 16 = x + 2$ $x = 18$ So Simon 18 years service and Natasha 28 years service.	A1 A3 M E	Must use algebra to form and solve an equation.	**Excellence:** Merit **plus** Code E.

Student's Name: _____

Teacher's Name: _____

10

Year 10 Mathematics, 2007

Measurement

Solve problems involving measurement of everyday objects

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 – 5 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.

For Assessor's use only	**Achievement Criteria**	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Solve simple measurement problems. Use measurements in calculations and conversions. ☐	Solve measurement problems. ☐	Plan, carry out and evaluate a measuring task. ☐
Overall Level of Performance (all criteria within a column met) ☐		

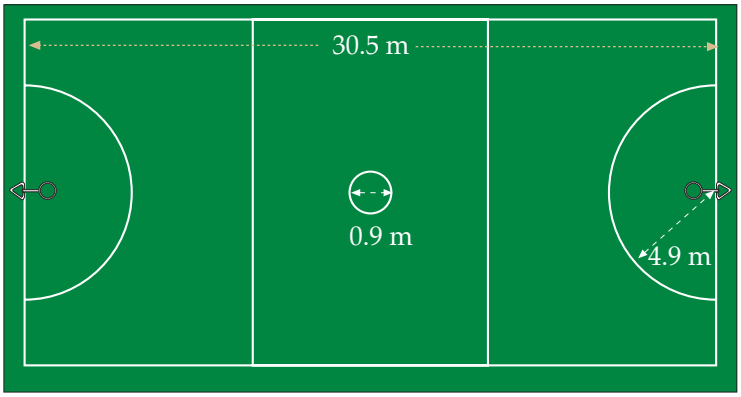
Make sure you show ALL relevant working for each question.

Assessor's use only

The Sports Coach

QUESTION ONE

A school has to purchase special tape for marking out their netball courts. You need to help Don the coach accurately calculate the length of the lines.



(a) The court is 30.5 metres long and half as wide as it is long.

Calculate the length of all the straight lines.

Length lines = _____

Width lines = _____

Total of straight lines = _____

(b) A 0.9 metre diameter centre circle is located in the centre of the court and there are two 4.9 metre radius semi-circles on each base line (called the goal circle). Calculate the circumference of both these semi-circles and the centre circle. ($C = 2\pi r$)

Centre circle = _____

Goal circles = _____

Total circles = _____

(c) Allowing 5% for wastage, what is the total length of special tape you recommend the coach purchase? Round your answer to the nearest 10 centimetres.

Tape required = _____

QUESTION TWO

Don the school sports coach is a marathon runner.
His fastest marathon is 2 hours 38.25 minutes for the 42.2 kilometres.

(a) What is 2 hours 38.25 minutes (2 h 38 min 15 sec) as a decimal fraction of an hour?

Time (hours) = _____

(b) What speed in kilometres per hour was Don running when he completed the 42.2 kilometres in 2 hours 38.25 minutes?

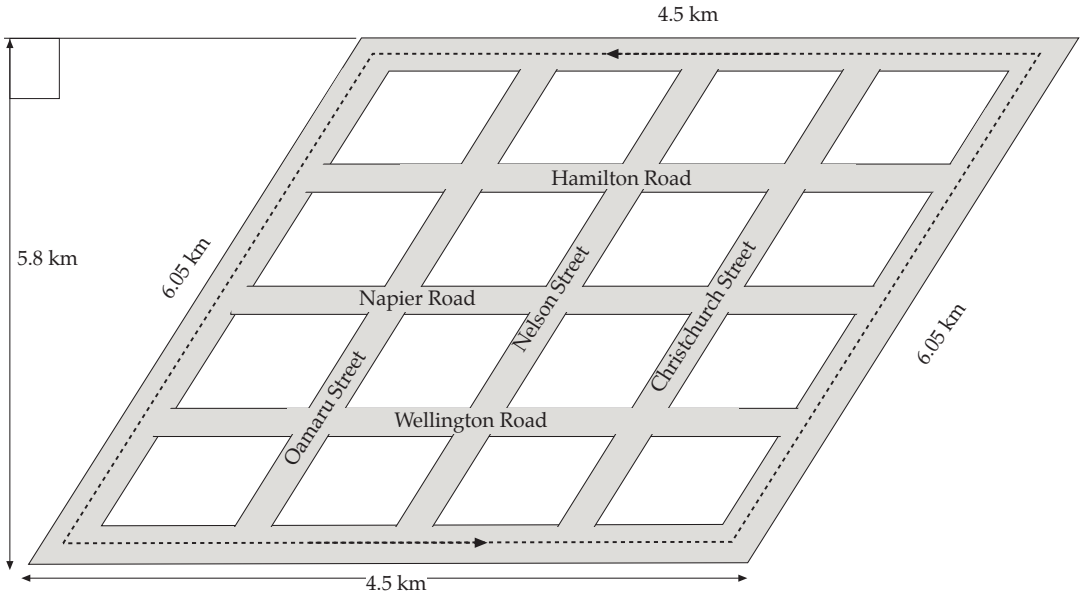
Speed (km/h) = _____

QUESTION TWO cont ...

Assessor's use only

Next week there is to be a marathon near the school. The visiting runners will run along city streets on a course in the shape of a parallelogram. The parallelogram has a base of 4.5 km and perpendicular height of 5.8 km but the runners run on a diagonal of 6.05 km.

The course is 21.1 km long so the runners need to complete it twice (= 42.2 km).



(c) Calculate the area of the town that the course will enclose.

The area of a parallelogram is given by Area = base x perpendicular height.

Area = _____

QUESTION THREE

As a result of time zone changes, a direct flight from Christchurch to Brisbane can take off at 6 am local time and arrive at 7 am local time in Brisbane, Australia. The same aircraft returning to New Zealand can take off at 5 pm local time from Brisbane and arrive in Christchurch at 12 midnight, local time.

Using these figures what is the time zone difference between Brisbane and Christchurch and what is the flying time?

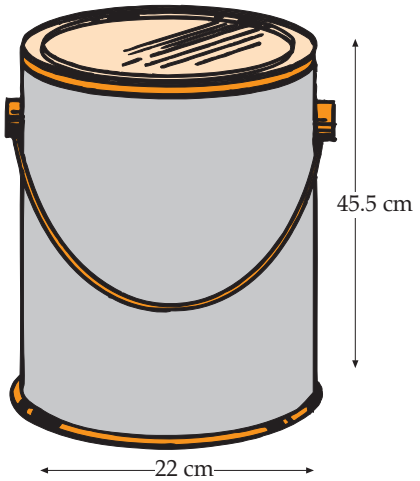
Time difference = _____

Flying time = _____

Assessor's use only

QUESTION FOUR

Don has found a full can of paint used for marking lines, but it has lost its label indicating the quantity.



The can is 45.5 cm tall and 22 cm in diameter.
Volume cylinder = $\pi r^2 h$

(a) Find the volume of the can in cm^3.

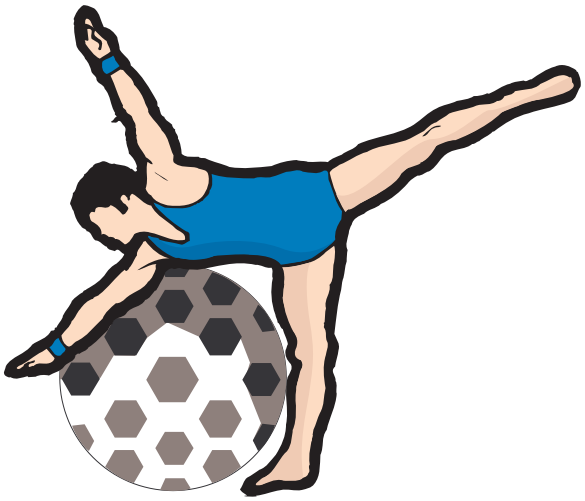
Volume (cm^3) = _____

(b) Calculate the maximum number of whole litres of paint the can could hold.

Capacity (litres) = _____

QUESTION FIVE

Don needs a large gymnastic ball which must have a volume of 1 m^3.



(a) What radius ball must he find?

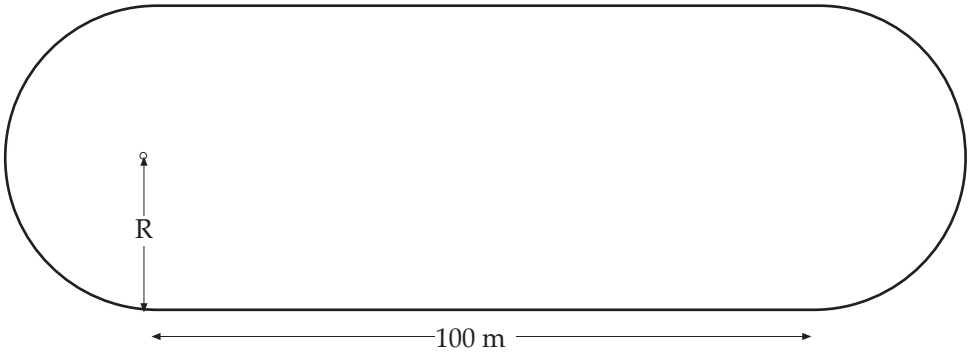
Use the formula. Volume = $\frac{4}{3}\pi r^3$.

Ball's radius = _____

QUESTION SIX

Assessor's use only

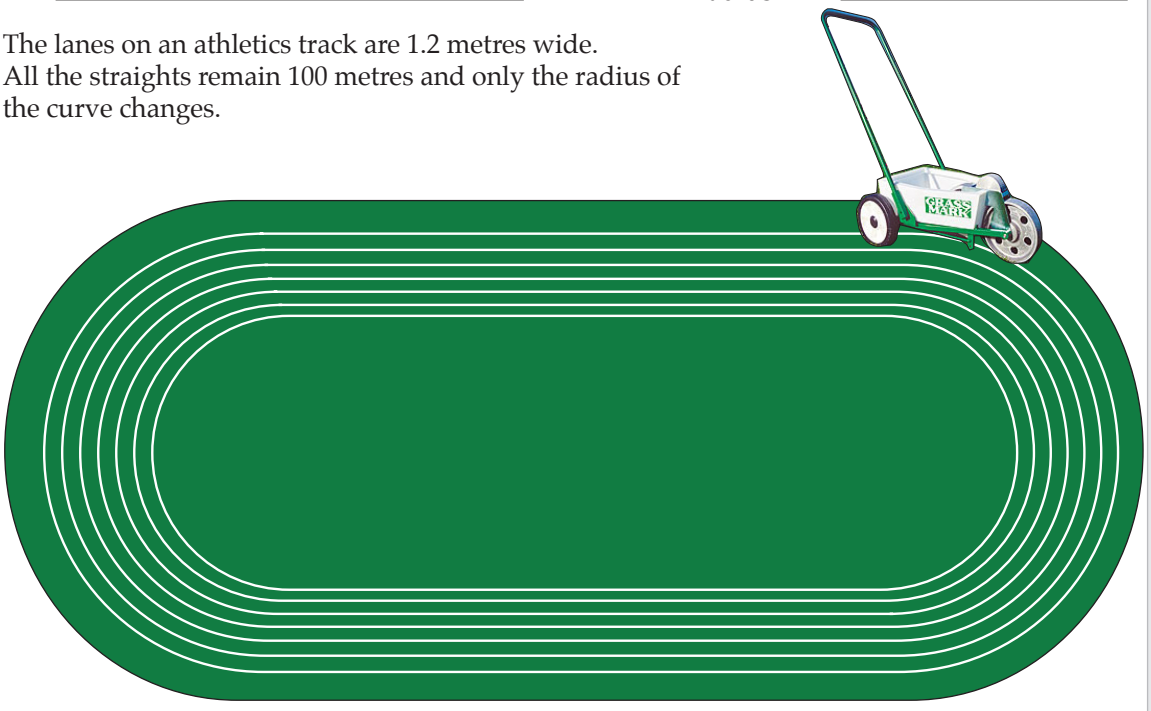
Don also has to mark out the athletics track. The straights are 100 metres long. The two semi-circular ends form a circle of radius R.



(a) Calculate R so the total length of the track is 400 metres.

Radius R = _____

The lanes on an athletics track are 1.2 metres wide.
All the straights remain 100 metres and only the radius of the curve changes.



Don has to arrange for the first 2 of the lanes to be marked on the school track.
The line marker draws a line 80 mm wide with a special paint.
The paint covers 12.1 m^2 per litre.

(b) What is the length of line needed to mark out the first 2 lines of the track and how much paint is needed just for these 2 lines? Round your answer appropriately.

Total lines length = _____

Paint needed = _____

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) ONE (b) ONE (c) TWO (a) TWO (b) TWO (c) THREE	Straight lines = 122 m Circles = 33.615 m Length = 163.4 m (must be 1dp) Time = 2.6375 h Speed = 16 km/h Area = 26.1 km^2 Time difference = 3 h Flying time = 4 h	A A A A A A A	CAO okay for achievement. Must be to 10 cm so 16340 cm is correct.	**Achievement:** **Four** or more of the seven code 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.	FOUR (a) FOUR (b) FIVE	Volume = 17 296 cm^3 Capacity = 17 litres (must be 0dp) Radius = 0.62 m	A/M A/M A/M	Accept any appropriate rounding.	**MERIT:** Achievement **plus** Two Code M **or** All three Code M.

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH EXCELLENCE	Plan, carry out and evaluate a measuring task.	SIX (a) (b)	R = 31.83 m P_1 = 400 P_2 = 200 + 2π x 33.03 = 407.53 m Total = 807.53 m Area = 64.6024 m^2 Paint = 5.34 litres = 6 litres (round up)	A M for Total E	Ignore 1 minor error that still leads to an acceptable answer. Accept correct number of litres or the quantity rounded up. Answer of 5 litres is wrong.	**Excellence:** Merit **plus** Code E.

Student's Name: _____

Teacher's Name: _____

10

Year 10 Mathematics, 2007

Number

Solve number problems

Time: 20 minutes.

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

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For Assessor's use only	**Achievement Criteria**	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Solve number problems. ☐	Solve number problems in context. ☐	Solve number problems in context involving several steps or reversing processes. ☐
Overall Level of Performance (all criteria within a column met) ☐		

Make sure you show ALL relevant working for each question.

Assessor's use only

A New iPod

QUESTION ONE

(a) Round off 3.1415926 to 4 significant figures. 3.1415926 = _____ (4 sig. figures)

(b) Write the number 45 678 000 000 000 in standard form.
45 678 000 000 000 = _____

(c) What is 48 out of 60 as a percentage? 48 out of 60 = _____ %

(d) Calculate 75% of $88. 75% of $80 = $_____

(e) Share $24 in the ratio of 3:1 3:1 of $24 = $_____ to $_____

(f) Decrease $35 by 20%. 20% off $35 = $_____

(g) Jody's job was to look after the bank's money in a board game. In one complete turn Peter paid the bank forty dollars, Clare was paid fifty dollars from the bank while Aaron paid the bank one hundred dollars. In this turn, how much money is the bank up (+) or down (–)?

_____

_____

Bank up or down = (+ or –) $ _____

QUESTION TWO

(a) An iPod MP3 music player needs 1×10^6 bytes of memory to store 1 minute of music. Joy's iPod player can hold 2000 songs, each 4 minutes long. How much memory does 2000 songs require? Answer in standard form.

Total memory = _____

= _____

= _____

= _____

(b) The 4GB iPod Nano sold in the US for $249 in 2005. In 2007 the price of the latest 4GB iPod Nano is $149. What percentage decrease is it from $249 to $149?

Percent decrease = _____

= _____

= _____

= _____ %

(c) Joy uses her iPod to listen to music $\frac{2}{5}$ of the time. She listens to audio books $\frac{3}{8}$ of the time and the rest of the time she uses it to watch videos.
What fraction of the time does Joy watch videos on her iPod?

Fraction watching videos = _____

= _____

= _____

= _____

QUESTION TWO cont. . .

Assessor's use only

(d) In 2005 18 million iPods were sold. In 2006 sales increased by 35%. What were the sales in 2006?

Total sales in 2006 = _____

= _____

= _____

= _____ million

(e) The number of transistors used on a single processor such as a MP3 player has increased yearly. From 2000 the number of transistors on a single processor was predicted to b
Transistors = (25 million) x 2^n where n is the years since 2000.
How many transistors were predicted for 2005 (n = 5)?

Transistors = (25 million) x 2^n = _____

= _____

= _____

= _____

QUESTION THREE

Joy would like to get a new iPod Nano 8GB.

- She could buy it locally for $324 including GST.
- On the internet she can purchase it in USA for US$199 with freight to New Zealand of US$15. When an item is imported into New Zealand, GST of 12.5% is added to the total cost. The exchange rate between US and New Zealand is US$0.76 = NZ$1.

Calculate the cost in New Zealand dollars of importing the iPod Nano 8GB. Explain what you are doing and any calculations you make. Which iPod should Joy purchase?

ASSESSMENT SCHEDULE Number

Mathematics: Solve number problems.

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT	Solve number problems. Numbers into standard form. Rounding of numbers. Percentage problems. Sharing a quantity in a given ratio. Solving word problems involving integers and decimals.	ONE (a) ONE (b) ONE (c) ONE (d) ONE (e) ONE (f) ONE (f)	3.142 4.5678×10^{13} Percentage = 80% 75% of 88 = $66 $18 : $6 $28 +$90 (up $90)	A A A A A A A	Only answer Must be in std form. CAO okay for all parts. Ignore units. Needs + or 'up'.	**Achievement:** **Five** or more of the seven code A.

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH MERIT	Solve number problems in context. Standard form. Increasing or decreasing by a given percentage. Calculation of percentage change. Ratio. Fractions.	TWO (a) TWO (b) TWO (c) TWO (d) TWO (e)	Memory = 8.0×10^{9} (bytes) Decrease = 40.2% (accept 40%) Videos = $\frac{9}{40}$ Sales = $24.3 million 800 million	A/M A/M A/M A/M A/M	Must be in std form. CAO okay.	**MERIT:** Achievement **plus** Three or four Code M **or** All five Code M.

	Achievement Criteria	No.	Evidence	Code	Judgement	Sufficiency
ACHIEVEMENT WITH EXCELLENCE	Solve number problems in context involving several steps or reversing processes.	THREE (a) THREE (b)	Cost + freight = US$214 Convert to NZ$ = 214 / 0.76 = $281.58 Add GST of 12.5% Cost NZ = $316.77 So should purchase from USA as it is cheaper OR Purchase from NZ because it is not that much more expensive and it may be easier to get service etc.	M E	Needs minimum of two steps with at least a heading or explanation. Order of GST and conversion not important. Any supported conclusion is acceptable.	**Excellence:** Merit **plus** Code E.

Student's Name: _____

Teacher's Name: _____

10

Year 10 Mathematics, 2007

Trigonometry

Solve right-angled triangle problems

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.

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For Assessor's use only	**Achievement Criteria**	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Find simple unknown lengths of right-angled triangles using trig ratios and Pythagoras. ☐	Find unknowns of right-angled triangles from words and diagrams using trig ratios and Pythagoras. ☐	Model 2-D situations to find unknowns of a right-angled triangle using trig ratios or Pythagoras. ☐
Overall Level of Performance (all criteria within a column met) ☐		

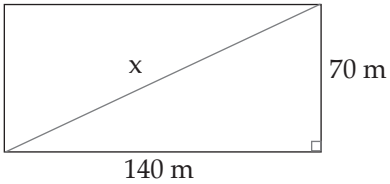
Make sure you show ALL relevant working for each question.

Assessor's use only

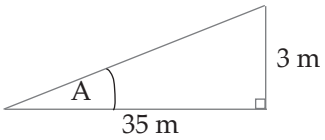
Rugby

QUESTION ONE

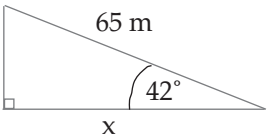
A rugby field is a rectangular shape measuring 140 m by 70 m.



(a) Calculate the length (marked x in the diagram above) from one corner of the dead ball line to the opposite corner at the other end.



(b) A fullback has a penalty attempt 35 metres from the goal post. If the crossbar is 3 metres high, what angle of elevation (labelled A in the diagram) will the fullback have to kick the ball, so it clears the crossbar.

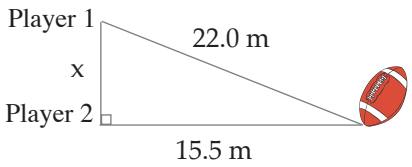


(c) A flyhalf punts the ball a total of 65 metres at an angle of elevation of 42°. Calculate the horizontal distance parallel to the ground (labelled x in the diagram) the ball has travelled.

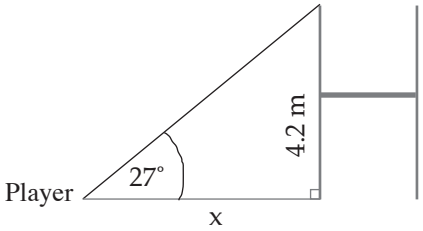
QUESTION TWO

Assessor's use only

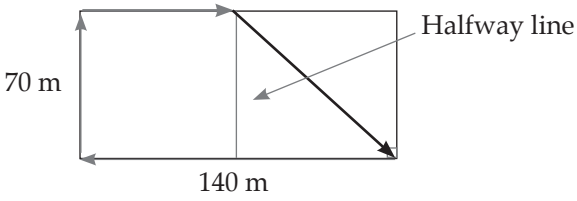
(a) Two players in the backline chase a high kick. If Player 1 runs 22.0 m and Player 2, 15.5 m to where the ball lands, calculate the distance (x) between the two players at the start. Assume the two players and where the ball lands form a right-angled triangle. See the diagram below.



(b) Calculate the distance (x) a player is standing from the base of one of the goal posts given the height of the goal posts are 4.2 m high and the angle of elevation from the player to the top of the goal post is 27°.
See the diagram below.



(c) A rugby coach gets half his squad to run the route around the rugby field marked in the diagram below and the other half of the squad to run around the perimeter of the entire field (140 m by 70 m). Which run is longer and by how much? Show ALL working.



QUESTION THREE

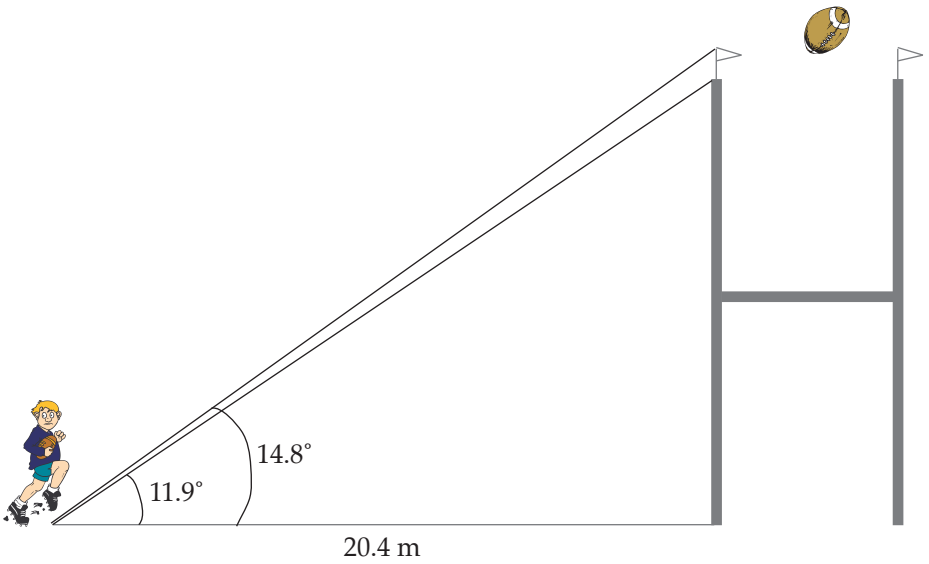
Assessor's use only

On top of the goal posts are flags. A player is standing 20.4 metres from the base of one goal post. The angle of elevation, from the player, to the top of the goal post is 11.9° and to the top of the flag is 14.8°.

Find the height of the flag attached to the top of the goal posts.

Show ALL working and explain each step of your calculation.

See the diagram below.



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) ONE (b) ONE (c)	Lgth = $\sqrt{140^2 + 70^2}$ Lgth = 156.5 m (1 dp) tan A = $\frac{3}{35}$ A = 4.9° (1 dp). Kick over 4.9° cos 42° = $\frac{x}{65}$ x = 48.3 m (1 dp)	A A A	Ignore units. Or equivalent. Ignore units. Or equivalent. Accept 4.9°. Ignore units. Or equivalent.	**Achievement:** **Two** or three of code A.

	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) TWO (b) TWO (c)	Dist. = $\sqrt{22.0^2 - 15.5^2}$ Dist = 15.6 m (1 dp) tan 27° = $\frac{4.2}{x}$ x = 8.25 m (1 dp) Entire field = 420 m Alt. Route = 140 + 70 + 70 + 99 = 379 metres Entire field longer by 41 m.	A M A M A M	Or equivalent. Ignore units. Or equivalent. Ignore units. Or equivalent. Ignore units. Conclusion drawn.	**Merit:** Achievement **plus** Two of Code M **or** All three Code M.

	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	Height of goal posts: tan 11.9° = $\frac{x}{20.4}$ x = 4.3 m (1 dp) Height to top of flag: tan 14.8° = $\frac{x}{20.4}$ x = 5.4 m (1 dp) Distance apart: 5.4 – 4.3 = 1.1 m (1 dp)	A M E	Must have appropriate statements and clear layout. Working required.	**Excellence:** Merit **plus** Code E.