

NEWINGTON COLLEGE



2015

Assessment 2 (HSC mini)

Year 12 General Mathematics 2

General Instructions:

- Date of task – Thursday 19th March, 2015
- Reading time – 5 mins
- Working time – 120 mins
- Weighting - 30%
- BOSTES-approved calculators may be used.
- Attempt all questions.
- Show all relevant mathematical reasoning and/or calculations.

Total marks – 80

Section I (20 marks)

- Answer questions 1 to 20 on the multiple choice answer sheet provided at the end of this paper.
- Allow about 30 minutes for this section.

Section II (60 marks)

- Answer questions 21 to 24 on the writing paper provided.
- **Start each question on a new page.**
- Each page must show the candidate's computer number.

Outcomes to be assessed:

MG2H5 - interprets the results of measurements and calculations and makes judgments about reasonableness, including the degree of accuracy of measurements and calculations and the conversion to appropriate units.

MG2H1 - uses mathematics and statistics to evaluate and construct arguments in a range of familiar and unfamiliar contexts

MG2H3 - makes predictions about situations based on mathematical models, including those involving cubic, hyperbolic or exponential functions

MG2H4 - analyses 2-dimensional and 3-dimensional models to solve practical problems, including those involving spheres and non-right-angled triangles.

Section I**20 marks****Attempt Questions 1-20****Allow about 30 minutes for this section.**

Use the multiple-choice answer sheet (tear off at end of paper).

- (1)** Find the median of the following data set:

8, 9, 10, 6, 6, 6, 7, 7, 4, 3, 4, 4, 8, 3

- (A) 6
- (B) 6.5
- (C) 7
- (D) 7.5

- (2)** Simplify the following: $x(x^3 - 5x) - 5x^2(x^2 - 3)$

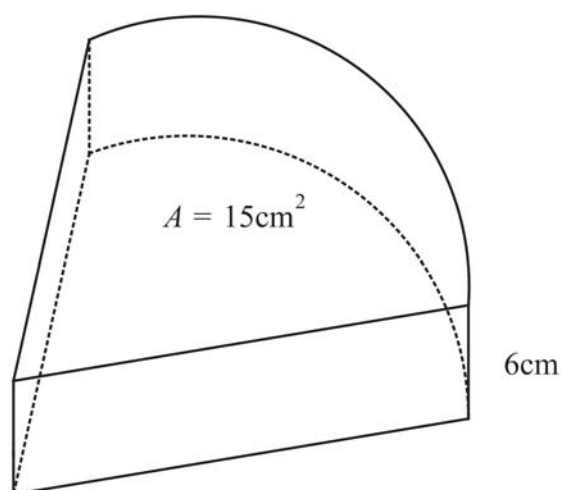
- (A) $-4x^4 - 20x^2$
- (B) $x^3 - 5x^4 - 20x^2$
- (C) $x^3 - 5x^4 - 15x^2 - 5x$
- (D) $-4x^4 + 10x^2$

- (3)** Which measure of location would be the best to describe the following data set:

3, 4, 4, 4, 4, 5, 6, 7, 9, 22

- (A) mean
- (B) mode
- (C) range
- (D) Standard deviation

- (4) Find the volume of the solid:



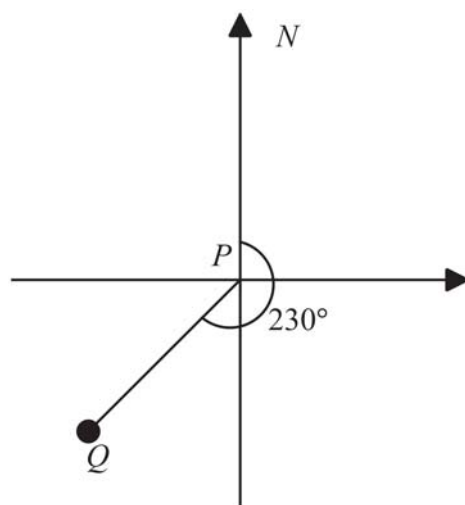
- (A) 90 cm^3
- (B) 45 cm^3
- (C) 2.5 cm^3
- (D) 75 cm^3
- (5) The formula to change between Fahrenheit and Celsius is:

$$C = \frac{5}{9}(F - 32)$$

What is the temperature in the Bahamas in Fahrenheit (to the nearest degree) if it is equivalent to 30°C ?

- (A) 49°F
- (B) 22°F
- (C) 86°F
- (D) 76°F

- (6) A ship sails on a bearing of 230°T from P to Q.

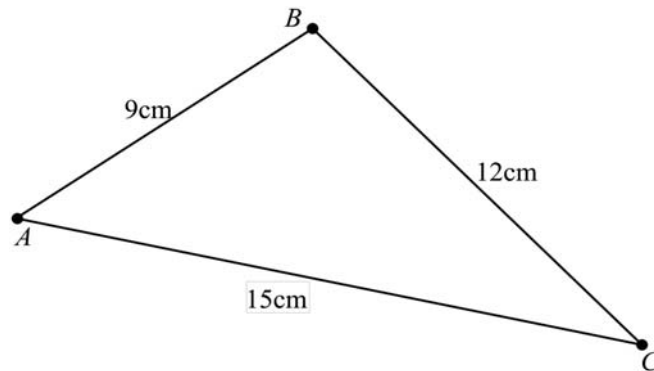


What is the bearing of P from Q?

- (A) 130°T
- (B) 230°T
- (C) 300°T
- (D) 050°T
- (7) If $e = -4$, $g = 7$ and $h = 9$, what is the value of:
 $gh - 2e$?

- (A) 55
- (B) 71
- (C) 17
- (D) 29

- (8) Fred wants to calculate the size of the largest angle in the triangle below. Which calculation will he use?



- (A) $\cos\theta = \frac{15^2 + 12^2 - 9^2}{2 \times 12 \times 15}$
- (B) $c^2 = 12^2 + 15^2 - 2 \times 12 \times 15 \times \cos(9)$
- (C) $\cos\theta = \frac{15^2 + 9^2 - 12^2}{2 \times 9 \times 15}$
- (D) $\cos\theta = \frac{12^2 + 9^2 - 15^2}{2 \times 9 \times 12}$

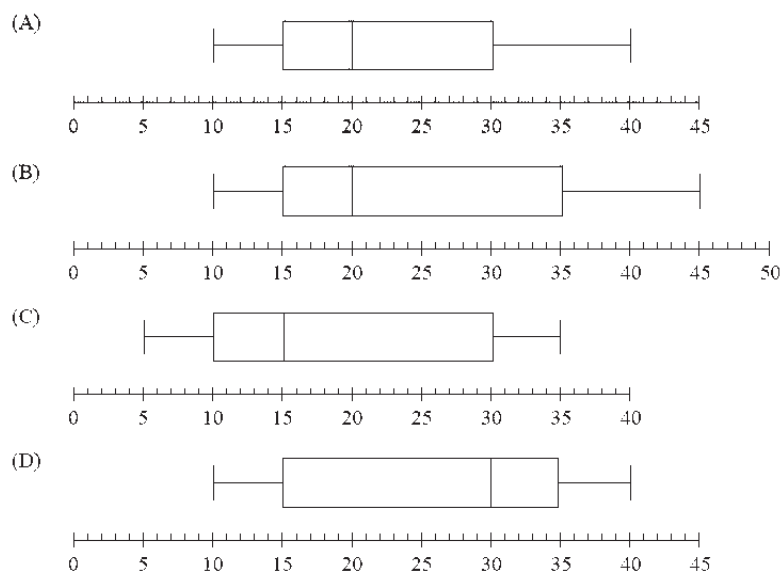
- (9) The prices of property sold in an apartment block are recorded in a stem and leaf plot shown below.

Stem	Leaf
15	1 1 1 2
16	0 0 3 3 3 3
17	2 3 5
18	0 1

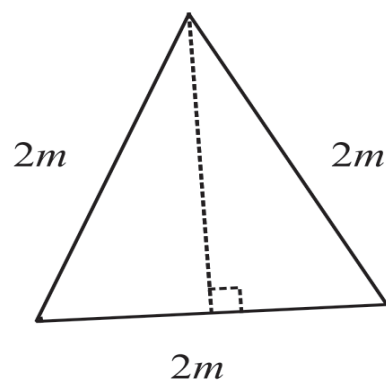
What is the cumulative frequency of 163?

- (A) 6
- (B) 7
- (C) 10
- (D) 15

- (10)** Which one of the following box and whisker plots shows an interquartile range of 15 and a median of 20?

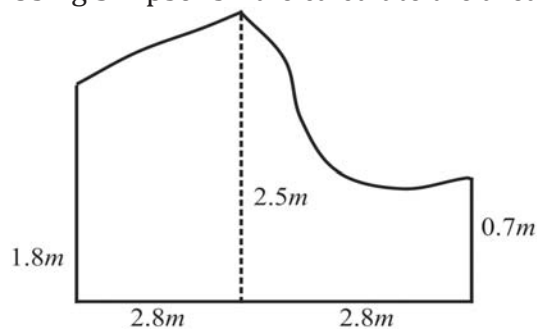


- (11)** George has made a roof on for the dog house that he built.
How high is the roof?

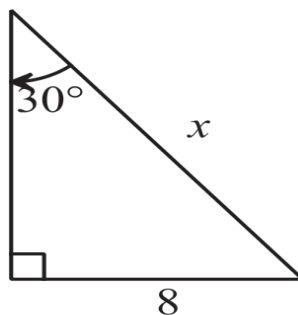


- (A) 1.73m
- (B) 2m
- (C) 2.2m
- (D) 3m

- (12) Using Simpsons Rule calculate the area of the shape below?



- (A) $9.3m^2$
- (B) $11.7m^2$
- (C) $18.7m^2$
- (D) $23.3m^2$
- (13) What is the correct expression for the value of x in this triangle?



- (A) $8 \cos 30$
- (B) $8 \sin 30$
- (C) $\frac{8}{\cos 30}$
- (D) $\frac{8}{\sin 30}$

(14) Solve for p:

$$3p - \frac{2}{5} - 2p + \frac{1}{4} = 3$$

(A) $36\frac{1}{2}$

(B) $3\frac{3}{20}$

(C) $3\frac{13}{20}$

(D) 1

(15) Find the area of a sector if the size of the radius is 5cm and the angle of the sector is 60°

(A) 78.53cm

(B) 2.61cm

(C) 4.2cm

(D) 13.1cm

(16) A plank of wood is measured to be 35cm by 4cm by 2cm, measured to the nearest centimeter. What is the upper bound volume?

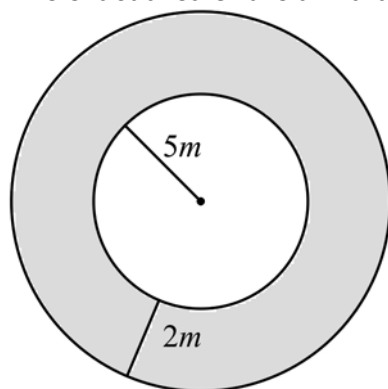
(A) 280cm^3

(B) 280.5cm^3

(C) 181.125cm^3

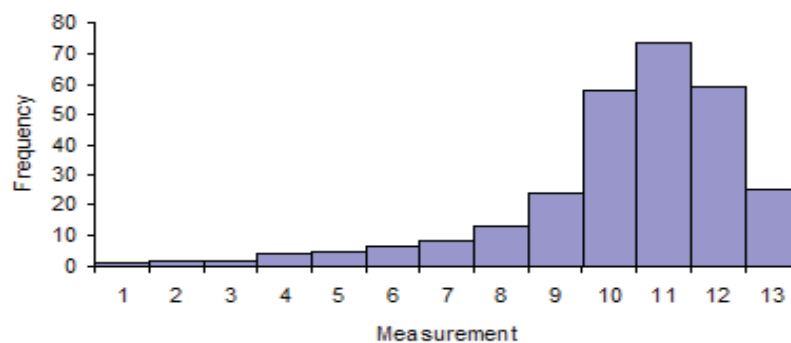
(D) 399.375cm^3

- (17) The exact area of the annulus shown is:



- (A) 3π
- (B) 21π
- (C) 24π
- (D) 2π

- (18)



Describe the graph above:

- (A) Positively skewed
- (B) Negatively skewed
- (C) Symmetrical
- (D) No Skew

- (19)** Which of the following correctly expresses a as the subject of:

$$s = ut + \frac{1}{2}at^2$$

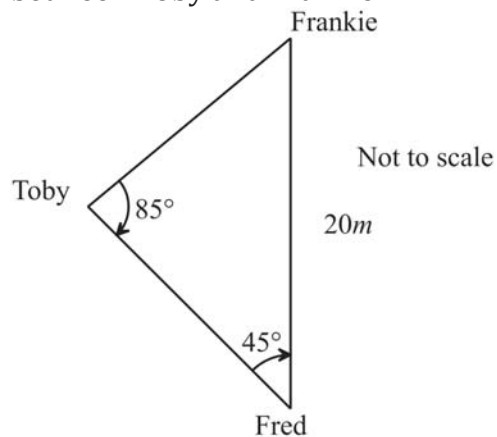
(A) $a = \frac{2(s - ut)}{t^2}$

(B) $a = \frac{2s - ut}{t^2}$

(C) $\pi a = \frac{\frac{1}{2}(s - ut)}{t^2}$

(D) $a = \frac{\frac{1}{2}s - ut}{t^2}$

- (20)** Which formula should be used to calculate the distance between Toby and Frankie?



(A) $\frac{a}{\sin A} = \frac{b}{\sin B}$

(B) $c^2 = a^2 + b^2$

(C) $A = \frac{1}{2}ab \sin C$

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

End of Section I

Section II

60 marks

Attempt Questions 21-24

Allow about 1 hour and 30 minutes for this section.

Question 21 (16 marks)

- (a) Fred tried to solve the following equation and made a mistake on line 2:

$$4(y + 2) - 3(y + 1) = -3 \quad \text{Line 1}$$

$$4y + 8 - 3y + 3 = -3 \quad \text{Line 2}$$

$$y + 11 = -3 \quad \text{Line 3}$$

$$y = -14 \quad \text{Line 4}$$

- (i) Rewrite line 2 correctly. 1

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- (ii) Hence find the correct solution for y. 2

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- (b) Consider the data set below:

16, 19, 12, 15, 16, 14, 16, 17, 24, 18, 22, 25, 34

- (i) Find the median 1

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- (ii) Find the interquartile range 1

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- (iii) Is 34 an outlier? Justify your answer with calculations. 2

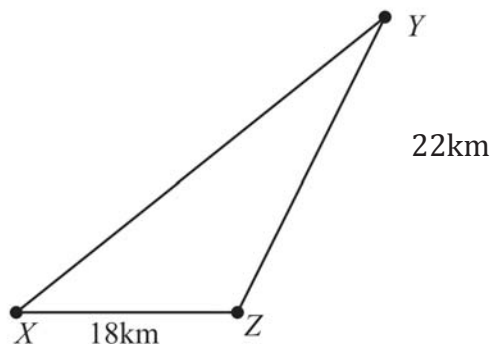
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- (c) In the diagram X, Y and Z represent the locations of three friends. Zane is due east of Xavier, and the bearing of Yulia from Xavier is 046°T .



- (i) Find the size of $\angle XYZ$ to the nearest minute. 2

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- (ii) Find the distance XY correct to 1 decimal place 2

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- (iii) What is the bearing of Y from Z 1

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- (d) Simplify completely $28x^7y^2 \div 4x^3y^4$ 2

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- (e) Solve simultaneously $y = 3x - 1$ and $x - 3y = -9$ 2

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End of Question 21

Question 22 (13 marks)

- (a) The time taken T (in seconds) for the length of rope R (metres) to be rotated about a central point is given by the formula $T = \sqrt{\frac{9R}{2.5}}$.

- (i) Make R the subject of the formula. 1

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- (ii) What is the length of rope if it takes 9 seconds for a single revolution? 1

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- (iii) What is the time taken for a rope of length 20 metres to complete a revolution? Answer correct to two decimal places. 1

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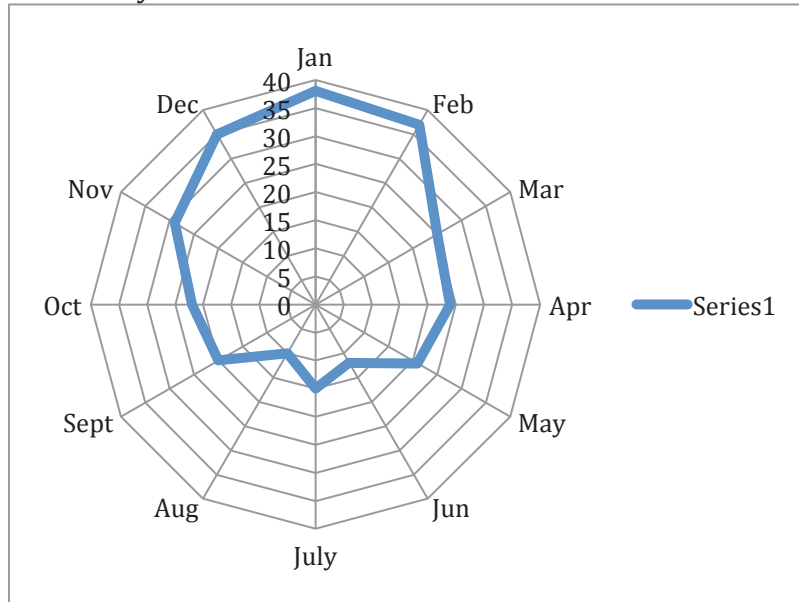
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- (b) Hiccup and Toothless recorded the average number of dragons they saw in their town during the year.
The radar chart shows the average number of dragons over the months of the year.



- (i) Which month had the most dragons? 1

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- (ii) The next year Hiccup and Toothless count dragons again. The mean the year before was 24 and the standard deviation was 8.9. 3

This year the values are:

52, 47, 49, 38, 31, 24, 13, 8, 20, 29, 32, 41.

Compare the data for both years; you must include the standard deviation and the mean.

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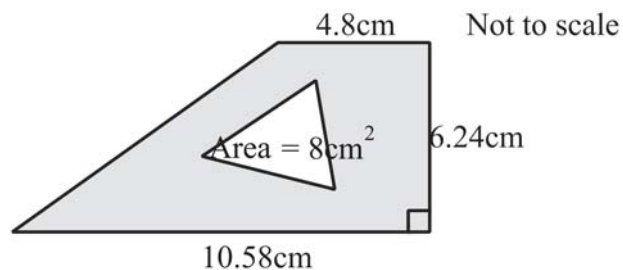
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- (c) Find the area of the following shape: (Note the area of the triangle is given in the diagram) 3



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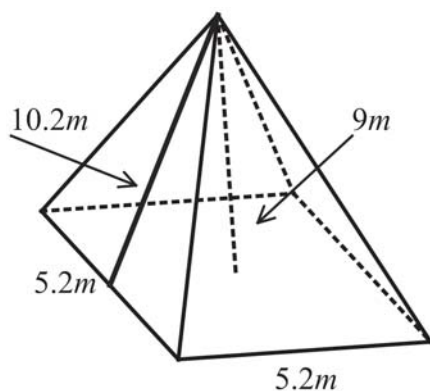
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- (d) Find the surface area of the square pyramid, correct to 2 significant figures. 3



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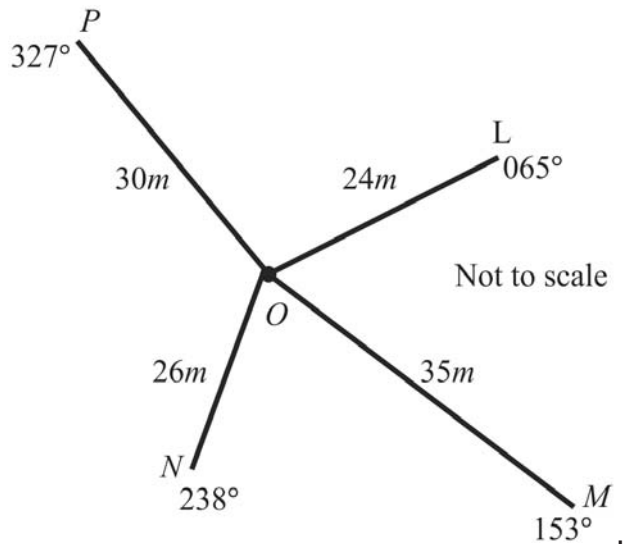
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End of Question 22

Question 23 (15 marks)

(a) The figure shows a radial survey:



(i) Find the size of $\angle POL$ 1

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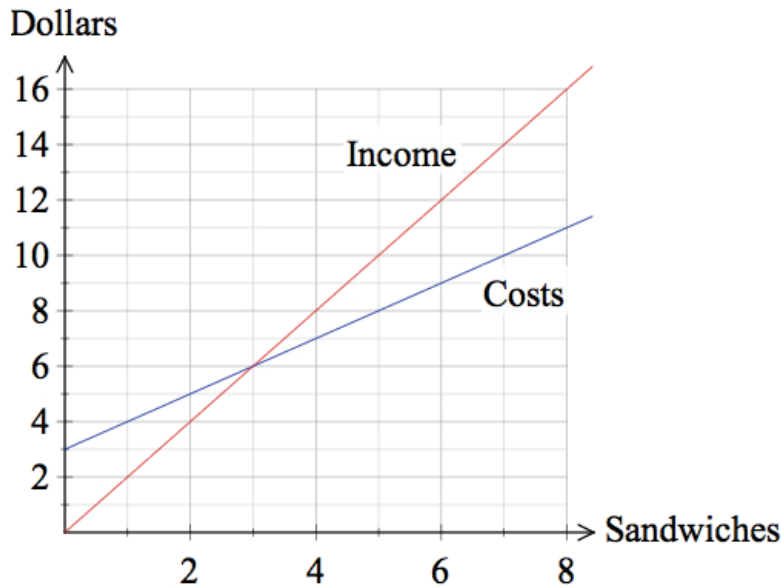
(ii) Use the cosine rule to find the length of PL to 2 decimal places. 2

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(iii) What is the area of $\triangle POL$ (to the nearest m^2) 2

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- (b) The linear graphs below show the cost of making a sandwich and the income received from selling the sandwiches.



- (i) Let the income received be \$ I and n the number of sandwiches sold. Write a formula for the income. 1

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- (ii) Let the costs of making a sandwich be \$ C and n the number of sandwiches sold. Write a formula for the costs. 1

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- (iii) How many sandwiches are needed to be sold to break-even? 1

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- (iv) What is the loss if 2 sandwiches are sold? 1

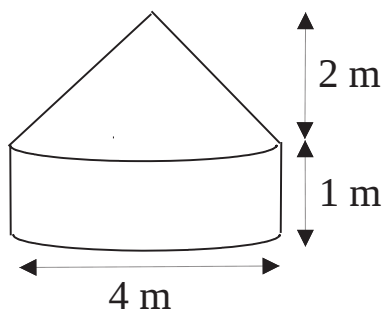
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- (c) A solid consists of a cylinder and a cone as shown. What is the volume of the solid correct to one decimal place?

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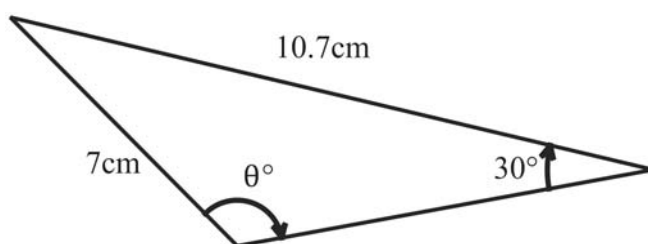
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- (d) Find the obtuse value of θ in the triangle below.

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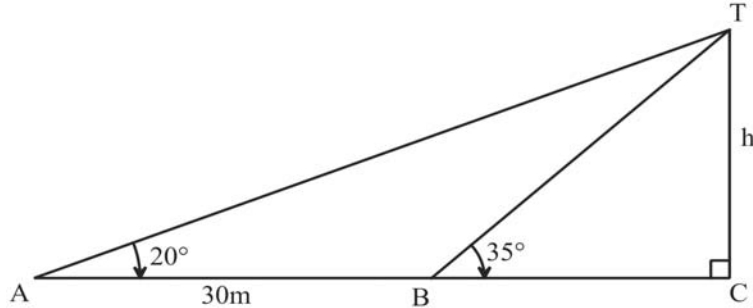
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End of Question 23

Question 24 (16 marks)

- (a) An observer sights the top of a building at an angle of elevation of 20° . From a point 30m closer to the building, the angle of elevation is 35° as shown in the figure below.



- (i) Calculate the size of $\angle ATB$ 1

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- (ii) Show that the distance BT can be given by the expression: 2

$$BT = \frac{30 \sin 20^\circ}{\sin 15^\circ}$$

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- (iii) In $\triangle TBC$, show that the height of the building can be given by: 2

$$h = \frac{30 \sin 20^\circ}{\sin 15^\circ} \times \sin 35^\circ$$

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- (iv) Calculate the height of the building to one decimal place. 1

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- (b) A new housing development has opened near a known possum reserve.

A survey is conducted to determine the number of motor vehicles that pass the reserve each day.

The results for 60 days have been recorded in the table and are displayed in the cumulative frequency histogram.

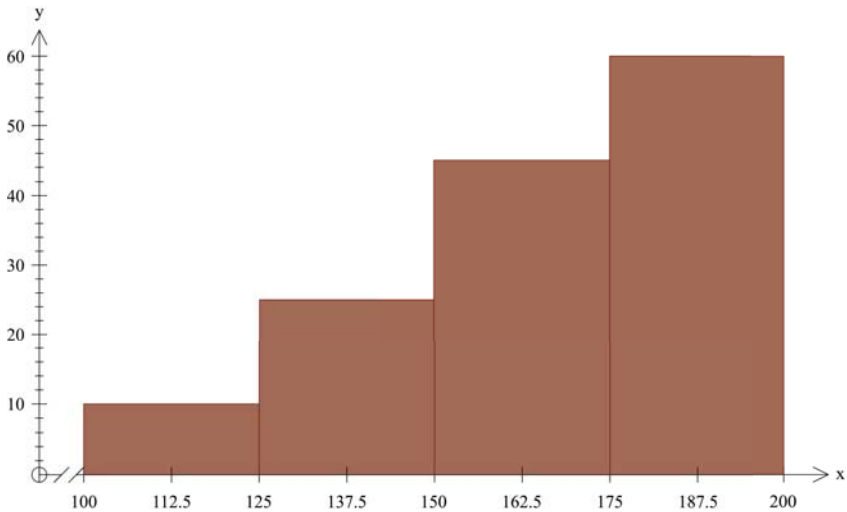
Score	Class Centre	Frequency	Cumulative Frequency
100-124	112	10	10
125-149	137	d	25
150-174	162	20	45
175-199	187	15	60

- (i) Find the value for d in the table. 1

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- (ii) Using the cumulative frequency histogram below, draw the ogive and determine the approximate median by drawing on the graph. 2



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- (iii) Prior to the housing development the median number of cars past the reserve was 35 vehicles per day. 2

What problems could arise with the change in the median number of vehicles around the reserve before and after the housing development?

Briefly explain a possible solution to the problem.

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- (c) Simplify the following completely: 2

$$\frac{7b^3(b+4)}{9a} \div \frac{14(b+4)}{8a^2}$$

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- (d) Solve the following equation: 3

$$\frac{x}{4} - 2 = 5 - \frac{x-4}{6}$$

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End of Question 24

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Section II – Extra writing space

If you use this space, clearly indicate which question you are answering.

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Student Number :

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SECTION I – Multiple Choice Answer Sheet*Instructions – 1. Tear off this page and write your student number in box above.**2. Colour in the circle corresponding to your correct answer.*

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|-------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Question 1 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 2 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 3 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 4 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 5 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 6 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 7 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 8 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 9 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 10 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 11 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 12 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 13 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 14 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 15 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 16 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 17 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 18 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 19 | A ☐ | B ☐ | C ☐ | D ☐ |
| Question 20 | A ☐ | B ☐ | C ☐ | D ☐ |

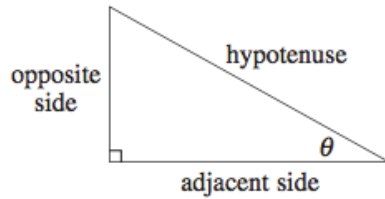
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Mathematics General 2

FORMULAE AND DATA SHEET

Financial Mathematics	Data Analysis
Simple interest $I = Prn$ P is initial amount r is interest rate per period, expressed as a decimal n is number of periods Compound interest $A = P(1 + r)^n$ A is final amount P is initial amount r is interest rate per period, expressed as a decimal n is number of compounding periods Present value and future value $PV = \frac{FV}{(1 + r)^n}, \quad FV = PV(1 + r)^n$ r is interest rate per period, expressed as a decimal n is number of compounding periods Straight-line method of depreciation $S = V_0 - Dn$ S is salvage value of asset after n periods V_0 is initial value of asset D is amount of depreciation per period n is number of periods Declining-balance method of depreciation $S = V_0(1 - r)^n$ S is salvage value of asset after n periods V_0 is initial value of asset r is depreciation rate per period, expressed as a decimal n is number of periods	Mean of a sample $\bar{x} = \frac{\text{sum of scores}}{\text{number of scores}}$ z-score For any score x, $z = \frac{x - \bar{x}}{s}$ $\bar{x}$ is mean s is standard deviation Outlier(s) score(s) less than $Q_L - 1.5 \times IQR$ or score(s) more than $Q_U + 1.5 \times IQR$ Q_L is lower quartile Q_U is upper quartile IQR is interquartile range Least-squares line of best fit $y = \text{gradient} \times x + y\text{-intercept}$ $\text{gradient} = r \times \frac{\text{standard deviation of } y \text{ scores}}{\text{standard deviation of } x \text{ scores}}$ $y\text{-intercept} = \bar{y} - (\text{gradient} \times \bar{x})$ r is correlation coefficient $\bar{x}$ is mean of x scores $\bar{y}$ is mean of y scores Normal distribution - approximately 68% of scores have z-scores between -1 and 1 - approximately 95% of scores have z-scores between -2 and 2 - approximately 99.7% of scores have z-scores between -3 and 3

Spherical Geometry	Surface Area
Circumference of a circle $C = 2\pi r \text{ or } C = \pi D$ r is radius D is diameter Arc length of a circle $l = \frac{\theta}{360} 2\pi r$ r is radius θ is number of degrees in central angle Radius of Earth (taken as) 6400 km Time differences For calculation of time differences using longitude: 15° = 1 hour time difference	Sphere $A = 4\pi r^2$ r is radius Closed cylinder $A = 2\pi r^2 + 2\pi rh$ r is radius h is perpendicular height
Area	Volume
Circle $A = \pi r^2$ r is radius Sector $A = \frac{\theta}{360} \pi r^2$ r is radius θ is number of degrees in central angle Annulus $A = \pi(R^2 - r^2)$ R is radius of outer circle r is radius of inner circle Trapezium $A = \frac{h}{2}(a + b)$ h is perpendicular height a and b are the lengths of the parallel sides Area of land and catchment areas unit conversion: 1 ha = 10 000 m²	Prism or cylinder $V = Ah$ A is area of base h is perpendicular height Pyramid or cone $V = \frac{1}{3}Ah$ A is area of base h is perpendicular height Volume and capacity unit conversion: 1 m³ = 1000 L
	Approximation Using Simpson's Rule
	Area $A \approx \frac{h}{3}(d_f + 4d_m + d_l)$ h is distance between successive measurements d_f is first measurement d_m is middle measurement d_l is last measurement Volume $V \approx \frac{h}{3}\{A_L + 4A_M + A_R\}$ h is distance between successive measurements A_L is area of left end A_M is area of middle A_R is area of right end

Trigonometric Ratios

$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$

Sine ruleIn $\triangle ABC$,

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Area of a triangleIn $\triangle ABC$,

$$A = \frac{1}{2}ab \sin C$$

Cosine ruleIn $\triangle ABC$,

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

or

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Units of Memory and File Size

$$1 \text{ byte} = 8 \text{ bits}$$

$$1 \text{ kilobyte} = 2^{10} \text{ bytes} = 1024 \text{ bytes}$$

$$1 \text{ megabyte} = 2^{20} \text{ bytes} = 1024 \text{ kilobytes}$$

$$1 \text{ gigabyte} = 2^{30} \text{ bytes} = 1024 \text{ megabytes}$$

$$1 \text{ terabyte} = 2^{40} \text{ bytes} = 1024 \text{ gigabytes}$$

Blood Alcohol Content Estimates

$$BAC_{\text{male}} = \frac{10N - 7.5H}{6.8M}$$

or

$$BAC_{\text{female}} = \frac{10N - 7.5H}{5.5M}$$

 N is number of standard drinks consumed H is number of hours of drinking M is person's mass in kilograms**Distance, Speed and Time**

$$D = ST, \quad S = \frac{D}{T}, \quad T = \frac{D}{S}$$

$$\text{average speed} = \frac{\text{total distance travelled}}{\text{total time taken}}$$

$$\text{stopping distance} = \left\{ \begin{array}{c} \text{reaction-time} \\ \text{distance} \end{array} \right\} + \left\{ \begin{array}{c} \text{braking} \\ \text{distance} \end{array} \right\}$$

Probability of an Event

The probability of an event where outcomes are equally likely is given by:

$$P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

Straight Lines**Gradient**

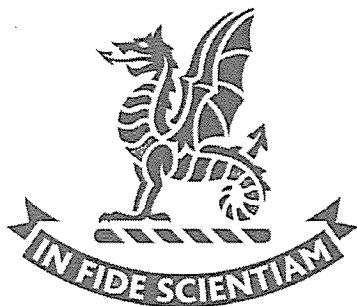
$$m = \frac{\text{vertical change in position}}{\text{horizontal change in position}}$$

Gradient-intercept form

$$y = mx + b$$

 m is gradient b is y-intercept

NEWINGTON COLLEGE



2015

Assessment 2 (HSC mini)

Year 12 General Mathematics 2

General Instructions:

- Date of task – Thursday 19th March, 2015
- Reading time – 5 mins
- Working time – 120 mins
- Weighting - 30%
- Board-approved calculators may be used.
- Attempt all questions.
- Show all relevant mathematical reasoning and/or calculations.

Total marks – 70

Section I (20 marks)

- Answer questions 1 to 20 on the multiple choice answer sheet provided at the end of this paper.
- Allow about 30 minutes for this section.

Section II (60 marks)

- Answer questions 11 to 14 on the writing paper provided.
- **Start each question on a new page.**
- Each page must show the candidate's computer number.

Outcomes to be assessed:

MG2H5 - interprets the results of measurements and calculations and makes judgments about reasonableness, including the degree of accuracy of measurements and calculations and the conversion to appropriate units.

MG2H1 - uses mathematics and statistics to evaluate and construct arguments in a range of familiar and unfamiliar contexts

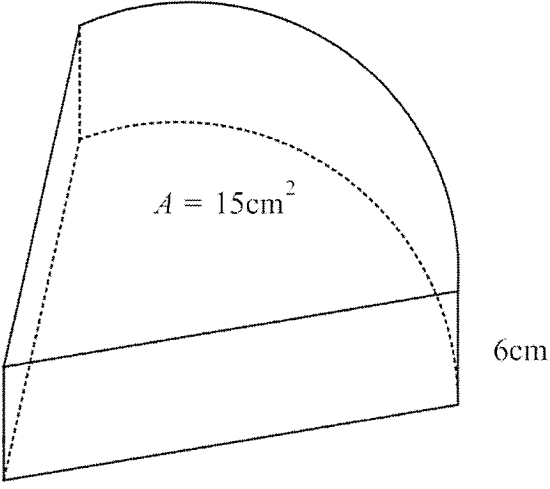
MG2H3 - makes predictions about situations based on mathematical models, including those involving cubic, hyperbolic or exponential functions

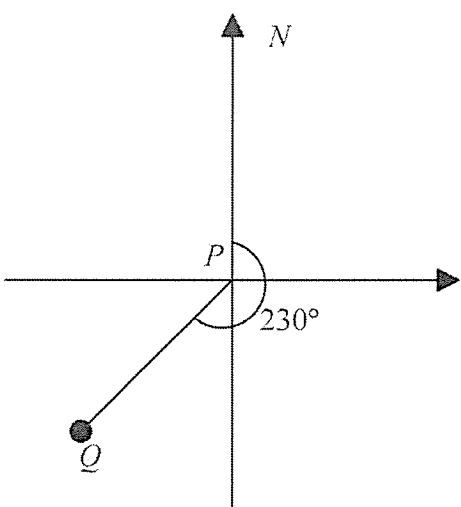
MG2H4 - analyses 2-dimensional and 3-dimensional models to solve practical problems, including those involving spheres and non-right-angled triangles.

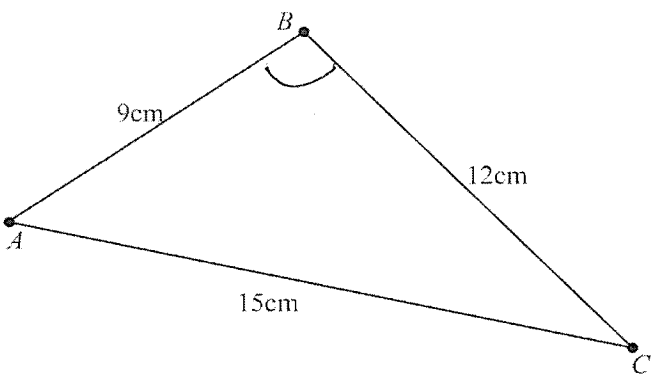
Section I**20 marks****Attempt Questions 1-20****Allow about 30 minutes for this section.**

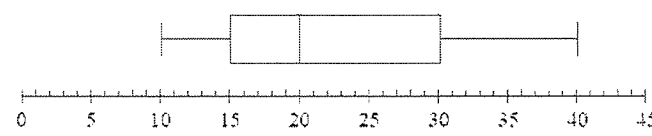
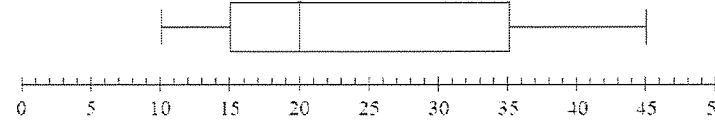
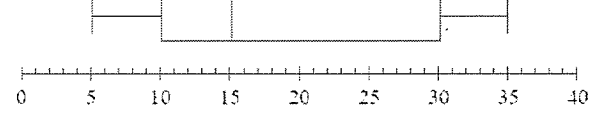
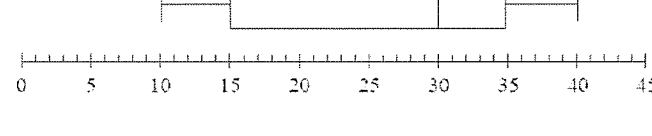
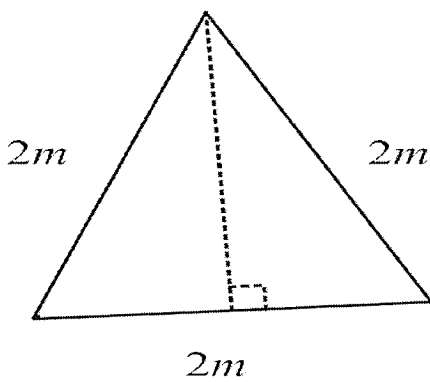
Use the multiple-choice answer sheet (tear off at end of paper).

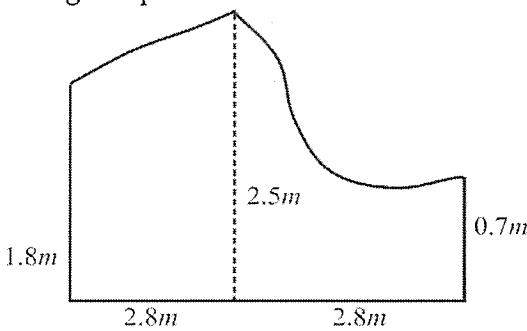
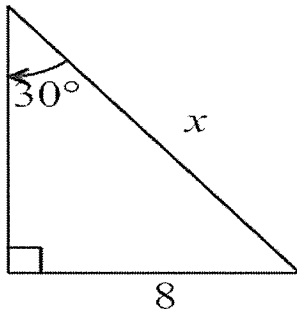
(1)	Find the median of the following data set: 8, 9, 10, 6, 6, 6, 7, 7, 4, 3, 4, 4, 8, 3 3, 3, 4, 4, 4, 6, 6, 6, 7, 7, 8, 8, 9, 10	
	(A) 6	
	(B) 6.5	
	(C) 7	
	(D) 7.5	
(2)	Simplify the following: $x(x^3 - 5x) - 5x^2(x^2 - 3)$ $x^4 - 5x^2 - 5x^4 + 15x^2$ $-4x^4 + 10x^2$	
	(A) $-4x^4 - 20x^2$	
	(B) $x^3 - 5x^4 - 20x^2$	
	(C) $x^3 - 5x^4 - 15x^2 - 5x$	
	(D) $-4x^4 + 10x^2$	
(3)	Which measure of location would be the best to describe the following data set: 3, 4, 4, 4, 4, 5, 6, 7, 9, 22	
	(A) mean	
	(B) mode	
	(C) range	
	(D) Standard deviation	

(4)	Find the volume of the solid: 		
	(A)	90cm ³	
	(B)	45cm ³	
	(C)	2.5cm ³	
	(D)	75cm ³	
(5)	The formula to change between Fahrenheit and Celsius is: $C = \frac{5}{9}(F - 32)$ What is the temperature in the Bahamas in Fahrenheit (to the nearest degree) if it is equivalent to 30°C?		
	(A)	49°F	
	(B)	22°F	
	(C)	86°F	
	(D)	76°F	

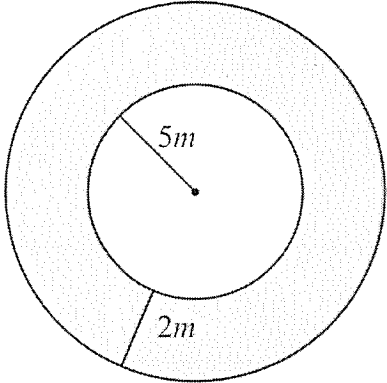
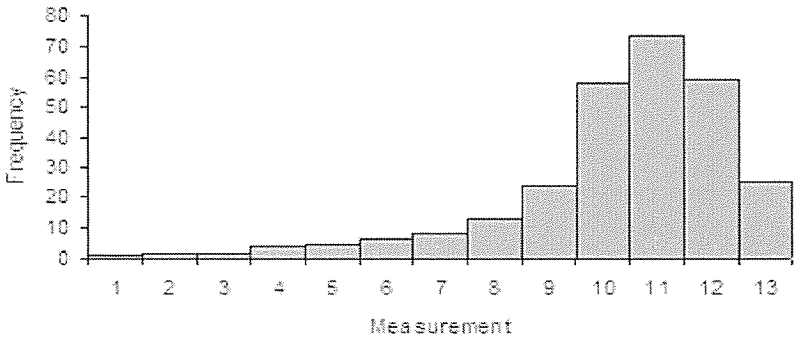
(6)	A ship sails on a bearing of 230°T from P to Q.  What is the bearing of P from Q?		
	<table border="1"> <tr> <td>(A)</td> <td>130°T</td> </tr> </table>	(A)	130°T
(A)	130°T		
	<table border="1"> <tr> <td>(B)</td> <td>230°T</td> </tr> </table>	(B)	230°T
(B)	230°T		
	<table border="1"> <tr> <td>(C)</td> <td>300°T</td> </tr> </table>	(C)	300°T
(C)	300°T		
	<table border="1"> <tr> <td>(D)</td> <td>050°T</td> </tr> </table>	(D)	050°T
(D)	050°T		
(7)	If $e = -4$, $g = 7$ and $h = 9$, what is the value of: $gh - 2e?$ $7 \times 9 - 2(-4)$		
	<table border="1"> <tr> <td>(A)</td> <td>55</td> </tr> </table>	(A)	55
(A)	55		
	<table border="1"> <tr> <td>(B)</td> <td>71</td> </tr> </table>	(B)	71
(B)	71		
	<table border="1"> <tr> <td>(C)</td> <td>17</td> </tr> </table>	(C)	17
(C)	17		
	<table border="1"> <tr> <td>(D)</td> <td>29</td> </tr> </table>	(D)	29
(D)	29		

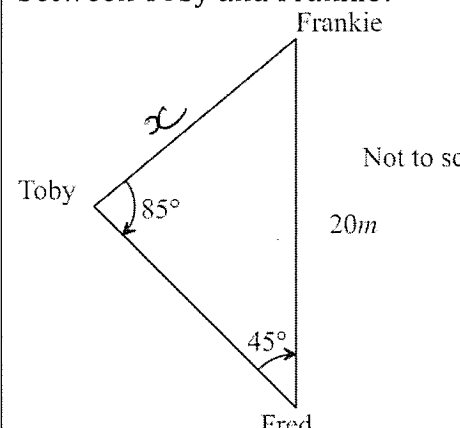
(8)	Fred wants to calculate the size of the largest angle in the triangle below. Which calculation will he use?											
												
	(A)	$\cos \theta = \frac{15^2 + 12^2 - 9^2}{2 \times 12 \times 15}$										
	(B)	$c^2 = 12^2 + 15^2 - 2 \times 12 \times 15 \times \cos(9)$										
	(C)	$\cos \theta = \frac{15^2 + 9^2 - 12^2}{2 \times 9 \times 15}$										
	(D)	$\cos \theta = \frac{12^2 + 9^2 - 15^2}{2 \times 9 \times 12}$										
(9)	The prices of property sold in an apartment block are recorded in a stem and leaf plot shown below. <table><thead><tr><th>Stem</th><th>Leaf</th></tr></thead><tbody><tr><td>15</td><td>1 1 1 2</td></tr><tr><td>16</td><td>0 0 3 3 3 3</td></tr><tr><td>17</td><td>2 3 5</td></tr><tr><td>18</td><td>0 1</td></tr></tbody></table> What is the cumulative frequency of 163?		Stem	Leaf	15	1 1 1 2	16	0 0 3 3 3 3	17	2 3 5	18	0 1
Stem	Leaf											
15	1 1 1 2											
16	0 0 3 3 3 3											
17	2 3 5											
18	0 1											
	(A)	6										
	(B)	7										
	(C)	10										
	(D)	15										

(10)	Which one of the following box and whisker plots shows an interquartile range of 15 and a median of 20? (A)  (B)  (C)  (D) 
(11)	George has made a roof on for the dog house that he built. How high is the roof? 
	(A) 1.73m
	(B) 2m
	(C) 2.2m
	(D) 3m

(12)	Using Simpsons Rule calculate the area of the shape below?	
		
	(A)	11.7m ²
	(B)	23.3m ²
	(C)	9.3m ²
	(D)	18.7m ²
↑ changed to be in numerical order ↓		
(13)	What is the correct expression for the value of x in this triangle?	
	 $\sin \theta = \frac{o}{h}$ $\sin 30 = \frac{8}{x}$	
	(A)	$8 \cos 30$
	(B)	$8 \sin 30$
	(C)	$\frac{8}{\cos 30}$
	(D)	$\frac{8}{\sin 30}$

(14)	Solve for p: $3p - \frac{2}{5} - 2p + \frac{1}{4} = 3$ $-p = 3 - \frac{1}{4} + \frac{2}{5}$	
	(A) $36\frac{1}{2}$	
	(B) $3\frac{3}{20}$	
	(C) $3\frac{13}{20}$	
	(D) 1	
(15)	Find the area of a sector if the size of the radius is 5cm and the angle of the sector is 60° $A = \frac{60}{360} \pi r^2 = \frac{60}{360} \pi (25)$	
	(A) 78.53cm	
	(B) 2.61cm	
	(C) 4.2cm	
	(D) 13.1cm	
(16)	A plank of wood is measured to be 35cm by 4cm by 2cm, measured to the nearest centimeter. What is the upper bound volume?	
	(A) 280cm ³	
	(B) 280.5cm ³	
	(C) 181.125cm ³	
	(D) 399.375cm ³	

(17)	The exact area of the annulus shown is:  $\pi(R^2 - r^2)$ $\pi(7^2 - 5^2)$		
	(A)	3π	
	(B)	21π	
	(C)	24π	
	(D)	2π	
(18)	 Describe the graph above:		
	(A)	Positively skewed	
	(B)	Negatively skewed	
	(C)	Symmetrical	
	(D)	No Skew	

(19)	Which of the following correctly expresses a as the subject of: $s = ut + \frac{1}{2}at^2$ $\frac{2(s-ut)}{t^2}$
	(A) $a = \frac{2(s-ut)}{t^2}$
	(B) $a = \frac{2s-ut}{t^2}$
	(C) $\pi a = \frac{\frac{1}{2}(s-ut)}{t^2}$
	(D) $a = \frac{\frac{1}{2}s-ut}{t^2}$
(20)	Which formula should be used to calculate the distance between Toby and Frankie?  Not to scale
	(A) $\frac{a}{\sin A} = \frac{b}{\sin B}$
	(B) $c^2 = a^2 + b^2$
	(C) $A = \frac{1}{2}ab \sin C$
	(D) $c^2 = a^2 + b^2 - 2ab \cos C$

End of Section I

Student Number :

A	N	S	W	E	R	S		
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SECTION I – Multiple Choice Answer Sheet*Instructions – 1. Tear off this page and write your student number in box above.**2. Colour in the circle corresponding to your correct answer.*

- | | | | | |
|-------------|---|---|------------------------------------|------------------------------------|
| Question 1 | A ☒ | B ☐ | C ☐ | D ☒ |
| Question 2 | A ☐ | B ☐ | C ☐ | D ☒ |
| Question 3 | A ☐ | B ☒ | C ☐ | D ☐ |
| Question 4 | A ☒ | B ☐ | C ☐ | D ☐ |
| Question 5 | A ☐ | B ☐ | C ☒ | D ☐ |
| Question 6 | A ☐ | B ☐ | C ☐ | D ☒ |
| Question 7 | A ☐ | B ☒ | C ☐ | D ☐ |
| Question 8 | A ☐ | B ☐ | C ☐ | D ☒ |
| Question 9 | A ☐ | B ☐ | C ☒ | D ☐ |
| Question 10 | A ☒ | B ☐ | C ☐ | D ☐ |
| Question 11 | A ☒ | B ☐ | C ☐ | D ☐ |
| Question 12 | A ☒ ^{old} | B ☒ ^{new} | C ☐ | D ☐ |
| Question 13 | A ☐ | B ☐ | C ☐ | D ☒ |
| Question 14 | A ☐ | B ☒ | C ☐ | D ☐ |
| Question 15 | A ☐ | B ☐ | C ☐ | D ☒ |
| Question 16 | A ☐ | B ☐ | C ☐ | D ☒ |
| Question 17 | A ☐ | B ☐ | C ☒ | D ☐ |
| Question 18 | A ☐ | B ☒ | C ☐ | D ☐ |
| Question 19 | A ☒ | B ☐ | C ☐ | D ☐ |
| Question 20 | A ☒ | B ☐ | C ☐ | D ☐ |

Section II

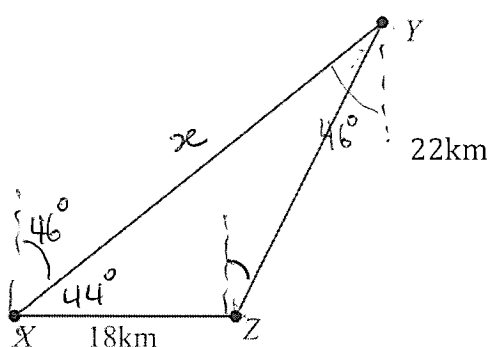
60 marks

Attempt Questions 21-24

Allow about 1 hour and 30 minutes for this section.

Question 21 (16 marks) – Use a SEPARATE writing booklet.

(a)	Fred tried to solve the following equation and made a mistake on line 2: $4(y+2) - 3(y+1) = -3 \quad \text{Line 1}$ $4y + 8 - 3y + 3 = -3 \quad \text{Line 2}$ $y + 11 = -3 \quad \text{Line 3}$ $y = -14 \quad \text{Line 4}$	
(i)	Rewrite line 2 correctly. $4y + 8 - 3y - 3 = -3$	1
(ii)	Hence find the correct solution for y. $4y + 8 - 3y - 3 = -3$ $y + 5 = -3$ $y = -8$	2
(b)	Consider the data set below: <u>12</u>, <u>14</u>, 15, 16, 16, 16, <u>17</u>, 18, 19, <u>22</u>, <u>24</u>, <u>25</u>, <u>34</u> 16, 19, 17, 15, 16, 14, 16, 17, 24, 18, 22, 25, 34	
(i)	Find the median 17	1
(ii)	Find the interquartile range $23 - 15.5$ $= 7.5$	1

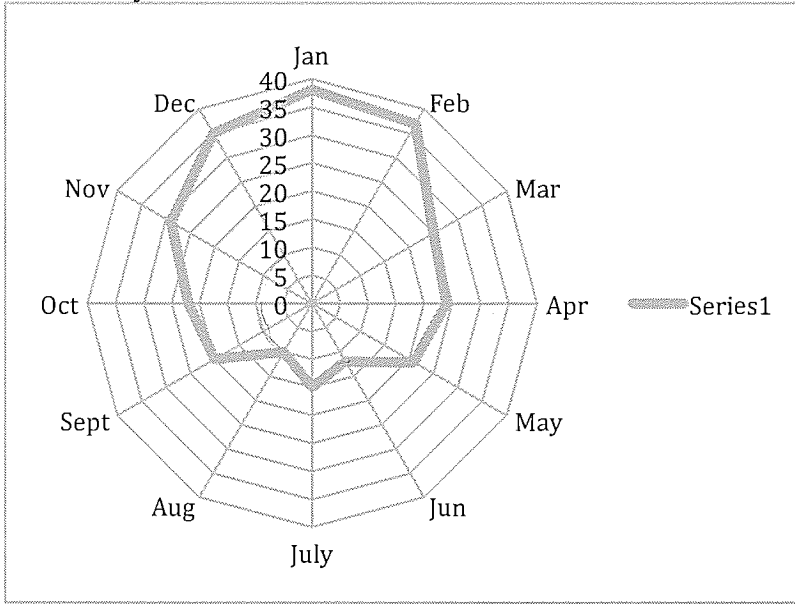
(iii)	Is 34 an outlier? Justify your answer with calculations.	2
	$\begin{aligned} \text{outlier} &= Q_u + 1.5 IQR \\ &= 23 + 1.5(7.5) \\ &= \textcircled{1} 34.25 \text{ Yes } \textcircled{1} \\ &\text{it is an outlier.} \end{aligned}$	
(c)	In the diagram X, Y and Z represent the locations of three friends. Zane is due east of Xavier, and the bearing of Yulia from Xavier is 046°T. 	
(i)	Find the size of $\angle XYZ$ to the nearest minute.	2
	$\begin{aligned} \frac{\sin Y}{18} &= \frac{\sin 44}{22} \\ \sin Y &= \frac{\sin 44 \times 18}{22} \\ Y &= \sin^{-1} \left(\frac{\sin 44 \times 18}{22} \right) \\ &= 34^\circ 38' \end{aligned}$	
(ii)	Find the distance XY correct to 1 decimal place $\begin{aligned} 180 - 34^\circ 38' - 44 &= 101^\circ 22' \\ x^2 &= 18^2 + 22^2 - 2 \times 18 \times 22 \cos(101^\circ 22') \\ &= 964.09... \\ x &= 31.0498... \\ x &= 31.0 \text{ km.} \end{aligned}$	2
(iii)	What is the bearing of Y from Z $46^\circ - 34^\circ 38' = 11^\circ 22' \text{ T}$ Accept 011°T	1

(d)	Simplify completely $28x^7y^2 \div 4x^3y^4$	2
	$\frac{28x^7y^2}{4x^3y^4} = \frac{7x^4}{y^2}$	
(e)	Solve simultaneously $y = 3x - 1$ and $x - 3y = -9$	2
	$x - 3(3x - 1) = -9$ $x - 9x + 3 = -9$ $-8x = -12$ $x = \frac{3}{2}$	1
	$y = 3\left(\frac{3}{2}\right) - 1$ $= \frac{7}{2}$	1
	$\therefore x = \frac{3}{2}, y = \frac{7}{2}$	

End of Question 21

Question 22 (13 marks) – Use a SEPARATE writing booklet.

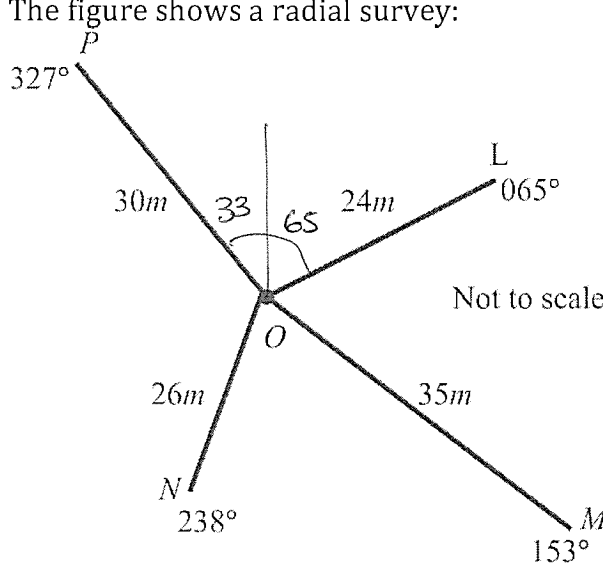
(a)	The time taken T (in seconds) for the length of rope R (metres) to be rotated about a central point is given by the formula $T = \sqrt{\frac{9R}{2.5}}$.	
(i)	Make R the subject of the formula.	1
	$\frac{2.5 \times T^2}{9} = R \quad \text{or} \quad \frac{2.5T^2}{9}$	
(ii)	What is the length of rope if it takes 9 seconds for a single revolution?	1
	$R = \frac{2.5 \times 9^2}{9}$ $= 22.5 \text{ m.}$	

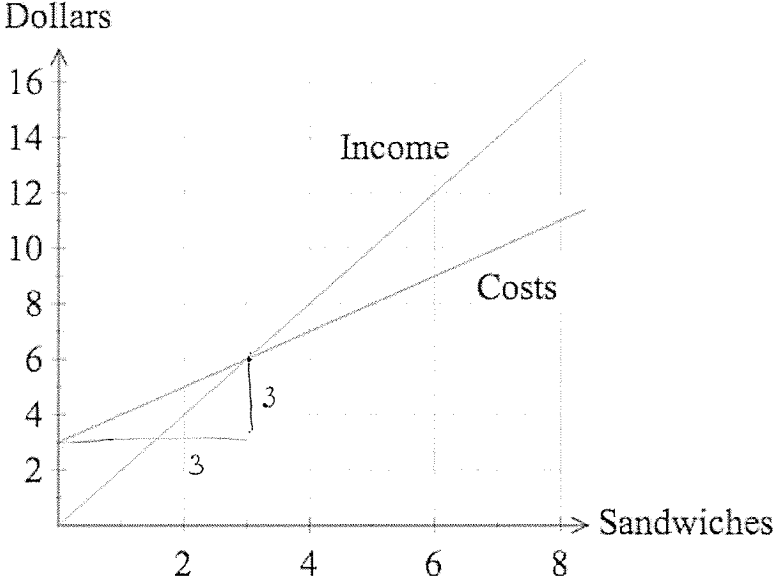
	(iii) What is the time taken for a rope of length 20 metres to complete a revolution? Answer correct to two decimal places. $T = \sqrt{\frac{9K}{2.5}}$ $= \sqrt{\frac{9 \times 20}{2.5}}$ $= 8.495$	1
	(b) Hiccup and Toothless recorded the average number of dragons they saw in their town during the year. The radar chart shows the average number of dragons over the months of the year. 	
	(i) Which month had the most dragons? January.	1
	(ii) The next year Hiccup and Toothless count dragons again. The mean the year before was 24 and the standard deviation was 8.9. This year the values are: 52, 47, 49, 38, 31, 24, 13, 8, 20, 29, 32, 41. Compare the data for both years; you must include the standard deviation and the mean. $\sigma_1 = 8.9$ $\bar{x}_1 = 24$ $\sigma_2 = 13.5$ $\bar{x}_2 = 32$ The second year has a higher mean but larger standard deviation, so its values are more widely spread.	3

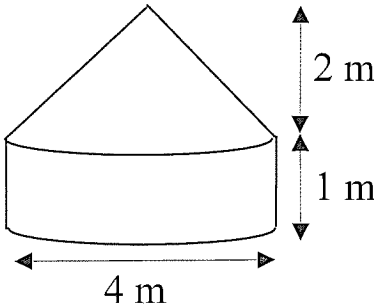
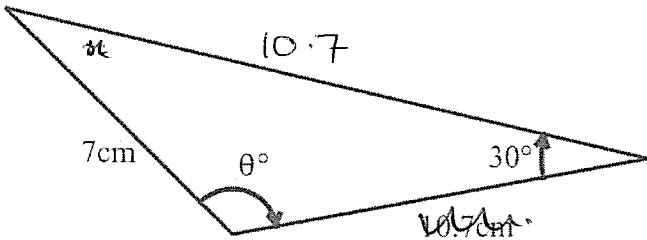
Overall the second year looks better has its lowest score is 8 compared to 10 but its highest score is 52 compared to 38. It has 4 scores higher than this.

			
(c)	Find the area of the following shape: (Note the area of the triangle is given in the diagram)	 $A_1 = \frac{1}{2}h(a+b) \quad A_2 = 8$ $= \frac{1}{2}(6.24)(10.58 - 4.8)$ $= 18.0336$ $18.0336 - 8 = 10.0336 \text{ cm}^2$ 	3
(d)	Find the surface area of the square pyramid, correct to 2 significant figures.	 $SA = 5.2 \times 5.2 + 4 \times \frac{1}{2} \times 10.2 \times 5.2$ $= 27.04 + 4 \times 26.52$ $= 133.12 \text{ m}^2$ 	3

End of Question 22**Question 23** (13 marks) – Use a SEPARATE writing booklet.

(a)	The figure shows a radial survey: 	
(i)	Find the size of $\angle POL$ $65 + 33 = 98^\circ$	1
(ii)	Use the cosine rule to find the length of PL to 2 decimal places. $PL^2 = 30^2 + 24^2 - 2 \times 30 \times 24 \cos 98$ $= 1412.6598...$ $PL = 37.585...$ $PL = 37.59 \text{ m}^2$	2
(iii)	What is the area of $\triangle POL$ (to the nearest m^2) $A = \frac{1}{2} ab \sin C$ $= \frac{1}{2} (30)(24) \sin 98$ $= 356.4965...$ $= 356 \text{ m}^2$	2

(b)	The linear graphs below show the cost of making a sandwich and the income received from selling the sandwiches. 	
(i)	Let the income received be \$$I$ and n the number of sandwiches sold. Write a formula for the income. $I = 2n$	1
(ii)	Let the costs of making a sandwich be \$$C$ and n the number of sandwiches sold. Write a formula for the costs. $C = n + 3$	1
(iii)	How many sandwiches are needed to be sold to break-even? 3 sandwiches.	1
(iv)	What is the loss if 2 sandwiches are sold? \$1 - loss.	1

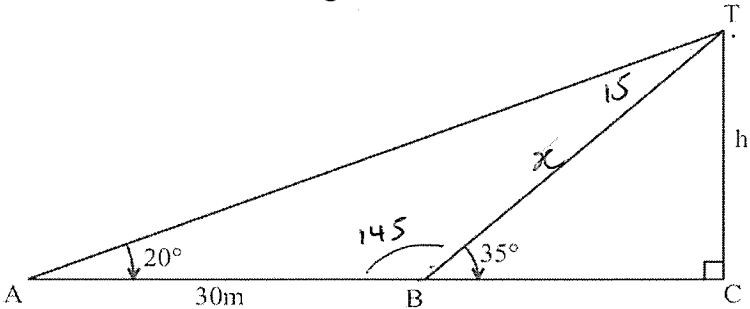
(c)	A solid consists of a cylinder and a cone as shown. What is the volume of the solid correct to one decimal place?  Cylinder = $\pi (2)^2 \times 1$ = 4π (1) Cone = $\frac{1}{3} \pi (2)^2 \times 2$ = $\frac{8\pi}{3}$ (1) Volume = $4\pi + \frac{8\pi}{3}$ (1) = $20.94395..$ = 20.9 m^2	3
(d)	Find the obtuse value of θ in the triangle below.  $\frac{\sin \theta}{10.7} = \frac{\sin 30}{7}$ $\sin \theta = \frac{10.7 \sin 30}{7} = 49.51^\circ$	3

End of Question 23

$$\theta = 180 - 49^\circ 51'$$

$$= 130^\circ 9'$$

Question 24 (13 marks) – Use a SEPARATE writing booklet.

(a)	An observer sights the top of a building at an angle of elevation of 20°. From a point 30m closer to the building, the angle of elevation is 35° as shown in the figure below. 	
(i)	Calculate the size of $\angle ATB$ $180 - 35 = 145^\circ$	1
(ii)	Show that the distance BT can be given by the expression: $BT = \frac{30 \sin 20^\circ}{\sin 15^\circ}$ $x = \frac{30}{\sin 15}$ $x = \frac{30 \sin 20}{\sin 15}$	2
(iii)	In $\triangle TBC$, show that the height of the building can be given by: $h = \frac{30 \sin 20^\circ}{\sin 15^\circ} \times \sin 35^\circ$ $\frac{h}{\sin 35} = \frac{x}{\sin 90}$ $h = x \sin 35$ $= \frac{30 \sin 20}{\sin 15} \times \sin 35$	2
(iv)	Calculate the height of the building to one decimal place. $22.7388 \dots = 22.7 \text{ m}$	1

- (b) A new housing development has opened near a known possum reserve.
- A survey is conducted to determine the number of motor vehicles that pass the reserve each day.
- The results for 60 days have been recorded in the table and are displayed in the cumulative frequency histogram.

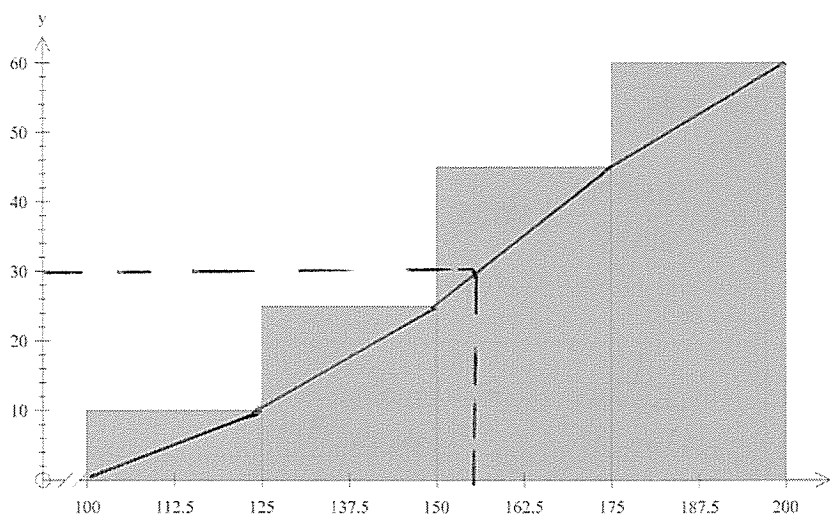
Score	Class Centre	Frequency	Cumulative Frequency
100-124	112	10	10
125-149	137	d	25
150-174	162	20	45
175-199	187	15	60

- (i) Find the value for d in the table.

$$d = 15$$

1

- (ii) Using the cumulative frequency histogram below, draw the ogive and determine the approximate median by drawing on the graph.



approx 156

2

	(iii) Prior to the housing development the median number of cars past the reserve was 35 vehicles per day. What problems could arise with the change in the median number of vehicles around the reserve before and after the housing development? Briefly explain a possible solution to the problem. - More traffic congestion - Squashed possums. - Car accidents for people stopping for possum. - Possum Crossing / Relocate possums	2
(c)	Simplify the following completely: $\frac{7b^3(b+4)}{9a} \div \frac{14(b+4)}{8a^2}$ $\frac{7b^3(b+4)}{9a} \times \frac{8a^2}{14(b+4)}$ $= \frac{ab^3}{9}$	2
(d)	Solve the following equation: $\frac{x}{4} - 2 = 5 - \frac{x-4}{6}$ $6x - 48 = 120 - 4(x-4)$ $6x - 48 = 120 - 4x + 16$ $10x = 120 + 16 + 48$ $10x = 184$ $x = 18.4$	3

End of Question 24