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Student Number

# General Mathematics

2014

## Year 12 Trial

### General Instructions

- Reading time – 5 minutes
- Working time –  $2\frac{1}{2}$  hours
- Write using blue or black pen
- Calculators may be used
- A formula sheet is provided at the back of this paper
- Student Number at the top of each answer booklet and the multiple-choice answer sheet

### Total Marks - 100

#### Section I

Pages 3 -10

#### 25 marks

- Attempt Questions 1 – 22
- Allow about 30 minutes for this section

#### Section II

Pages 11 - 19

#### 75 marks

- Attempt Questions 26 - 30
- Allow about 120 minutes for this section

25 marks

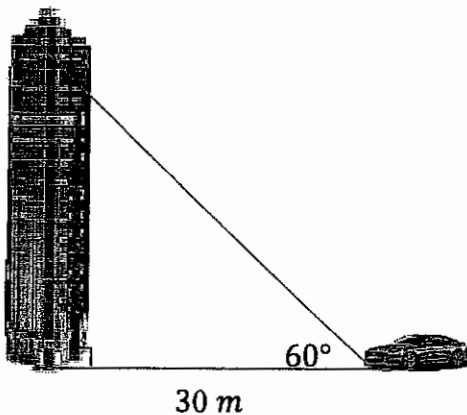
Attempt Questions 1 to 25.

Allow about 30 minutes for this section.

Use the multiple-choice answer sheet for Questions 1-25.

The angle of elevation from a car 30 metres from the base of a building is  $60^\circ$

1.



Calculate the height of the building, to the nearest metre.

- (A) 15 m
- (B) 17 m
- (C) 51 m
- (D) 52 m

2. What is  $12a^8b^4 \div 4a^4c^2$  expressed in its simplest form using positive indices?

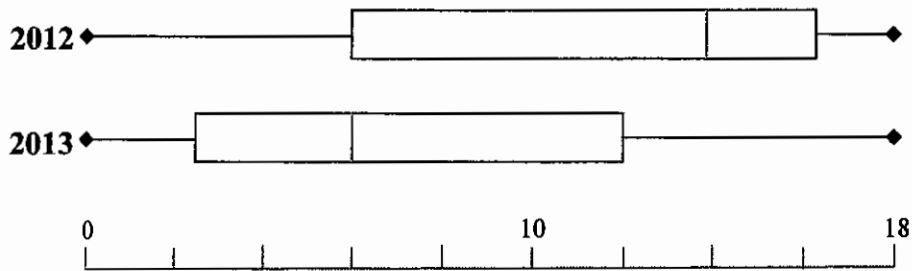
- (A)  $3a^2b^4c^2$
- (B)  $3a^4b^4c^2$
- (C)  $\frac{3a^2b^4}{c^2}$
- (D)  $\frac{3a^4b^4}{c^2}$

3. Simplify fully:

$$\frac{9m^2n^4 \times 4mn^2}{(3mn^3)^2}$$

- (A) 4m
- (B) 6m
- (C) 12m
- (D)  $12m^5n^{12}$

and 2013.



In 2012 there were 1800 trees between 0 – 16 metres. The number of trees in 2012 and 2013 was the same between 0 – 6 metres.

How many trees were there in Reddam Forest in 2013?

- (A) 300
- (B) 600
- (C) 1200
- (D) 2400

5. A car is travelling at 80 km/h. It takes a driver 1.5 second to apply the brakes before coming to a stop.

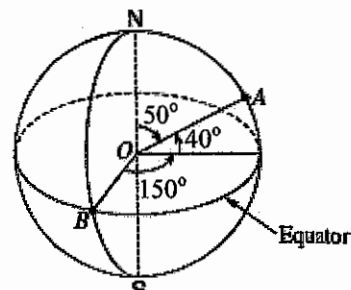
Approximately how far will the car travel in this time?

- (A) 3.3 m
- (B) 22.2 m
- (C) 33.3 m
- (D) 2000 m

6. In the diagram,  $O$  represents the centre of the Earth, and  $B$  lies on the Equator and the Greenwich Meridian (Prime Meridian).

What are the position coordinates of  $A$ .

- (A)  $(150^\circ N, 40^\circ E)$
- (B)  $(150^\circ N, 50^\circ E)$
- (C)  $(50^\circ N, 150^\circ E)$
- (D)  $(40^\circ N, 150^\circ E)$



7.  $2(3x - 4) - 2x + 5 =$

(A)  $4x - 9$

(B)  $3x - 3$

(C)  $4x - 3$

(D)  $4x - 13$

8. Rearrange  $A = \frac{LT^2}{B}$  to make  $T$  the subject.

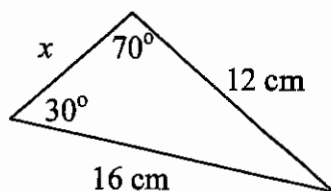
(A)  $T = \frac{A+B}{L}$

(B)  $T = \pm \sqrt{\frac{A+B}{L}}$

(C)  $T = \pm \sqrt{\frac{AB}{L}}$

(D)  $T = \pm \sqrt{AB - L}$

9. Which expression can be used to find  $x$ ,



(A)  $\frac{x}{\sin 30} = \frac{16}{\sin 70}$

(B)  $x^2 = 16^2 + 12^2 + 2(16)(12)\cos 80$

(C)  $\frac{x}{\sin 80} = \frac{12}{\sin 30}$

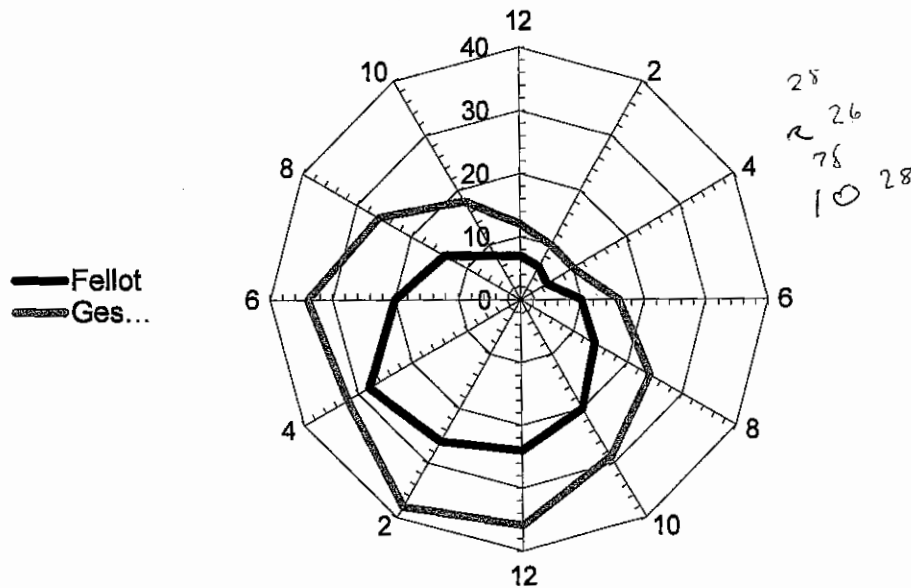
(D)  $x = \frac{1}{2}(16)(12)\sin 80$

10. In the half yearly examination Harry sat for six papers and the mean of his marks was 45 with a standard deviation of 10. In the yearly examination he improved by 10 marks on every paper, compared to the half yearly. What would be the effect of this on the mean and standard deviation of his yearly marks compared to the half yearly?

- (A) The mean and standard deviation will both be the same.
- (B) The mean will be the same and the standard deviation will increase.
- (C) The mean will increase and the standard deviation will be the same.
- (D) The mean and standard deviation will both increase.

11. The radar chart shows a comparison between the temperatures at two towns on the same day. Which statement is true about the temperatures?

Temperature comparison between two towns.



- (A) Gessey has a greater mean and greater range.
- (B) Fellot has a greater mean and greater range.
- (C) Gessey and Fellot have the same mean and range.
- (D) Gessy has a greater mean but Fellot has a greater range.

12. A locker at an airport has a code made up of a letter followed by 4 numbers.

For example valid codes could be:

**A-0008**

**P-1981**

Which expression below gives the total number of different codes?

- (A)  $10 \times 9 \times 8 \times 7$
- (B)  $10 \times 10 \times 10 \times 10$
- (C)  $26 \times 10 \times 10 \times 10 \times 10$
- (D)  $26 \times 10 \times 9 \times 8 \times 7$

13. A hemisphere has a surface area equal to  $27\pi \text{ cm}^2$ .

Its volume would be equal to?.

- (A)  $\frac{9\pi}{2}$
- (B)  $9\pi$
- (C)  $18\pi$
- (D)  $27\pi$

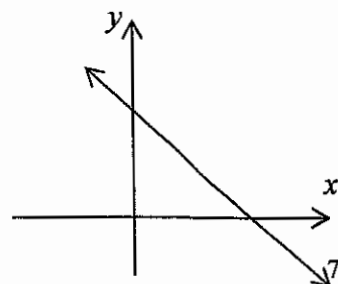
14. A score of 8 is added to the scores 65, 56, 70, 68, 68, 59 and 67.

Which measure of central tendency would be greatest affected by the new score?

- (A) mean
- (B) mode
- (C) range
- (D) median

15. Which equation best describes the graph drawn below.

- (A)  $y = 7x - 2$
- (B)  $y = 7x + 2$
- (C)  $y = -7x - 2$
- (D)  $y = -7x + 2$



16. A box contains 8 cherry ripens and 4 mars bars. If two are taken from the box and eaten, which expression would give the probability that both chocolates were different?

(A)  $P(\text{different}) = \left(\frac{8}{12} \times \frac{4}{12}\right) + \left(\frac{7}{12} \times \frac{3}{12}\right)$

(B)  $P(\text{different}) = \left(\frac{8}{12} \times \frac{4}{12}\right) + \left(\frac{4}{12} \times \frac{12}{12}\right)$

(C)  $P(\text{different}) = \left(\frac{8}{12} \times \frac{4}{11}\right) + \left(\frac{4}{12} \times \frac{8}{11}\right)$

(D)  $P(\text{different}) = \left(\frac{8}{12} \times \frac{4}{12}\right) + \left(\frac{7}{12} \times \frac{3}{12}\right)$

17. On Monday at 5:00 am local time in Sydney (150°E), an email is sent to Mr Palmer in Rio de Janiero (45°W).

At what local time in Rio de Janiero should the email arrive? ( It arrives instantaneously )

(A) 3:00 pm Sunday

(B) 4:00 pm Sunday

(C) 7:00 am Tuesday

(D) 3:00 pm Tuesday

18. Michael worked the number of hours shown in the table below.

<b>Hours worked</b>			
<b>Employee</b>	<b>Normal hours</b>	<b>Hours at time and a half</b>	<b>Gross wage</b>
Michael	35	4	\$594.50

According to the information in the table, what was the hourly rate Michael was paid.

(A) \$19.84

(B) \$15.24

(C) \$13.82

(D) \$14.50

19. Joel bought a 2010 Nissan skyline. The fuel tank, when full to capacity holds 68 litres of petrol. His car consumes 8.4 L/100km on a trip.

How many kilometres can Joel's car travel on one full tank of petrol?

- (A) 8 km
- (B) 571 km
- (C) 810 km
- (D) 6800 km

20. Bradley works for RH Hard Drives, where he checks every 10<sup>th</sup> hard drive that is made.

This is an example of what type of a survey?

- (A) Random
- (B) Systematic
- (C) Stratified
- (D) Census

21. A die is rolled 60 times.

How many numbers greater than 4 would you expect?

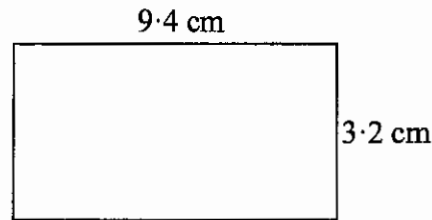
- (A) 4
- (B) 6
- (C) 12
- (D) 18

22. Kelsey bought a car three years ago. It now has a salvage value of \$18500 and it depreciated \$1200 each year. How much did she pay for the car?

- (A) \$14900
- (B) \$19700
- (C) \$20900
- (D) \$22100



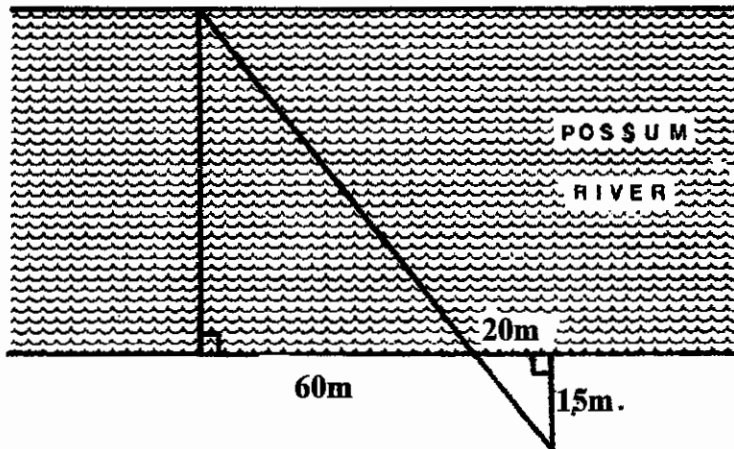
23. The following diagram shows the dimensions of a rectangle correct to nearest millimetre.



The true area of the rectangle would lie between: (2 decimal places)

- (A)  $29.77\text{cm}^2$  and  $30.71\text{cm}^2$
- (B)  $29.45\text{cm}^2$  and  $30.71\text{cm}^2$
- (C)  $29.45\text{cm}^2$  and  $30.39\text{cm}^2$
- (D)  $29.77\text{cm}^2$  and  $30.39\text{cm}^2$

24.



To find the width of Possum River, the measurements shown were made. The width of the river is:

- (A) 45m
- (B) 60m
- (C) 70m
- (D) 80m

25. Convert  $4\text{ m/s}$  to  $\text{km/h}$ , correct to one decimal place.

- (A)  $1.4\text{ km/h}$
- (B)  $14.4\text{ km/h}$
- (C)  $16.6\text{ km/h}$
- (D)  $24.3\text{ km/h}$

**General Mathematics**

75 marks

Attempt Questions 26-30

Allow about 2 hours for this part

Answer each question in the appropriate writing booklet. Extra writing booklets are available.  
All necessary working should be shown in every question.

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**Question 26 (15 marks)    Start a new examination booklet.    Marks**

(a) Carla and Maya are staying at two different holiday resorts that both lie on the equator. Carla is at one that lies on the meridian of longitude  $80^{\circ}\text{W}$  and Maya is at the other which lies on the meridian of longitude  $130^{\circ}\text{E}$

(i) State the longitudinal difference between the two girls. 1

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(ii) Calculate the **shortest** distance between the girls to the nearest kilometre. 2

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(iii) Calculate the time difference between Carla and Maya. 2

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(iv) Carla catches a helicopter flight which flies straight to the resort where Maya is waiting. If the time and date when Carla leaves is 10.00 pm on Wednesday, 9<sup>th</sup> September, and the flight takes 16 hours and 20 minutes, at what time and on what day did the helicopter arrive at Maya's resort? 3

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(b) Two friends sit the same test at school. The test has a mean of 58 and a standard deviation equal to 8.

(i) Bradley gets a score of 64. What is his z-score? 1

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(ii) Matthew gets a z score of -0.5. What is his score? 1

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(iii) Assuming the test scores are normally distributed what percentage of students will score between 50 and 66? 1

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(iv) <sup>50</sup>~~30~~ students sat the test all together. 1  
How many of them would be expected to have achieved a score over 66?

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(c) Anton, Jamie, Michael, Joel, Christian, Kelsey, Tina and Simone, make up 8 players on a mixed basketball team.

(i) How many ways can the starting 5 be selected? **1**

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(ii) How many ways can the 8 players line up in a straight line to get a photo before the game starts? **1**

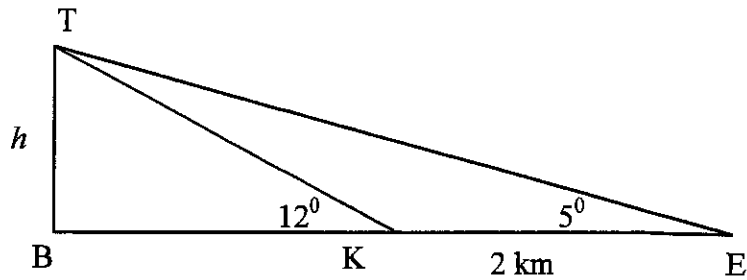
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(iii) How many ways can a captain and vice-captain be selected from the 8 players? **1**

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- (a) A ship is  $x$  kilometres out to sea from the base of a cliff. The angle of elevation from the ship at this point E is  $5^\circ$ . After the ship has sailed 2 km towards the cliff to a point K, the angle of elevation is  $12^\circ$ .

NOT TO SCALE



Calculate the height of the cliff, correct to decimal places.

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- (b) A machine produces metal bolts that have a mean length 150 mm with standard deviation 0.5 mm. The lengths are distributed normally. If rods are more than 2 standard deviations from the mean, they are rejected.

- (i) If 4000 metal bolts are produced during a working day, how many of these will be rejected?

1

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- (ii) What is the probability that a rod chosen at random will have a length between 149.5 mm and 151 mm?

1

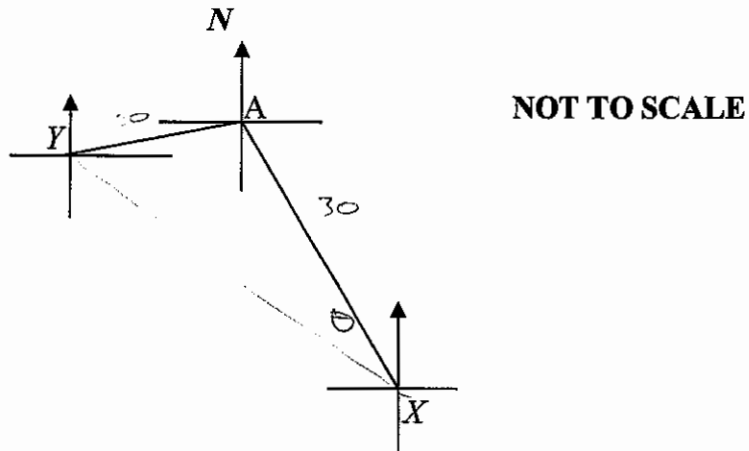
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- (c) Two cars leave from the same location  $A$ .  
 Car 1 travels for 30 km to a point  $X$  on a bearing of  $160^\circ$  T.  
 Car 2 travels 20 km to a point  $Y$  on a bearing of  $265^\circ$  T.

- (i) Complete the diagram showing this information.

1



- (i) Show that  $\angle YAX = 105^\circ$ .

1

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- (ii) How far apart are the two cars, correct to 1 decimal place?

2

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- (iii) Find the bearing of car 2 from car 1.

Give your answer to the nearest degree.

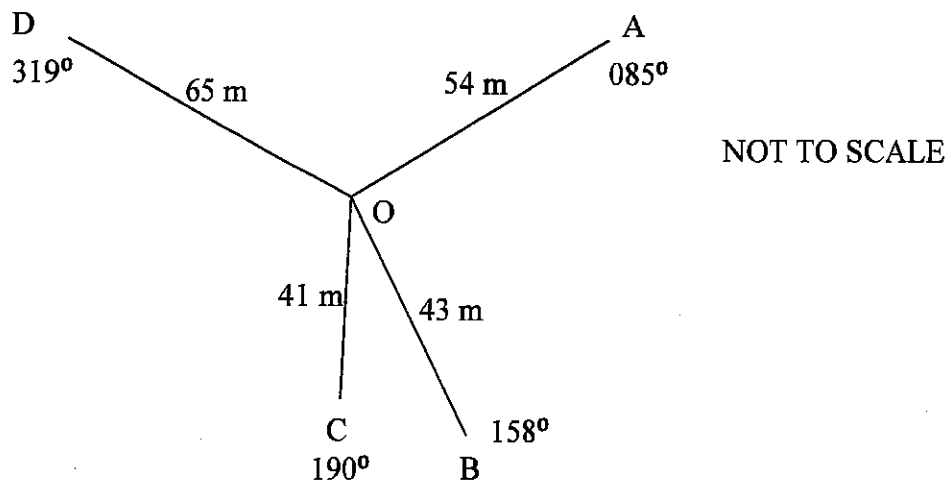
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(a) The following sketch was made during a radial survey of a field.



- (i) What is the size of  $\angle BOC$ ? 1

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- (ii) Calculate the area of  $\triangle BOC$  correct to the nearest square metre. 2

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- (e) Marie is a marine biologist who needs to estimate the number of fish in a lake. She caught 120 fish, tagged them and returned them to the lake. Later, she caught 180 fish from the lake and found that 42 were tagged. Estimate the fish population in the lake. 1

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- (a) Sophie's Delicious Muffins makes muffins for parties.  
Her fixed monthly costs of \$800 plus \$1 to produce each muffin.

Sophie sells each muffin for \$3. She is able to produce 1000 muffins a month.

- (i) Complete the following tables for each of the equations.

2

**Cost of producing the caps:**  $C = 800 + n$

$n$	0	100	400	800	1000
$C$	\$800		\$1200	\$1600	

**Income from the sale of caps:**  $I = 3n$

$n$	100	300	500	700	900
$I$	\$300		\$1500		\$2700

- (ii) Draw neat graphs of the graphs in (i) on the grid paper provided. (Page 30)

2

- (iii) How many muffins does Sophie have to sell to break even?

2

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- (iii) How many muffins does Sophie have to sell to make a profit of \$1100 per month?

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(b) The results of a pre-test on trigonometry out of 30 was recorded below

8 10 12 18 16 8 10 6

After the topic on trigonometry was concluded, the students were given another test and the results are shown below.

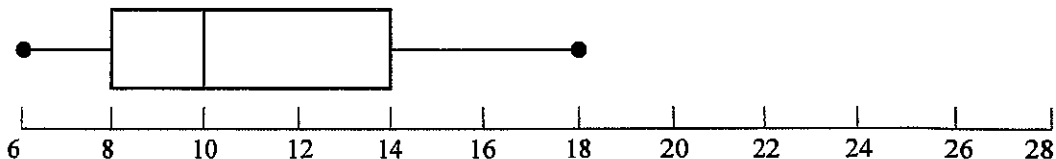
20 24 22 28 25 12 20 18

- (i) Draw a box-and-whisker plot for the results recorded **after** they had completed the topic on trigonometry, above the box and whisker plot below.

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**Post-test Result.**

**Pre-test Result.**



- (ii) Compare and contrast the data collected, making reference to the shape, location and spread.

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(c) Mia bought a new SUV, it was a Audi A\$ valued at \$80 000.

In addition to the purchase price, there are the following costs:

- Dealer delivery cost: \$1800
- Compulsory third-party insurance \$698
- Registration \$378
- Comprehensive insurance \$1755
- Stamp duty calculated at,
  - 2% of the value of the car up to and including \$50 000
  - Plus 5% of the value of the car over \$45 000.

Calculate the amount that Mia will need to pay for her new car before she can drive it out of the showroom.

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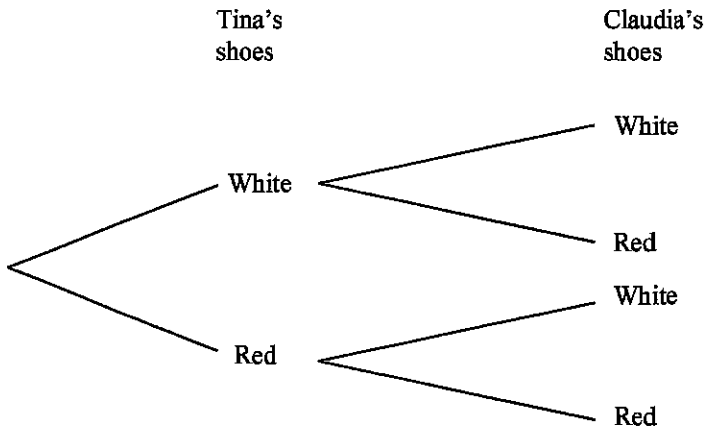
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(a) Tina and Claudia are getting ready for a party. Tina has 4 pairs of white shoes and 3 pairs of red shoes. Tina selects a pair of shoes to wear and then lets Claudia select a pair to wear.

(i) What is the probability that Tina selects a red pair to wear? 1

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(ii) Complete the tree diagram by writing the correct probability on each branch. 1



(iii) Calculate the probability that both girls select the same coloured shoes. 2

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(b) Young's rule for calculating the amount of medicine a child (up to 2 years) can receive is:

$$Child\ dosage = \frac{age\ in\ years}{age\ in\ years + 12} \times adult\ dosage.$$

Harry has an 18 month old son who weighs 15 kg.

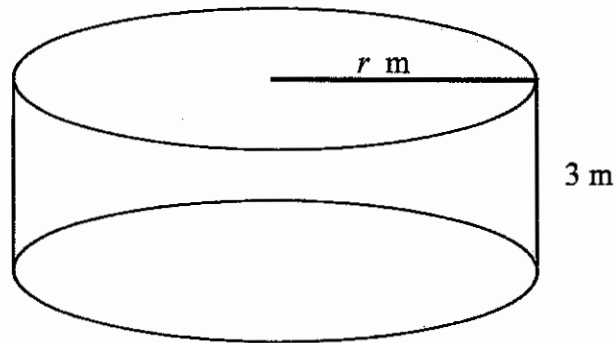
The adult dosage of a drug prescribed for him is 300 g.

Calculate the dosage Harry should give his son. 1

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- (c) A new house is being built on a country property. Town water cannot be supplied and the owners need to have a tank to store and supply their water. The water is collected from rain that runs off the roof of the house.

The capacity of the tank is 140,000 Litres and the house has a roof area of  $600 \text{ m}^2$ .



- (i) Express 140,000 L in cubic metres. [1,000L =  $1 \text{ m}^3$ ] 1

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- (ii) Calculate the radius of the tank if the height of the tank is 3 m, correct to decimal places. 2

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- (iii) If 100 mm of rain falls on the roof and is collected in the tank, by how much will the water level rise in the tank? (Answer correct to the nearest cm). 2

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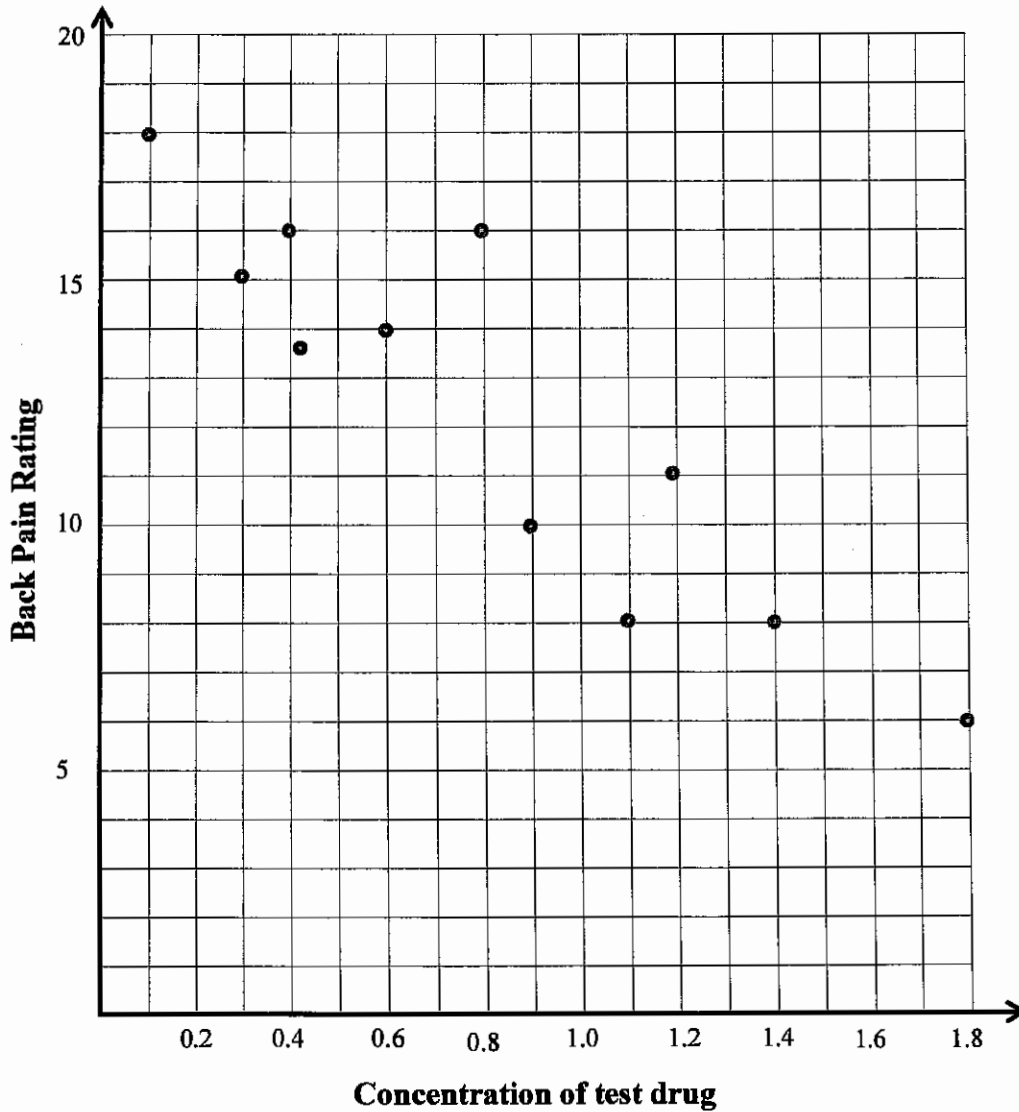
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(d) Patients experiencing back pain were asked to participate in a trial of a new drug. 10 patients were all given a different concentration of the drug being tested. After a period of 10 minutes, the patients were asked to rate the intensity of their back pain, using a scale of 0 – 20 , where 0 equals no back pain being experienced and 20 meaning their back pain was unchanged. A table of the results are shown below.

Concentration of new drug	0.1	0.3	0.4	0.6	0.8	0.9	1.1	1.2	1.4	1.8
Back pain rating (0-20)	18	15	16	14	16	10	8	12	8	6



i. Use your calculator to find the following values:

2

a.  $r =$

b.  $\sigma_x =$

c.  $\sigma_y =$

d.  $\bar{x} =$

e.  $\bar{y} =$

ii. Use the information obtained in part (i) to find the equation of the 'least squares of fit.' **2**

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iii. By taking suitable values, draw the "least – squares line of fit" on the graph given in the question. **1**

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**Question 30 ( 15 Marks)**

(a) The human body is made up of bone, muscle and fat/organs in the ratio 3 : 7 : 10.

(i) Cameron has a mass of 95kg. What was the mass of his muscles? **1**

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(ii) Maya's body has 28 kg of muscles. What does she weigh? **1**

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(b) Lewis was admitted to hospital with a mysterious illness. He was prescribed 300 millilitres of fluid per hour. Fluid is supplied via an intravenous drip at a constant rate.

(i) How many litres of fluid are needed per day for this patient? **1**

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(ii) If 1 ml of fluid contains 15 drops, how many drops are needed each hour? **1**

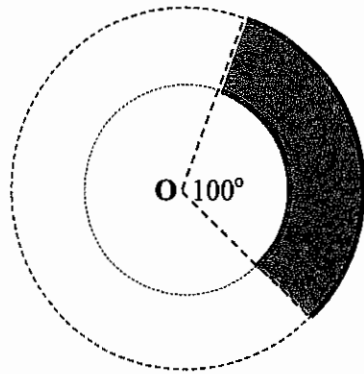
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(iii) What is the drip rate (in drops per minute) if the drip runs for 6 hours? **1**

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(c) Calculate the area of the shaded region, correct to 2 decimal places.

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O is the centre of both circles.  
The larger circle has a radius of  $12\pi$  cm.  
The smaller circle has a radius of  $8\pi$  cm.

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(d) Simone has 5 people living in her household. Each person uses 240L of water a day on average. Current water prices are \$2.18 per kilolitre (kL).

They agree as a household to reduce their water usage by 5%.

How much will they save per year?

2

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- (e) A drunk driver takes 4 seconds to react to a dangerous situation.  
If he was travelling at 90 km/h, approximately how far will the car travel in this time? **2**

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- (f) The purchases bought on Joel's credit card are shown below in the table.

**This Month's Activity:**

TRANSACTION DATE	TRANSACTION DESCRIPTION	AMOUNT
10/04/2014	New shoes	\$250
19/04/2014	Laura's sporting apparel	\$89

The credit card charges simple interest at a rate of 18.75% per annum.  
There is a no interest free period on the card. The period for which interest was charged **included** the date of purchase and the date of payment.

Calculate the amount that Joel needs to be pay, if the account is paid in full on the 16 of May.

**3**

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FORMULAE AND DATA SHEET

**Financial Mathematics**

**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

**Data Analysis**

**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

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

$\theta$  is number of degrees in central angle

Radius of Earth

(taken as) 6400 km

Time differences

For calculation of time differences using longitude:

$15^\circ = 1$  hour time difference

### Area

Circle

$$A = \pi r^2$$

$r$  is radius

Sector

$$A = \frac{\theta}{360} \pi r^2$$

$r$  is radius

$\theta$  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:  $1 \text{ ha} = 10\,000 \text{ m}^2$

## Surface Area

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

### Volume

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:  $1 \text{ m}^3 = 1000 \text{ L}$

### 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

$$V = \frac{h}{3}\{A_L + 4A_M + A_R\}$$

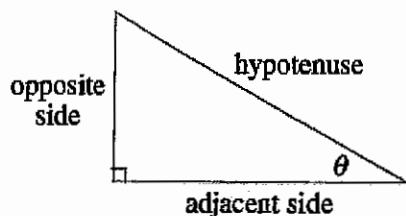
$h$  is distance between successive measurements

$A_L$  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 rule

In  $\triangle ABC$ ,

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

### Area of a triangle

In  $\triangle ABC$ ,

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

### Cosine rule

In  $\triangle ABC$ ,

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

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

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

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

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

## 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

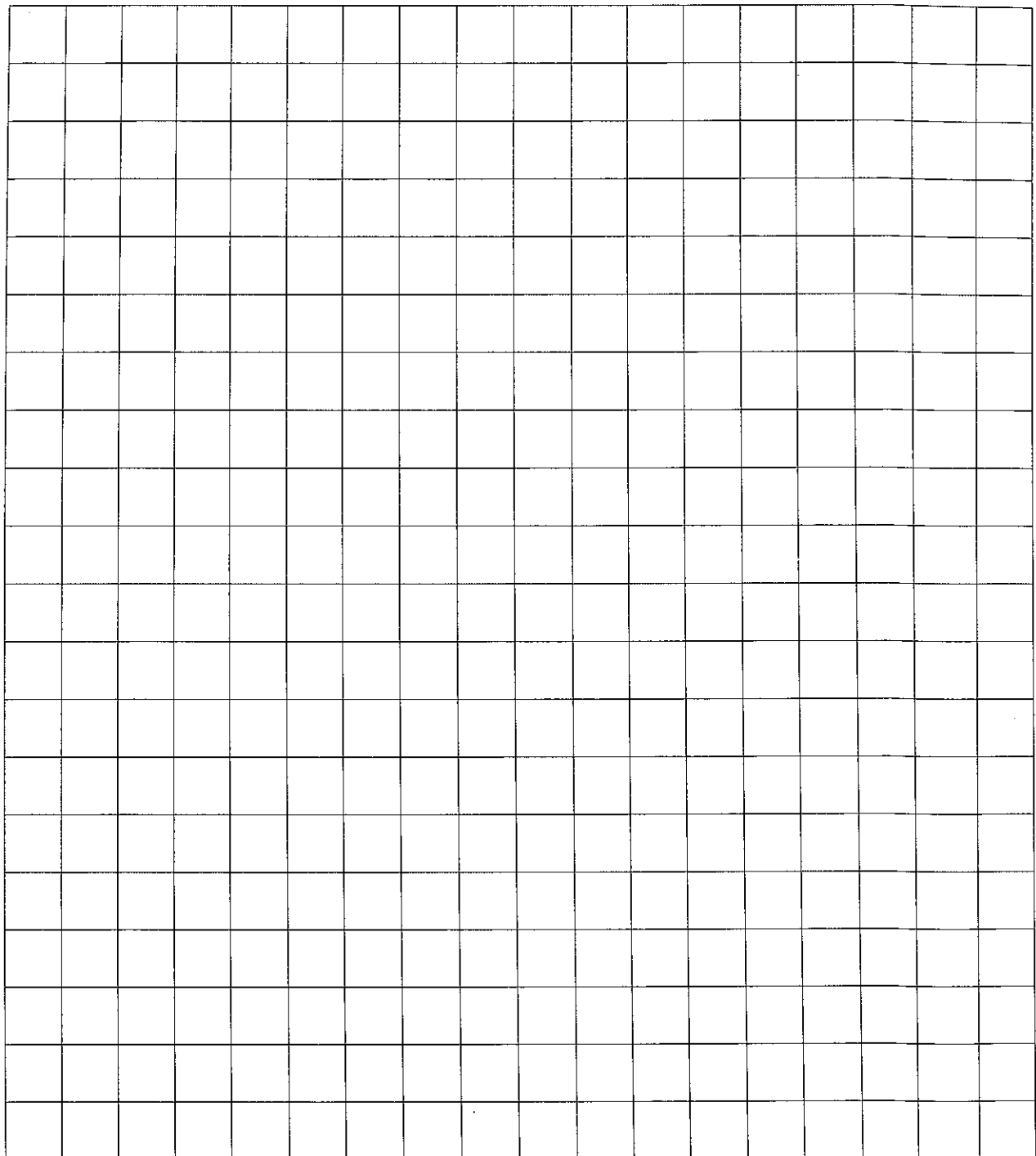
$$y = mx + b$$

$m$  is gradient

$b$  is y-intercept

**Question 28**

(a) ii.



- |     |                         |                         |                         |                         |
|-----|-------------------------|-------------------------|-------------------------|-------------------------|
| 1.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 2.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 3.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 4.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 5.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 6.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 7.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 8.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 9.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 10. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 11. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 12. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 13. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 14. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 15. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 16. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 17. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 18. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 19. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 20. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 21. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 22. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 23. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 24. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 25. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |



2014 YEAR 12 Pre Trial  
GENERAL MATHEMATICS – MULTIPLE CHOICE ANSWER SHEET

- 1.            A         B         C         D
- 2.            A         B         C         D
- 3.            A         B         C         D
- 4.            A         B         C         D
- 5.            A         B         C         D
- 6.            A         B         C         D
- 7.            A         B         C         D
- 8.            A         B         C         D
- 9.            A         B         C         D
- 10.           A         B         C         D
- 11.           A         B         C         D
- 12.           A         B         C         D
- 13.           A         B         C         D
- 14.           A         B         C         D
- 15.           A         B         C         D
- 16.           A         B         C         D
- 17.           A         B         C         D
- 18.           A         B         C         D
- 19.           A         B         C         D
- 20.           A         B         C         D
- 21.           A         B         C         D
- 22.           A         B         C         D
- 23.           A         B         C         D
- 24.           A         B         C         D
- 25.           A         B         C         D

ANSWER IS "20-times"

**General Mathematics**

75 marks

Attempt Questions 26-30

Allow about 2 hours for this part

Answer each question in the appropriate writing booklet. Extra writing booklets are available.  
All necessary working should be shown in every question.

**Question 26 (15 marks) Start a new examination booklet.**

**Marks**

- (a) Carla and Maya are staying at two different holiday resorts that both lie on the equator. Carla is at one that lies on the meridian of longitude  $80^\circ\text{W}$  and Maya is at the other which lies on the meridian of longitude  $130^\circ\text{E}$

- (i) State the longitudinal difference between the two girls. 1

$$210^\circ \text{ OR } 150^\circ$$

- (ii) Calculate the **shortest** distance between the girls to the nearest kilometre. 2

$$d = \frac{150}{360} \times 2 \times \pi \times 6450$$

$$= 16755 \text{ km}$$

- (iii) Calculate the time difference between Carla and Maya. 2

MAYA IS 14 hrs AHEAD OF CARLA.

- (iv) Carla catches a helicopter flight which flies straight to the resort where Maya is waiting. If the time and date when Carla leaves is 10.00 pm on Wednesday, 9<sup>th</sup> September, and the flight takes 16 hours and 20 minutes, at what time and on what day did the helicopter arrive at Maya's resort? 3

10pm WEDNESDAY  $\rightarrow$  2:20pm THURSDAY

$$\text{Plus } 210^\circ \div 15 = 14 \text{ Hours}$$

$$2:20 \text{ pm THURSDAY} + 14 \text{ HRS}$$

$$= 4:20 \text{ AM FRIDAY}$$



(b) Two friends sit the same test at school. The test has a mean of 58 and a standard deviation equal to 8.

(i) Bradley gets a score of 64. What is his z-score? 1

$$z = \frac{64 - 58}{8}$$

$$= 0.75$$

(ii) Matthew gets a z score of -0.5. What is his score? 1

$$x = 54$$

(iii) Assuming the test scores are normally distributed what percentage of students will score between 50 and 66? 1

$$68\%$$

(iv) <sup>50</sup>~~30~~ students sat the test all together. 1  
How many of them would be expected to have achieved a score over 66?

$$16\% \text{ of } 50$$

$$= 8$$

(c) Anton, Jamie, Michael, Joel, Christian, Kelsey, Tina and Simone, make up 8 players on a mixed basketball team.

- (i) How many ways can the starting 5 be selected? 1

$${}^8C_5 = 56$$

---

---

- (ii) How many ways can the 8 players line up in a straight line to get a photo before the game starts? 1

$$8! = 40320$$

---

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- (iii) How many ways can a captain and vice-captain be selected from the 8 players? 1

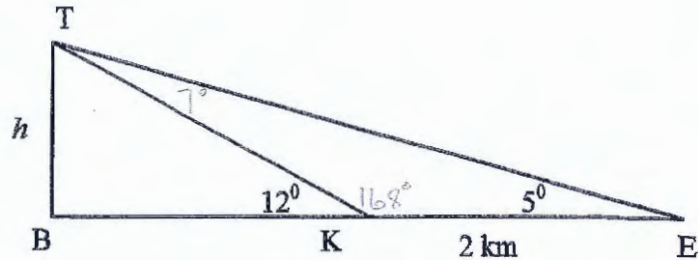
$$8 \times 7 = 56$$

---

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- (a) A ship is  $x$  kilometres out to sea from the base of a cliff. The angle of elevation from the ship at this point E is  $5^\circ$ . After the ship has sailed 2 km towards the cliff to a point K, the angle of elevation is  $12^\circ$ .

NOT TO SCALE



Calculate the height of the cliff, correct to decimal places.

3

$$\frac{TK}{\sin 5^\circ} = \frac{2}{\sin 7^\circ}$$

$$TK = \frac{2}{\sin 7^\circ} \times \sin 5^\circ$$

$$= 1.43 \text{ km}$$

$$\therefore \frac{h}{TK} = \sin 12^\circ \rightarrow h = \sin 12^\circ \times 1.43$$

$$= 0.30 \text{ km}$$

- (b) A machine produces metal bolts that have a mean length 150 mm with standard deviation 0.5 mm. The lengths are distributed normally. If rods are more than 2 standard deviations from the mean, they are rejected.

- (i) If 4000 metal bolts are produced during a working day, how many of these will be rejected?

1

$$2.5\% \times 4000 = 100$$

- (ii) What is the probability that a rod chosen at random will have a length between 149.5 mm and 151 mm?

1

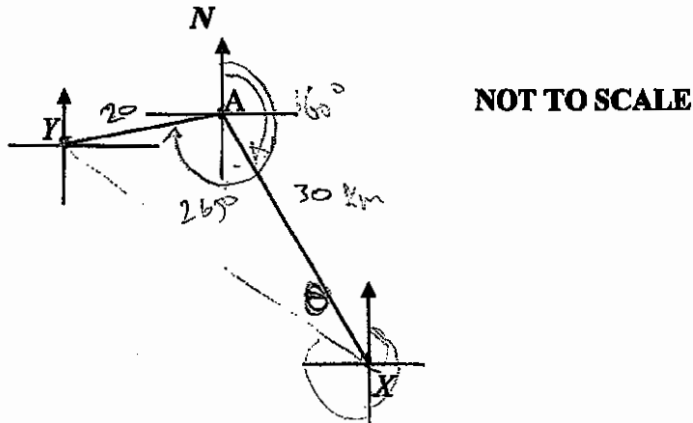
$$0.815$$

(c) Two cars leave from the same location  $A$ .

Car 1 travels for 30 km to a point  $X$  on a bearing of  $160^\circ$  T.

Car 2 travels 20 km to a point  $Y$  on a bearing of  $265^\circ$  T.

(i) Complete the diagram showing this information. 1



(i) Show that  $\angle YAX = 105^\circ$ . 1

$$265 - 160 = 105^\circ$$

(ii) How far apart are the two cars, correct to 1 decimal place? 2

$$x^2 = 20^2 + 30^2 - 2 \times 20 \times 30 \times \cos 105^\circ$$

$$x = 40.1320 \dots$$

$$\therefore XY = 40.1 \text{ km (to 1 d.p.)}$$

(iii) Find the bearing of car 2 from car 1.

Give your answer to the nearest degree.

$$360 - 20 - \theta \longrightarrow$$

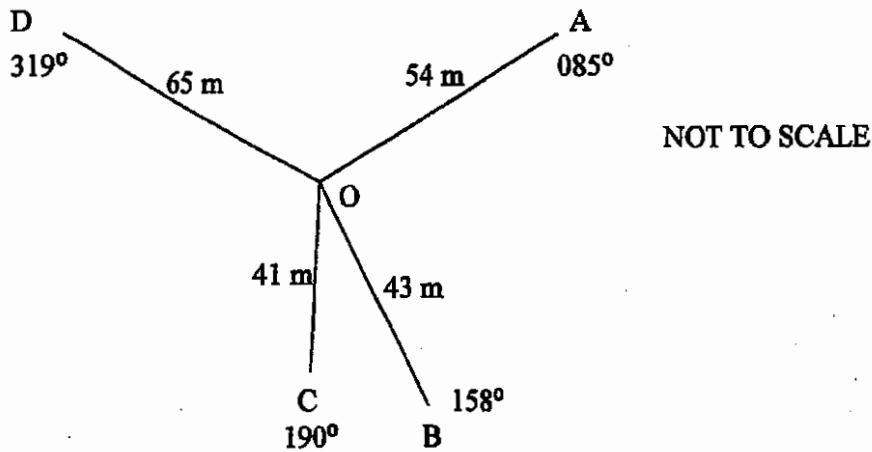
$$= 360 - 20 - 29$$

$$= 311^\circ \text{ T}$$

$$\cos \theta = \frac{40.1^2 + 30^2 - 20^2}{2 \times 40.1 \times 30}$$

$$\theta \doteq 29^\circ$$

(a) The following sketch was made during a radial survey of a field.



(i) What is the size of  $\angle BOC$ ?

1

$$\angle BOC = 190 - 158 = 32^\circ$$

(ii) Calculate the area of  $\triangle BOC$  correct to the nearest square metre.

2

$$A = \frac{1}{2} \times 41 \times 43 \times \sin 32^\circ$$

$$\approx 467 \text{ m}^2$$

(e) Marie is a marine biologist who needs to estimate the number of fish in a lake. She caught 120 fish, tagged them and returned them to the lake. Later, she caught 180 fish from the lake and found that 42 were tagged. Estimate the fish population in the lake.

1

$$\frac{120}{?} = \frac{42}{180}$$

$$\frac{120 \times 180}{42} = ?$$

About 514

16

- (a) Sophie's Delicious Muffins makes muffins for parties.  
Her fixed monthly costs of \$800 plus \$1 to produce each muffin.

Sophie sells each muffin for \$3. She is able to produce 1000 muffins a month.

- (i) Complete the following tables for each of the equations.

2

Cost of producing the caps:  $C = 800 + n$

$n$	0	100	400	800	1000
$C$	\$800		\$1200	\$1600	

Income from the sale of caps:  $I = 3n$

$n$	100	300	500	700	900
$I$	\$300		\$1500		\$2700

- (ii) Draw neat graphs of the graphs in (i) on the grid paper provided. (Page 30)

2

- (iii) How many muffins does Sophie have to sell to break even?

2

$$400$$

$$C = 800 + 400 = 1200$$

$$I = 3 \times 400 = 1200$$

- (iii) How many muffins does Sophie have to sell to make a profit of \$1100 per month?

2

$$\text{Profit} = I - \text{cost}$$

$$1100 = 3n - (800 + n)$$

$$1100 = 2n - 800$$

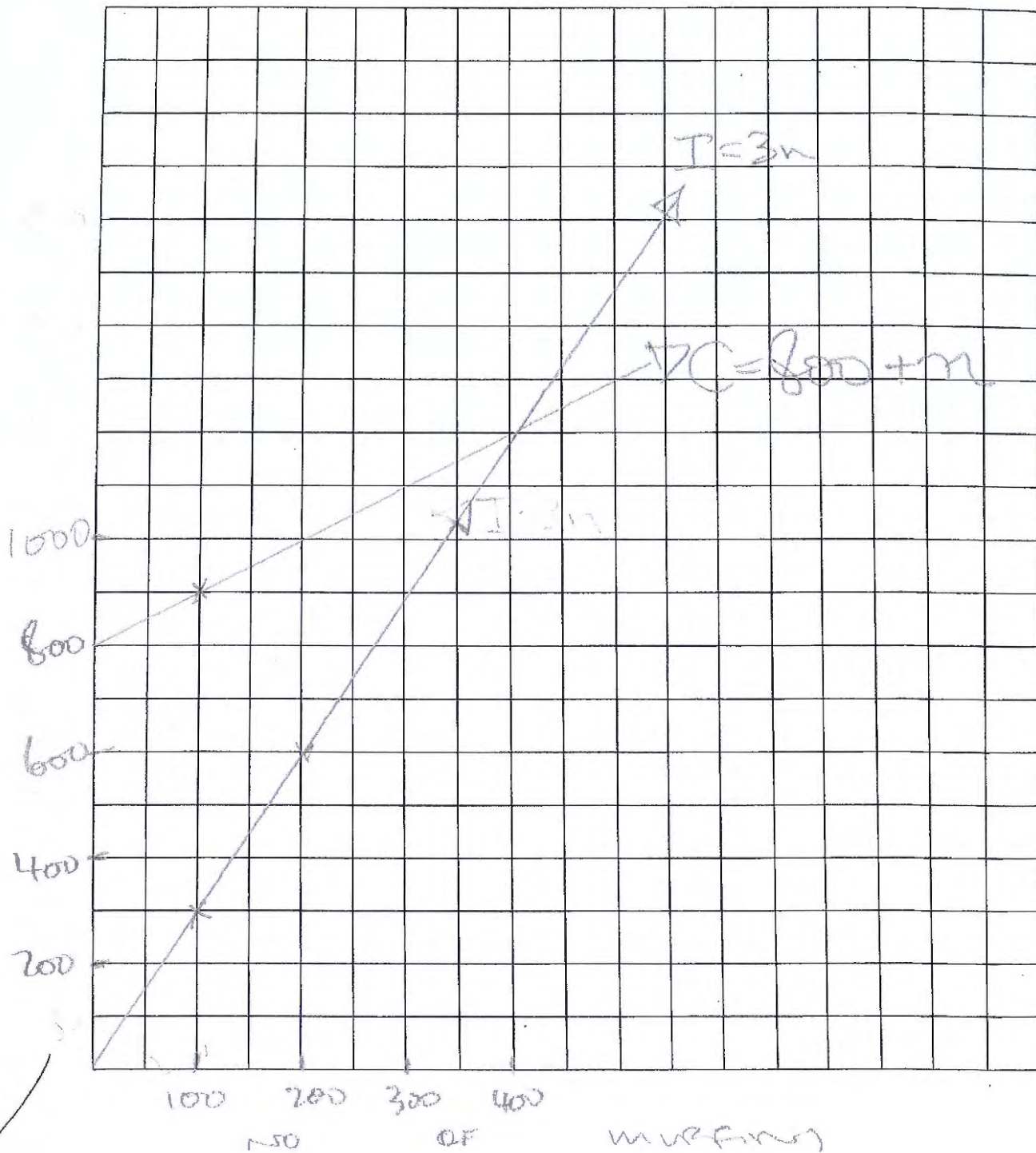
$$1900 = 2n$$

$$n = 950$$



Question 28

(a) ii.



(b) The results of a pre-test on trigonometry out of 30 was recorded below

8 10 12 18 16 8 10 6  
 6 8 8 10 10 12 16 18

After the topic on trigonometry was concluded, the students were given another test and the results are shown below.

20 24 22 28 25 12 20 18  
 12 18 20 20 22 24 25 28

- (i) Draw a box-and-whisker plot for the results recorded **after** they had completed the topic on trigonometry, above the box and whisker plot below.

2

Post-test Result.



Pre-test Result.



- (ii) Compare and contrast the data collected, making reference to the shape, location and spread.

3

THE POST RESULTS HAD A HIGHER  
 MEDIAN AND INTERQUARTILE RANGE  
 SO THE POST MARKS IN GENERAL  
 WERE HIGHER BUT MORE SPREAD  
 THE PRE MARKS WERE POSITIVELY  
 SKEWED.



(c) Mia bought a new SUV, it was a Audi A\$ valued at \$80 000.

In addition to the purchase price, there are the following costs:

- Dealer delivery cost: \$1800
- Compulsory third-party insurance \$698
- Registration \$378
- Comprehensive insurance \$1755
- Stamp duty calculated at,
  - 2% of the value of the car up to and including \$50 000
  - Plus 5% of the value of the car over \$50 000

Calculate the amount that Mia will need to pay for her new car before she can drive it out of the showroom.

2

$$\begin{array}{r} \$80\,000 + \\ \hline 1\,800 + \\ \hline 698 + \\ \hline 378 + \\ \hline 1755 \\ \hline \underline{84\,631} + 2\,500 = \underline{\underline{\$87\,131}} \end{array}$$

*Stamp duty*  
 $= \frac{2}{100} \times 50\,000 + \frac{5}{100} \times 30\,000$   
 $= \$2\,500$

**Question 29 (15 Marks)**

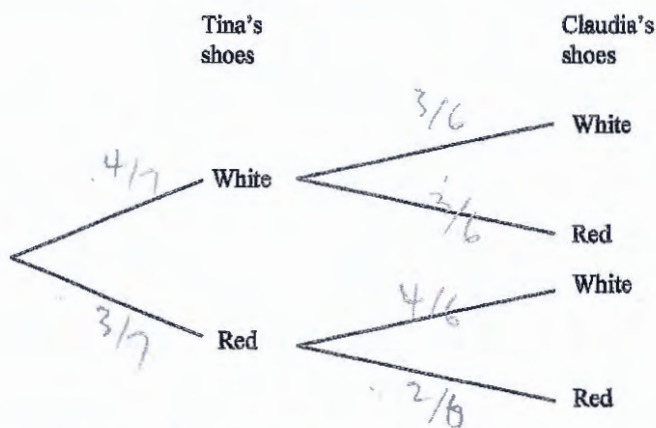
(a) Tina and Claudia are getting ready for a party. Tina has 4 pairs of white shoes and 3 pairs of red shoes. Tina selects a pair of shoes to wear and then lets Claudia select a pair to wear.

- (i) What is the probability that Tina selects a red pair to wear? 1

$\frac{3}{7}$

---

- (ii) Complete the tree diagram by writing the correct probability on each branch. 1



- (iii) Calculate the probability that both girls select the same coloured shoes. 2

$$\frac{4}{7} \times \frac{3}{6} + \frac{3}{7} \times \frac{2}{6}$$


---


$$= \frac{12}{42} + \frac{6}{42} = \frac{18}{42} = \frac{3}{7}$$


---

(b) Young's rule for calculating the amount of medicine a child (up to 2 years) can receive is:

$$\text{Child dosage} = \frac{\text{age in years}}{\text{age in years} + 12} \times \text{adult dosage.}$$

Harry has an 18 month old son who weighs 15 kg.

The adult dosage of a drug prescribed for him is 300 g.

Calculate the dosage Harry should give his son. 1

$$\frac{1.5}{13.5} \times 300g$$

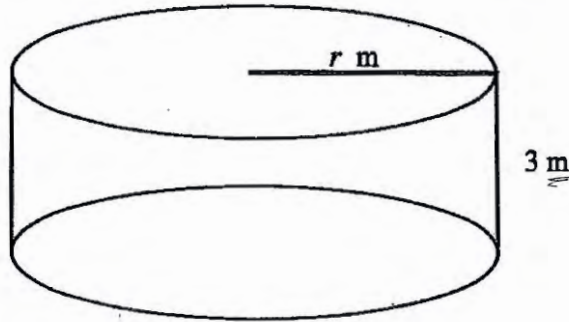

---


$$= 33 \frac{1}{3} g$$


---

- (c) A new house is being built on a country property. Town water cannot be supplied and the owners need to have a tank to store and supply their water. The water is collected from rain that runs off the roof of the house.

The capacity of the tank is 140,000 Litres and the house has a roof area of 600 m<sup>2</sup>.



- (i) Express 140,000 L in cubic metres. [1,000L = 1m<sup>3</sup>] 1

$$\div 1000 = 140 \text{ m}^3$$

- (ii) Calculate the radius of the tank if the height of the tank is 3 m, correct to decimal places. 2

$$140 = \pi \times r^2 \times 3$$

$$r = 3.8541 \dots \text{ metres}$$

$$r = 3.85 \text{ m (to 2 d.p.)}$$

- (iii) If 100 mm of rain falls on the roof and is collected in the tank, by how much will the water level rise in the tank? (Answer correct to the nearest cm). 2

$$100 \text{ mm} \div 1000 = 0.1 \text{ m}$$

$$V = 600 \times 0.1 = 60 \text{ m}^3$$

$$60 = \pi \times 3.8541^2 \times h$$

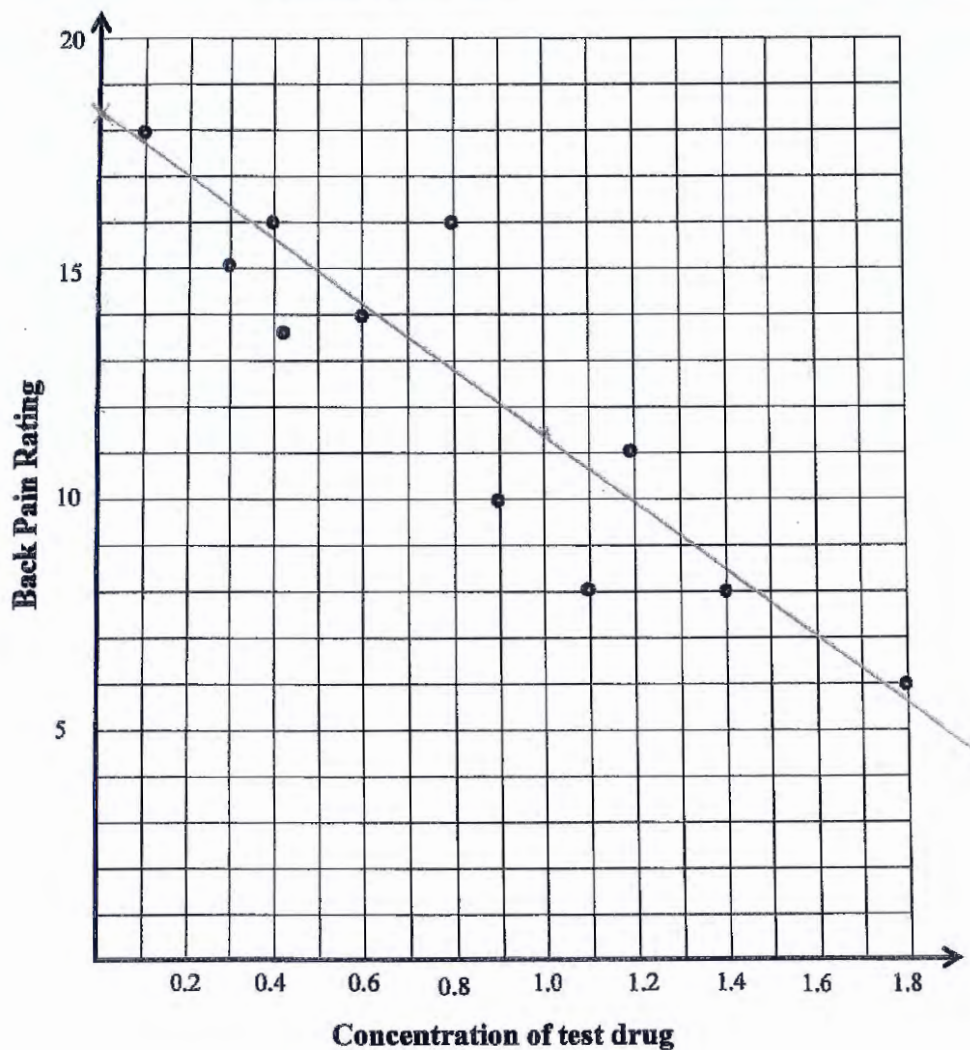
$$h = 1.2857 \dots \text{ m}$$

$$\doteq 129 \text{ cm}$$



(d) Patients experiencing back pain were asked to participate in a trial of a new drug. 10 patients were all given a different concentration of the drug being tested. After a period of 10 minutes, the patients were asked to rate the intensity of their back pain, using a scale of 0 – 20 , where 0 equals no back pain being experienced and 20 meaning their back pain was unchanged. A table of the results are shown below.

Concentration of new drug	0.1	0.3	0.4	0.6	0.8	0.9	1.1	1.2	1.4	1.8
Back pain rating (0-20)	18	15	16	14	16	10	8	12	8	6



i. Use your calculator to find the following values:

2

a.  $r = -0.902$

b.  $\sigma_x = 0.502$

c.  $\sigma_y = 3.9$

d.  $\bar{x} = 0.86$

e.  $\bar{y} = 12.3$

- ii. Use the information obtained in part (i) to find the equation of the 'least squares of fit.' 2

$$\text{gradient} = -0.902 \times \frac{3.9}{0.502}$$

$$= -7.01$$

$$y\text{-INT} = 12.3 - (-7.01 \times 0.86)$$

$$= 18.34$$

$$\text{So EQN is } y = -7.01x + 18.34$$

- iii. By taking suitable values, draw the "least - squares line of fit" on the graph given in the question. 1

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Question 30 (15 Marks)

(a) The human body is made up of bone, muscle and fat/organs in the ratio 3 : 7 : 10.

(i) Cameron has a mass of 95kg. What was the mass of his muscles? 1

$$3+7+10 = 20$$

$$\text{MUSCLE} = \frac{7}{20} \times 95$$

$$= 33.25 \text{ kg}$$

(ii) Maya's body has 28 kg of muscles. What does she weigh? 1

$$7 \text{ parts} = 28$$

$$\text{OR } \frac{7}{20} \text{ OF } ? = 28$$

$$1 \text{ part} = 4$$

$$? = 28 = \frac{7}{20}$$

$$20 \text{ PART} = 80 \text{ kg}$$

$$= 80 \text{ kg}$$

(b) Lewis was admitted to hospital with a mysterious illness. He was prescribed 300 millilitres of fluid per hour. Fluid is supplied via an intravenous drip at a constant rate.

(i) How many litres of fluid are needed per day for this patient? 1

$$300 \times 24 = 7.2 \text{ LITRES}$$

(ii) If 1 ml of fluid contains 15 drops, how many drops are needed each hour? 1

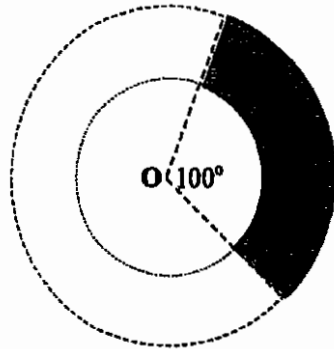
$$300 \times 15 = 4500 \text{ DROPS}$$

(iii) What is the drip rate (in drops per minute) if the drip runs for 6 hours? 1

$$4500 \div 60 = 75 \text{ DROPS/minute}$$

(c) Calculate the area of the shaded region, correct to 2 decimal places.

3



O is the centre of both circles.  
The larger circle has a radius of  $12\pi$  cm.  
The smaller circle has a radius of  $8\pi$  cm.

$$A = \frac{100}{360} \left[ \pi \times (12\pi)^2 - \pi \times (8\pi)^2 \right]$$

$$= \frac{100}{360} \times \pi^3 (144 - 64)$$

$$= 689.0283 \dots$$

$$= 689.03 \text{ cm}^2$$

(d) Simone has 5 people living in her household. Each person uses 240L of water a day on average. Current water prices are \$2.18 per kilolitre (kL).

They agree as a household to reduce their water usage by 5%.

How much will they save per year?

2

$$240\text{L} \times 5 = 1200\text{L} = 1.2\text{ kL}$$

$$5\% \text{ of } 1.2\text{ kL} = 0.06\text{ kL}$$

$$\$2.18 \times 0.06 = 13 \text{ CENTS}$$

25



- (e) A drunk driver takes 4 seconds to react to a dangerous situation.  
If he was travelling at 90 km/h, approximately how far will the car travel in this time? 2

$$90 \text{ km in } 1 \text{ hr}$$

$$= 90000 \text{ m in } 3600 \text{ secs}$$

$$= 25 \text{ m/s}$$

$$4 \times 25 = \boxed{100 \text{ m}}$$

- (f) The purchases bought on Joel's credit card are shown below in the table.

**This Month's Activity:**

TRANSACTION DATE	TRANSACTION DESCRIPTION	AMOUNT
10/04/2014	New shoes	\$250
19/04/2014	Laura's sporting apparel	\$89

The credit card charges simple interest at a rate of 18.75% per annum.  
There is a no interest free period on the card. The period for which interest was charged **included** the date of purchase and the date of payment.

Calculate the amount that Joel needs to be pay, if the account is paid in full on the 16 of May. 3

SHOES: 21 DAYS IN APRIL; 16 DAYS IN MAY = 37 DAYS

$$\text{INT} = 250 \times 0.1875 \times \frac{37}{365} = \$4.75$$

SPORTING APPAREL: 12 DAYS IN APRIL; 16 IN MAY = 28 DAYS

$$\text{INT} = \$89 \times 0.1875 \times \frac{28}{365} = \$1.28$$

$$\text{JOEL NEEDS TO PAY } \$250 + \$89 + \$4.75 + \$1.28$$

$$= \$345.03$$