



2014
HSC Course
Half Yearly Examination

GENERAL MATHEMATICS

General instructions

- Reading time – 5 minutes
- Writing time – 2 hours
- Write using blue or black pen
- Scientific Calculators may be used
- A formulae sheet is provided
- Start a new booklet for each question.
- Multiple choice answer sheet is attached to the back of this paper and may be removed.

Section I

Total marks (20)

- Attempt Questions 1 – 20
- Allow about 30 minutes for this section

Section II

Total marks (60)

- Attempt Questions 21 - 26
- Allow about 1 hour 30 minutes for this section

Section I

Total marks (20)

Attempt Questions 1 – 20

Allow about 30 minutes for this section

Use the multiple choice answer sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9
 A ☐ B ☒ C ☐ D ☐

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ☒ B ☒ C ☐ D ☐

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows.

correct
  A ☒ B ☒ C ☐ D ☐

1. Belinda works for x hours at the normal rate and 10 hours at the “time-and-a-half-rate”. She earned a total of \$531.10 for the hours worked, paid at an hourly rate of \$11.30. How many hours did Belinda work at the normal rate?
 - (A) 32
 - (B) 35
 - (C) 37
 - (D) 47

2. A new piece of machinery is purchased for \$245 000 and depreciates by 12% each year using the declining balance method.
Which expression gives the value of the machine at the end of 4 years?
 - (A) $\$245\,000 \times (1.88)^4$
 - (B) $\$245\,000 - (1.12) \times 4$
 - (C) $\$245\,000 \times 0.12 \times 4$
 - (D) $\$245\,000 \times (0.88)^4$

3. Which of the following is most important when designing an effective survey?
 - (A) Freedom from bias
 - (B) The cost of postage
 - (C) The number of questions
 - (D) The colour of the paper written on.

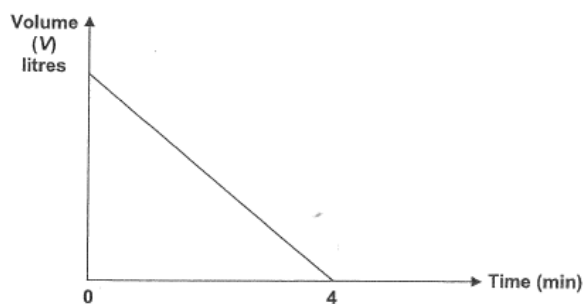
4. On Monday at 2:00pm local time in Sydney (150°E), an email is sent to Rio de Janeiro (45°W).
At what local time in Rio de Janeiro should the email arrive?
 - (A) 1:00 am Monday
 - (B) 1:00 pm Monday
 - (C) 7:00 am Monday
 - (D) 3:00 pm Tuesday

5. The speed limit on the M5 Motorway is 110km/hr. This is equivalent to:
 - (A) 1.83m/s
 - (B) 30.6m/s
 - (C) 1833.3 m/s
 - (D) 110m/s

6. Which of the following gives Q as the subject of the formula $P = \frac{Q}{2}(K + L)$?

- (A) $Q = \frac{2P}{K+L}$
 (B) $Q = \frac{2P-L}{K}$
 (C) $Q = \frac{P}{2(K+L)}$
 (D) $Q = \frac{2P}{K} + L$

7. The graph shows the volume (V) of liquid in a container as it is being emptied over time (t).



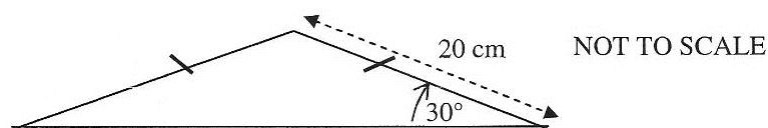
The liquid in the container is flowing out of the container at a constant rate of 12.5L/min.

What is the equation of the line in this graph?

- (A) $V = 12.5t + 4$
 (B) $V = 4t + 12.5$
 (C) $V = -12.5t + 50$
 (D) $V = -50t + 4$
8. $12 - 8(x - 2) =$

- (A) $28 - 8x$
 (B) $4x + 8$
 (C) $10 - 8x$
 (D) $4x + 2$

9. What is the area of this triangle to the nearest square centimetre?



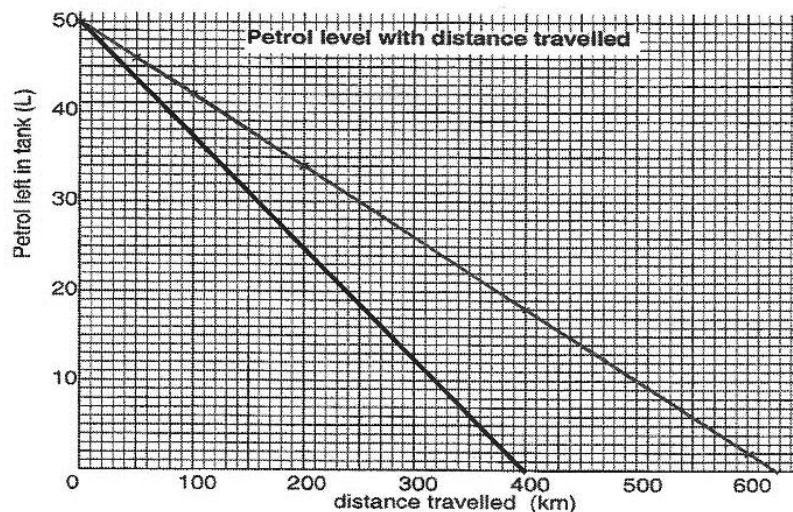
- (A) 87
 (B) 173
 (C) 200
 (D) 300

10. An unbiased coin was tossed 30 times. The results were 21 heads and 9 tails.

Which of the following statements is true regarding the next time the coin is tossed?

- (A) There is no way to tell which result is more likely.
 - (B) The result is more likely to be tails.
 - (C) The result is more likely to be heads.
 - (D) The coin has an equal chance of showing either heads or tails.
11. The radius of Earth is approximately 6400km at the equator. If two cities lie on the equator and the angle subtended between them is 230° , what is the shortest distance to the nearest kilometre between them?
- (A) 14521 km
 - (B) 40212 km
 - (C) 25691 km
 - (D) 29042 km

12. The following graph show a comparison of petrol consumption for two vehicles with the same fuel capacity.



The petrol consumption of the vehicles is measured in Litres/100km

What is the approximate difference in petrol consumption for the two vehicles?

- (A) 4 L / 100km
- (B) 4.5 L / 100km
- (C) 22.7L / 100km
- (D) 25L / 100km

13. What is the solution to the equation $4x - 5 = \frac{x+1}{2}$?

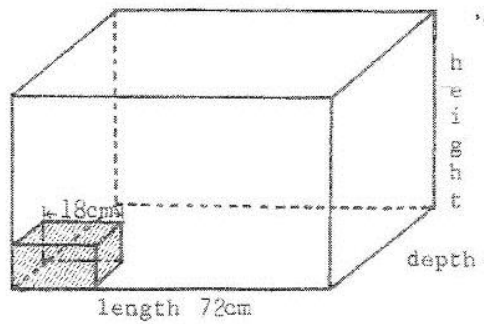
(A) $x = -\frac{9}{7}$

(B) $x = -\frac{4}{7}$

(C) $x = \frac{6}{7}$

(D) $x = \frac{11}{7}$

14. Identical boxes of length 18cm are transported in a similar shaped carton which has a length of 72cm.



The boxes completely fill the carton.

What is the ratio of the volume of a box to the volume of the carton?

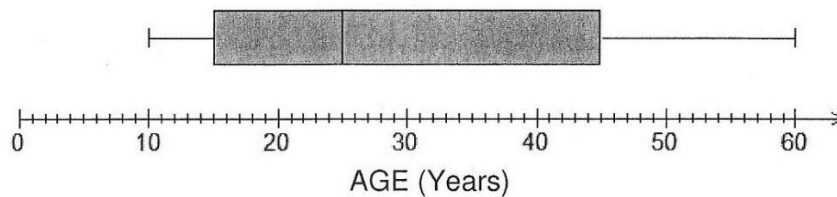
(A) 1:64

(B) 1:32

(C) 1:16

(D) 1:4

15. The ages of 80 people at a screening of the movie “Gulliver’s Travels” are shown in the box-and-whisker plot below.



How many people are aged between 15 and 25?

(A) 10

(B) 20

(C) 40

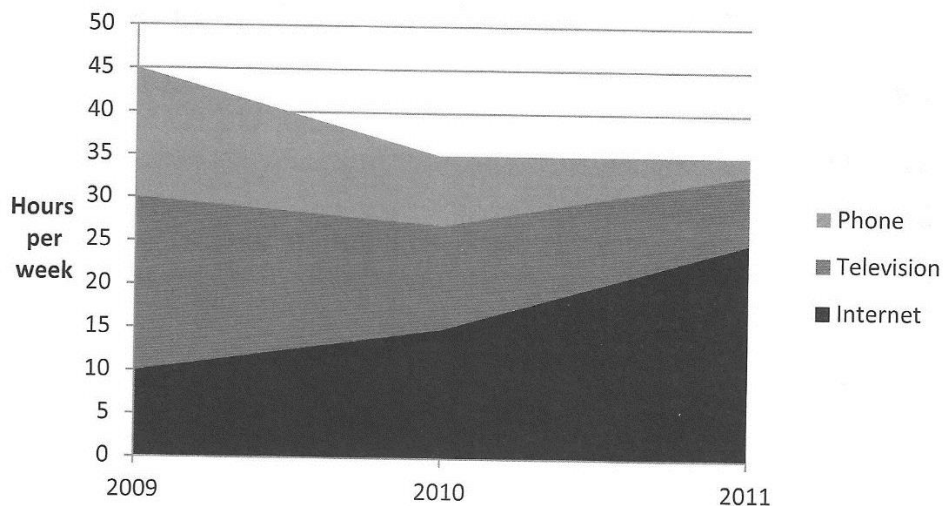
(D) 60

16. Joe earns \$81 752 p.a working as an accountant in the city. He also earns \$680 a year in interest from the bank.

He has allowable deductions of \$380 in professional fees each year, \$5200 in work expenses each year and \$50 per week in travel expenses.

What is Joe's taxable income?

- (A) \$72 892
(B) \$74 252
(C) \$75 442
(D) \$76 802
17. The area chart shows the average number of hours per week spent by Year 12 students talking on the phone, watching TV and on the internet.



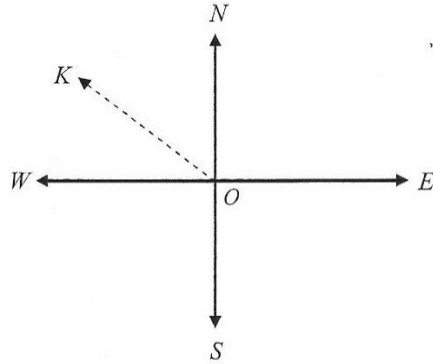
Which of the following statements is NOT correct?

- (A) On average, eight hours per week were spent on the phone in 2010.
(B) The average number of hours spent on the internet increased between 2009 and 2011
(C) There was a decrease in the average number of hours per week spent on the phone between 2010 and 2011.
(D) There was no change in the average number of hours per week spent on the phone between 2010 and 2011.
18. The time in the town of Saka is 1 hour and 48 minutes behind the city of San Paulo. The coordinates of San Paulo are (10°S, 55°W).

What are the co-ordinates of Saka?

- (A) $(10^{\circ}\text{S}, 82^{\circ}\text{W})$
- (B) $(10^{\circ}\text{S}, 28^{\circ}\text{W})$
- (C) $(37^{\circ}\text{S}, 55^{\circ}\text{W})$
- (D) $(37^{\circ}\text{S}, 28^{\circ}\text{W})$

19. Observe the following image



Angle $\text{NOK} = 50^{\circ}$

Which bearing correctly gives the position of K in relation to O?

- (A) $\text{N}40^{\circ}\text{W}$
- (B) 050°
- (C) 130°
- (D) 310°

20. Michael Clarke has scored 5909 runs in 145 test cricket innings.

How many runs does he need to score in his next innings to take the mean number of run scored per innings to 42?

- (A) 181
- (B) 223
- (C) 6090
- (D) 6132

Section II

Total marks (60)

Attempt Questions 21 - 26

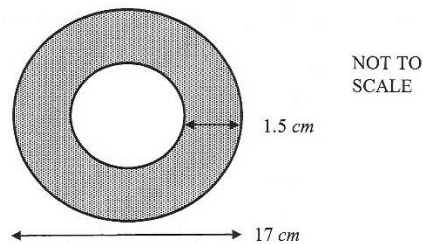
Allow about 1 hour 30 minutes for this section

Answer each question in a separate writing booklet.

Question 21 (10 marks)

Marks

- (a) The cross section of a plastic pipe with an outer diameter of 17cm is shown below.

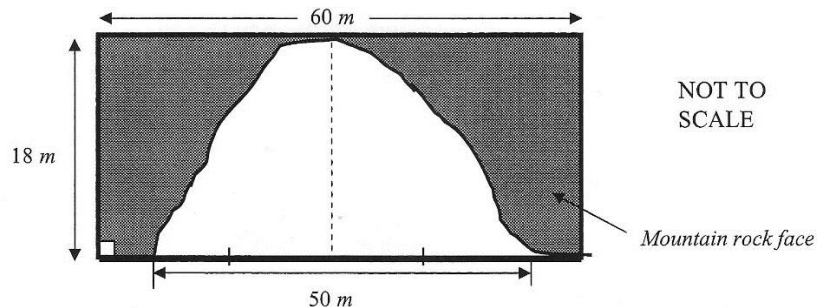


The pipe has a thickness of 1.5cm

- (i) What is the inner diameter of the pipe? 1
- (ii) Calculate the cross- sectional (shaded) area of the pipe, correct to the nearest square centimetre. 2
- (iii) The pipes are manufactured in 2 m lengths. Calculate the area of the inside surface of a length of pipe. (Give your answer in square metres correct to 2 decimal places) 3
-
- (b) At an auction, a property is bought for 20% less than the owners were expecting from the sale. 2
After renovations, the new owners sold the property for \$439 400, making a profit of 30% on their purchase price.
What amount were the original owners expecting from the sale of the property?
- (c) Fully simplify $3AP \div 6P^2$ 2

Question 22 (10 marks)**Please start a separate writing booklet.**

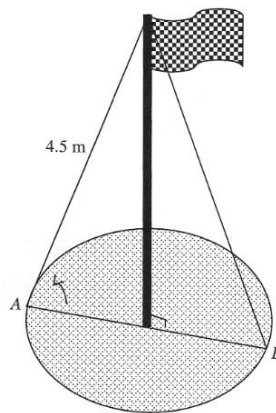
- (a) Construction work begins on a tunnel, which is to be drilled through a rectangular section of a mountain rock face.



The tunnel is to have an opening that is 50 metres wide and 18 metres high.

- (i) Use Simpson's Rule to calculate the approximate area of the tunnel opening that will be cut out from the rock face. (Give your answer to the nearest square metre) 2
- (ii) The tunnel will be 2.5km long and will cost \$57 million to excavate. What is the cost to excavate each cubic metre of rock from the tunnel? 2

- (b) Two 4.5m support wires are at angles of elevation of 40° , from the points A and B.



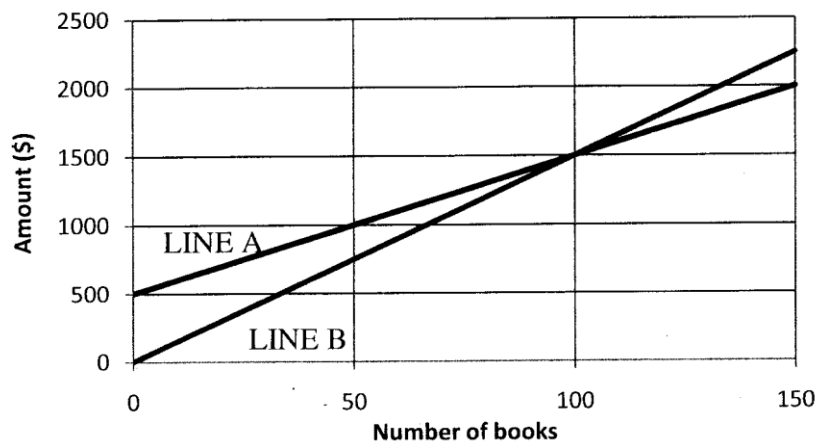
- (i) Calculate the height of the flag pole correct to one decimal place. 2
- (ii) Calculate the diameter of the circular base correct to one decimal place. 2
- (c) Tina is saving to go to university in five years time. She invests \$1500 into an account that earns 9% p.a interest, compounding monthly. How much money has Tina saved for university at the end of the five years? 2

Question 23 (10 marks)**Please start a separate writing booklet.**

(a) Simplify $\frac{w^8}{3w^2} \times w^6$

1

- (b) Ravi has just written a new summary book to help his classmates and friends prepare for his HSC.
It initially cost him \$500 to produce the book and a further \$10 per copy. The cost (C), in dollars, can be represented by the equation $C = 500 + 10n$ where n is the number of books sold.
Ravi is hoping to sell the books at \$15 each.



The graph above is a model that Ravi used to help him make decisions about the financial success of his project.

- (i) What does LINE B on the graph represent? 1
- (ii) Explain the significance of the point where the two lines intersect. 1
- (iii) Using the graph, or otherwise, find the approximate loss if only 50 books are sold. 1
- (c) Lily has 200 ordinary shares in Watergex with a face value of \$1.00. The shares have a market value of \$4.34 and this year, Watergex paid a dividend of 32 cents per share. 2
Calculate the dividend yield correct to ONE decimal place.

Question continued over page.....

- (d) A Health Survey calculated the Body Mass Index (BMI) for 200 men and women.

The results are displayed in the two-way table below.

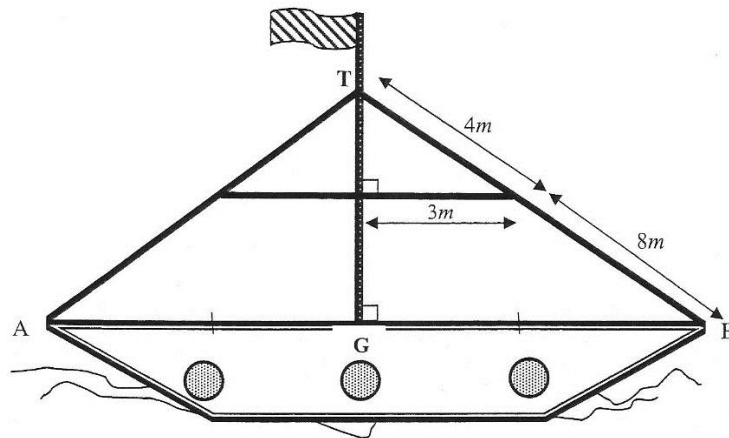
	Men	Women	TOTALS
Normal	33	40	73
Overweight	42	36	77
Obese	25	24	49
TOTALS	100	100	200

- (i) How many men were classified as overweight? 1
- (ii) What percentage of those surveyed were women? 1
- (iii) What fraction of women are classified as overweight or obese? 1
- (iv) If a person is selected at random from the obese group, find the probability that the person selected is male. 1

Question 24 (10 marks)

Please start a separate writing booklet.

- (a) Observe the following image



The mast (TG) on a ship stands in the centre of the ship and at right angles to the deck AB. The lengths of the beams supporting the mast are shown on the diagram above.

- (i) Show that the ship's deck has a length of 18 metres. 2
- (ii) Calculate the angle of elevation of the mast from the ship's deck at the point B. (Give your answer correct to the nearest minute) 2
- (iii) Use the cosine rule to determine the size of angle ATB, where the supporting beams meet at the top of the mast.(Give your answer correct to the nearest minute) 3

Question continued over page.....

- (b) The number of goals scored by Nathan in each soccer game last season is recorded in the frequency distribution table below.

The mean of the data is approximately 1.96.

Score	Frequency
0	6
1	4
2	5
3	3
4	6

- (i) Is the collected data above continuous or discrete? Explain your answer.

1

- (ii) Calculate the population standard deviation, correct to TWO decimal places.

1

- (iii) Nathan's friend, Matthew, plays for another soccer team.

1

The mean and population standard deviation for Matthew's season were 1.42 and 0.8 respectively.

Who was the more consistent goal scorer? Justify your answer

Question 25 (10 marks)**Please start a separate writing booklet.**

- (a) Before starting a fitness program, 16 people were asked to complete as many push-ups as possible in one minute. After six weeks in the fitness program, the participants were again asked to complete as many push-ups as possible in one minute.

The results are displayed in the back-to-back stem-and-leaf plot below.

Number of Push-ups 1/5 = 15

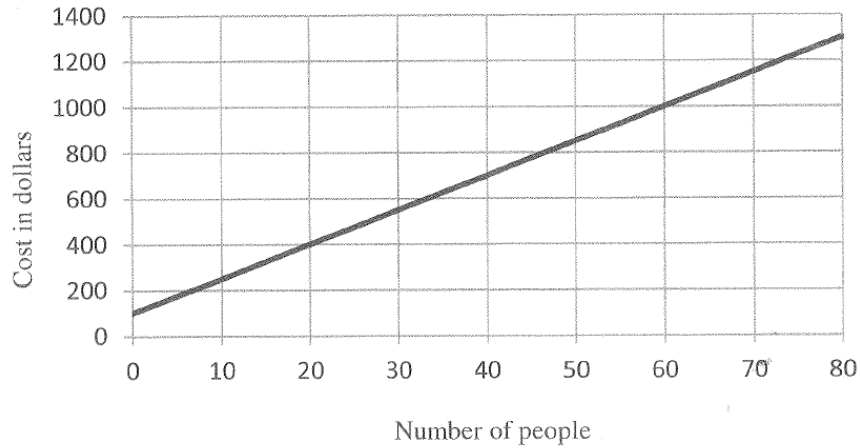
Before		After
9 6 3 1	1	5
9 9 8 8 7 5 1	2	2 3
2 1 0 0	3	1 2 6 7 7
1	4	4 4 7 9 9
	5	0 8
	6	3

Compare and contrast the TWO sets of data by examining the shape and skewness of the distribution and the measures of location and spread.

- (b) Fiona is planning to sail from Baker Island (0° , 176°W) to Nauru (0° , 166°E)
- (i) Find the shortest distance between Baker Island and Nauru. 1
- (ii) It takes Fiona 48 hours to sail the shortest distance from Baker Island to Nauru. 2
- If she leaves Baker Island at 8:00am on Monday, what is the local time and day in Nauru, on her arrival. (Ignore time zones)

Question continued over page.....

- (c) Abbey is holding her 18th Birthday party at a local restaurant. The graph below models the cost of Abbey's party at this restaurant.

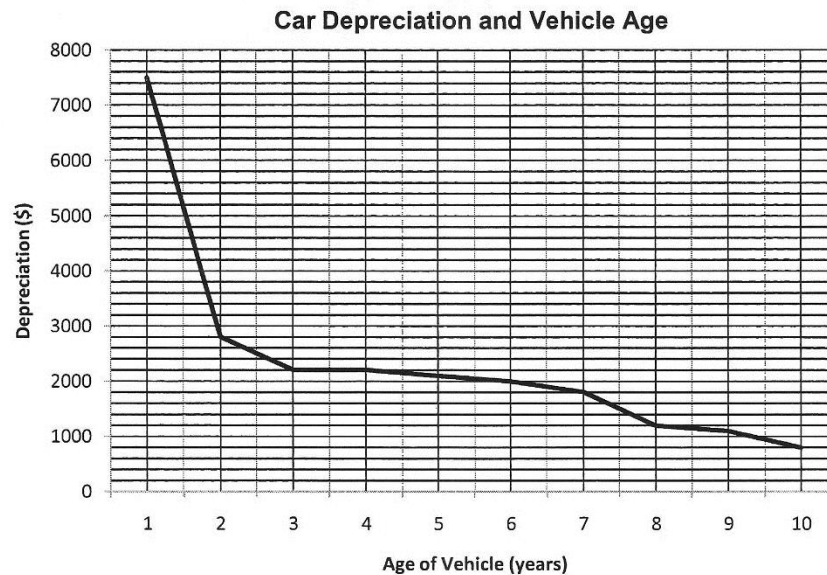


- (i) What is the initial cost to hire the restaurant? 1
- (ii) What is the gradient of the line? What does it represent? 2
- (iii) If the restaurant increases the cost per person, what effect will this have on the line? 1

Question 26 (10 marks)

Please start a separate writing booklet.

- (a) A new car is purchased for \$30 000.
The depreciation of a car in its first 10 years is shown in the following graph.



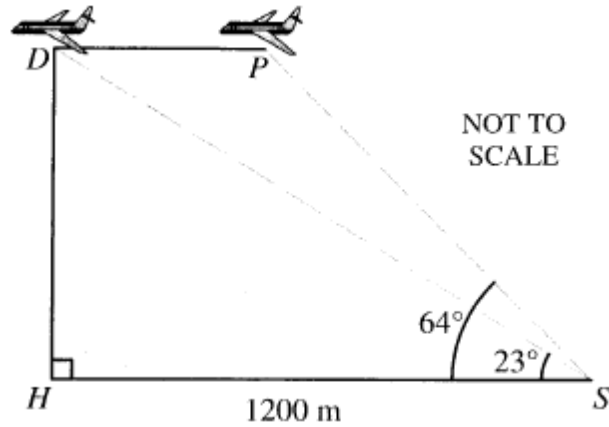
- (i) What is the value of the car after 1 year? 1
- (ii) What is the value of the car after 2 years? 1
- (iii) What is the percentage loss in the value of the car after 2 years? 2
- (iv) Show by calculations, that by the end of the third year, the car has lost another 11.2% of its value. 2
- (v) Outline the loss in value of a new car over the first 10 years. 1

Question continued over page.....

(b)

3

Sean, S, is 1200 metres from his home, H, when he first sees an aeroplane. The angle of elevation from Sean to the plane at P is 64° . Five minutes later the plane is directly above Sean's home at D. The angle of elevation from Sean to D is 23° .



How far did the aeroplane travel from P to D, to the nearest metre?

End of Examination

1. Belinda works for x hours at the normal rate and 10 hours at the "time-and-a-half-rate". She earned a total of \$531.10 for the hours worked, paid at an hourly rate of \$11.30. How many hours did Belinda work at the normal rate?

(A) 32
(B) 35
(C) 37
(D) 47

$$10 \times 1.5 = 15 \times 11.30 = 169.50$$

$$\therefore 11.30x + 169.50 = 531.10$$

$$11.30x = 361.60$$

$$\therefore x = 32.$$

2. A new piece of machinery is purchased for \$245 000 and depreciates by 12% each year using the declining balance method. Which expression gives the value of the machine at the end of 4 years?

(A) $\$245\,000 \times (1.88)^4$
(B) $\$245\,000 - (1.12) \times 4$
(C) $\$245\,000 \times 0.12 \times 4$
(D) $\$245\,000 \times (0.88)^4$

3. Which of the following is most important when designing an effective survey?

(A) Freedom from bias
(B) The cost of postage
(C) The number of questions
(D) The colour of the paper written on.

4. On Monday at 2:00pm local time in Sydney (150°E), an email is sent to Rio de Janeiro (45° W).

At what local time in Rio de Janeiro should the email arrive?

(A) 1:00 am Monday
(B) 1:00 pm Monday
(C) 7:00 am Monday
(D) 3:00 pm Tuesday

$$165^\circ \div 15 = 11$$

$$2:00 \text{ pm Mon} + 11 = 1:00 \text{ am Tues} - 1 \text{ day}$$

$$= 1:00 \text{ am Mon.}$$

5. The speed limit on the M5 Motorway is 110km/hr. This is equivalent to:

(A) 1.83m/s
(B) 30.6m/s
(C) 1833.3 m/s
(D) 110m/s

$$110 \times 1000 \div 60 \div 60 = 30.555 \dots$$

$$\approx 30.6 \text{ m/s}$$

6. Which of the following gives Q as the subject of the formula $P = \frac{Q}{2}(K + L)$?

(A) $Q = \frac{2P}{K+L}$

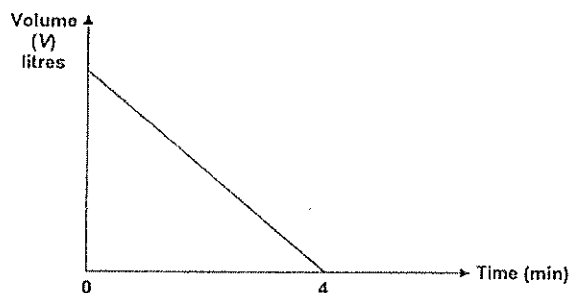
(B) $Q = \frac{2P-L}{K}$

(C) $Q = \frac{P}{2(K+L)}$

(D) $Q = \frac{2P}{K} + L$

$$Q = \frac{2P}{K+L}$$

7. The graph shows the volume (V) of liquid in a container as it is being emptied over time (t).



The liquid in the container is flowing out of the container at a constant rate of 12.5L/min.

What is the equation of the line in this graph?

(A) $V = 12.5t + 4$

(B) $V = 4t + 12.5$

(C) $V = -12.5t + 50$

(D) $V = -50t + 4$

$$m = -12.5$$

$$V = 4 \times 12.5 = 50 \text{ at the start.}$$

8. $12 - 8(x - 2) = 12 - 8x + 16 = 28 - 8x$

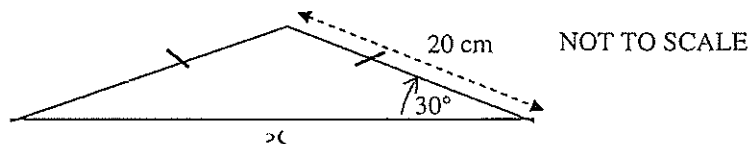
(A) $28 - 8x$

(B) $4x + 8$

(C) $10 - 8x$

(D) $4x + 2$

9. What is the area of this triangle to the nearest square centimetre?



(A) 87

(B) 173

(C) 200

(D) 300

$$\frac{20}{\sin 120^\circ} = \frac{20}{\sin 30^\circ}$$

$$20 = \frac{20}{\sin 30^\circ} \times \sin 120^\circ$$

$$= 34.64$$

$$\therefore \text{Area} = \frac{1}{2} \times 20 \times 34.64 \times \sin 30^\circ$$

$$= 173.2$$

$$\approx 173 \text{ cm}^2$$

10. An unbiased coin was tossed 30 times. The results were 21 heads and 9 tails.

Which of the following statements is true regarding the next time the coin is tossed?

- (A) There is no way to tell which result is more likely.
 (B) The result is more likely to be tails.
 (C) The result is more likely to be heads.
 (D) The coin has an equal chance of showing either heads or tails.
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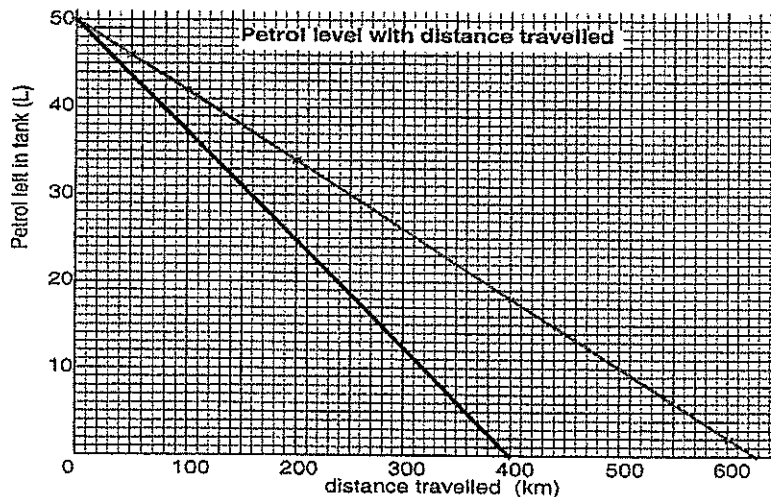
(A) 14521 km

$$\frac{130^\circ}{360^\circ} \times 2 \times \pi \times 6400$$

$$= 14521.139..$$

$$\approx 14521 \text{ km}$$

12. The following graph show a comparison of petrol consumption for two vehicles with the same fuel capacity.



The petrol consumption of the vehicles is measured in Litres/100km

What is the approximate difference in petrol consumption for the two vehicles?

- (A) 4 L / 100km
 (B) 4.5 L / 100km
 (C) 22.7L / 100km
 (D) 25L / 100km

50 L / 400 km	50 L / 600 km
12.5 L / 100 km	8.33 L / 100 km

$$12.5 - 8.333$$

$$= 4.2$$

$$\approx 4 \text{ L / 100 km}$$

13. What is the solution to the equation $4x - 5 = \frac{x+1}{2}$?

(A) $x = -\frac{9}{7}$

(B) $x = -\frac{4}{7}$

(C) $x = \frac{6}{7}$

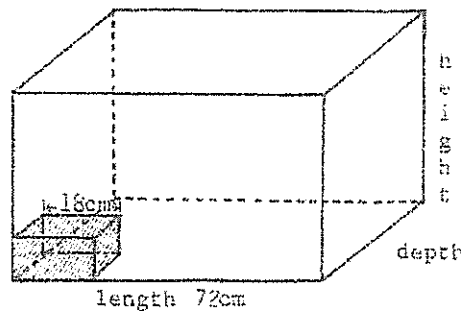
(D) $x = \frac{11}{7}$

$$8x - 10 = x + 1$$

$$7x = 11$$

$$x = 11/7$$

14. Identical boxes of length 18cm are transported in a similar shaped carton which has a length of 72cm.



$$18 : 72 = 1 : 4$$

$$\text{ratio of volumes} = 1^3 : 4^3$$

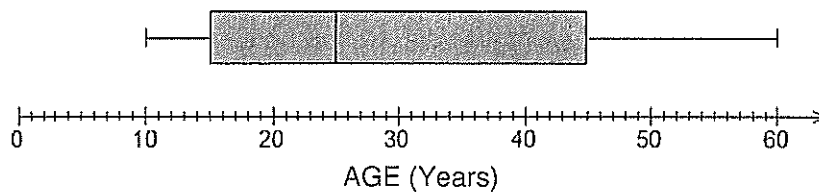
$$= 1 : 64$$

The boxes completely fill the carton.

What is the ratio of the volume of a box to the volume of the carton?

- (A) 1:64
(B) 1:32
(C) 1:16
(D) 1:4

15. The ages of 80 people at a screening of the movie "Gulliver's Travels" are shown in the box-and-whisker plot below.



How many people are aged between 15 and 25?

- (A) 10
(B) 20
(C) 40
(D) 60

$$25\% = \frac{1}{4} \times 80$$

$$= 20$$

16. Joe earns \$81 752 p.a working as an accountant in the city. He also earns \$680 a year in interest from the bank.

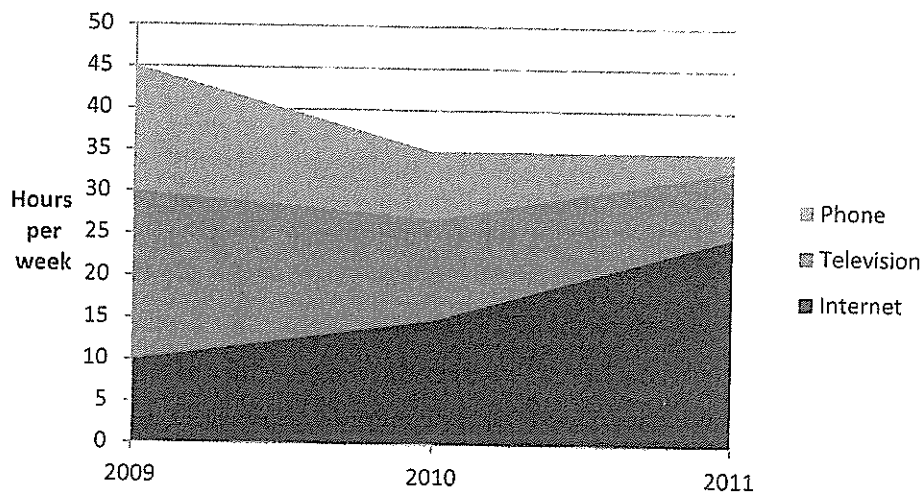
He has allowable deductions of \$380 in professional fees each year, \$5200 in work expenses each year and \$50 per week in travel expenses.

What is Joe's taxable income?

- (A) \$72 892
 (B) \$74 252
 (C) \$75 442
 (D) \$76 802

$$81\,752 + 680 - 380 - 5200 - 50 \times 52 = \$74\,252$$

17. The area chart shows the average number of hours per week spent by Year 12 students talking on the phone, watching TV and on the internet.



Which of the following statements is NOT correct?

- (A) On average, eight hours per week were spent on the phone in 2010.
 (B) The average number of hours spent on the internet increased between 2009 and 2011
 (C) There was a decrease in the average number of hours per week spent on the phone between 2010 and 2011.
 (D) There was no change in the average number of hours per week spent on the phone between 2010 and 2011.

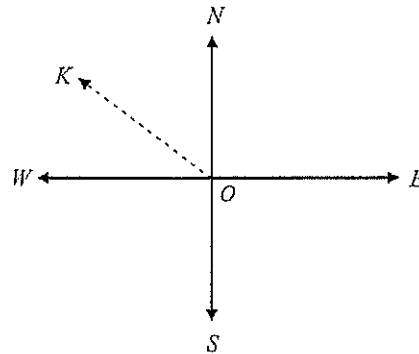
18. The time in the town of Saka is 1 hour and 48 minutes behind the city of San Paulo. The coordinates of San Paulo are (10°S, 55°W).

What are the co-ordinates of Saka?

- (A) $(10^{\circ}\text{S}, 82^{\circ}\text{W})$
- (B) $(10^{\circ}\text{S}, 28^{\circ}\text{W})$
- (C) $(37^{\circ}\text{S}, 55^{\circ}\text{W})$
- (D) $(37^{\circ}\text{S}, 28^{\circ}\text{W})$

$$108 \text{ mins} \div 4 = 27^{\circ} \text{ further west}$$

19. Observe the following image



Angle $\text{NOK} = 50^{\circ}$

Which bearing correctly gives the position of K in relation to O?

- (A) $\text{N}40^{\circ}\text{W}$
- (B) 050°
- (C) 130°
- (D) 310°

$$\begin{array}{rcl} 5909 + x & = & 42 \\ 145 & & \\ \hline x & = & 181 \end{array}$$

20. Michael Clarke has scored 5909 runs in 145 test cricket innings.

How many runs does he need to score in his next innings to take the mean number of run scored per innings to 42?

- (A) 181
- (B) 223
- (C) 6090
- (D) 6132

Section II

Total marks (60)

Attempt Questions 21 - 26

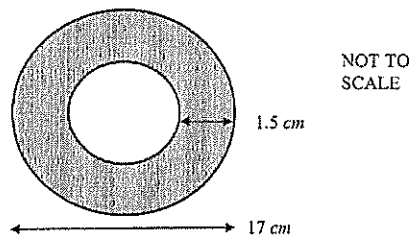
Allow about 1 hour 30 minutes for this section

Answer each question in a separate writing booklet.

Question 21 (10 marks)

Marks

- (a) The cross section of a plastic pipe with an outer diameter of 17cm is shown below.



The pipe has a thickness of 1.5cm

- (i) What is the inner diameter of the pipe?

$$17 - 2 \times 1.5 = 14 \text{ cm}$$

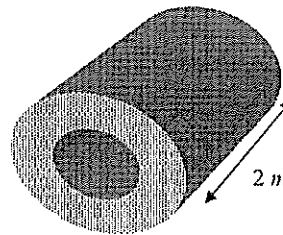
1

- (ii) Calculate the cross-sectional (shaded) area of the pipe, correct to the nearest square centimetre.

$$\pi (8.5^2 - 7^2) = 73.042 \dots \approx 73 \text{ cm}^2$$

- (iii) The pipes are manufactured in 2 m lengths.

Calculate the area of the inside surface of a length of pipe. (Give your answer in square metres correct to 2 decimal places)



3

$$\begin{aligned} \text{Area} &= \pi \times 14^2 \times 20 \text{ cm}^2 \\ &= \pi \times 0.14^2 \times 2 \\ &= 0.12315 \dots \\ &\approx 0.12 \text{ m}^2 \end{aligned}$$

2

- (b) At an auction, a property is bought for 20% less than the owners were expecting from the sale.

After renovations, the new owners sold the property for \$439 400, making a profit of 30% on their purchase price.

What amount were the original owners expecting from the sale of the property?

- (c) Fully simplify $3AP \div 6P^2$

$$\frac{3AP}{6P^2} = \frac{A}{2P}$$

$$1.3 \times 0.8 \times x = 439400$$

$$1.04x = 439400$$

$$x = \frac{439400}{1.04}$$

$$= \$422500$$

2

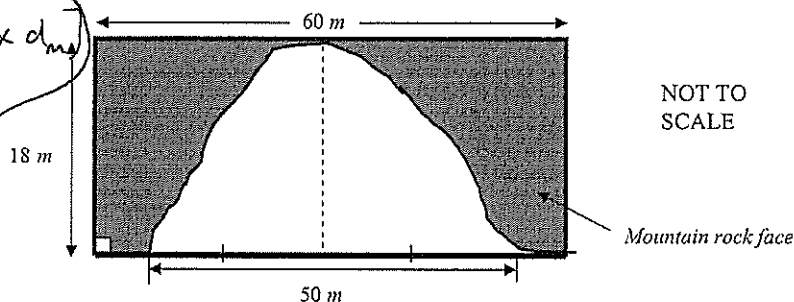
Question 22 (10 marks)

Please start a separate writing booklet.

- (a) Construction work begins on a tunnel, which is to be drilled through a rectangular section of a mountain rock face.

(i)

$$\begin{aligned} A/B &= \frac{h}{3} [(d_f + d_L) + 4 \times d_m] \\ &= \frac{50}{3} (4 \times 18) \\ &= 1200 \text{ m}^2 \\ &= 0.0012 \text{ km}^2 \end{aligned}$$



(ii) 0.0012×2.5

$$= 0.003 \text{ km}^2$$

0.003 km^2 at

\$57 m

$$= \$19 \text{ billion / km}^2$$

The tunnel is to have an opening that is 50 metres wide and 18 metres high.

- (i) Use Simpson's Rule to calculate the approximate area of the tunnel opening that will be cut out from the rock face. (Give your answer to the nearest square metre)

2

- (ii) The tunnel will be 2.5km long and will cost \$57 million to excavate. What is the cost to excavate each cubic metre of rock from the tunnel?

2

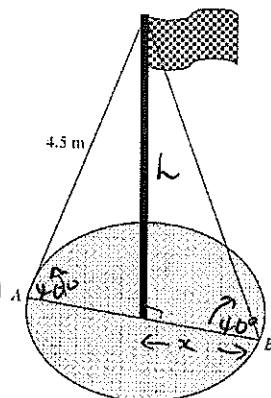
- (b) Two 4.5m support wires are at angles of elevation of 40° , from the points A and B.

$$(i) \frac{h}{4.5} = \sin 40^\circ$$

$$\begin{aligned} h &= 4.5 \times \sin 40^\circ \\ &= 2.8925 \dots \end{aligned}$$

$$\approx 2.9 \text{ m}$$

$$\therefore \text{height of flagpole} \approx 2.9 \text{ m}$$



$$(ii) \cos 40^\circ = \frac{x}{4.5}$$

$$\begin{aligned} x &= 4.5 \times \cos 40^\circ \\ &= 3.4471 \dots \end{aligned}$$

$$\begin{aligned} \text{diameter} &= 2 \times x \\ &= 2 \times 3.4471 \dots \\ &= 6.8942 \dots \\ &\approx 6.9 \text{ m} \end{aligned}$$

- (i) Calculate the height of the flag pole correct to one decimal place.

2

- (ii) Calculate the diameter of the circular base correct to one decimal place.

2

- (c) Tina is saving to go to university in five years time. She invests \$1500 into an account that earns 9% p.a interest, compounding monthly. How much money has Tina saved for university at the end of the five years?

2

$$A = P(1+r)^n$$

$$= 1500 (1+0.0075)^{60}$$

$$= 2348.521 \dots$$

$$\approx \$2348.52$$

Tina will have saved \$2348.52

$$\begin{aligned} n &= 5 \times 12 = 60, P = 1500, r = 0.09 \div 12 \\ &= 0.0075 \end{aligned}$$

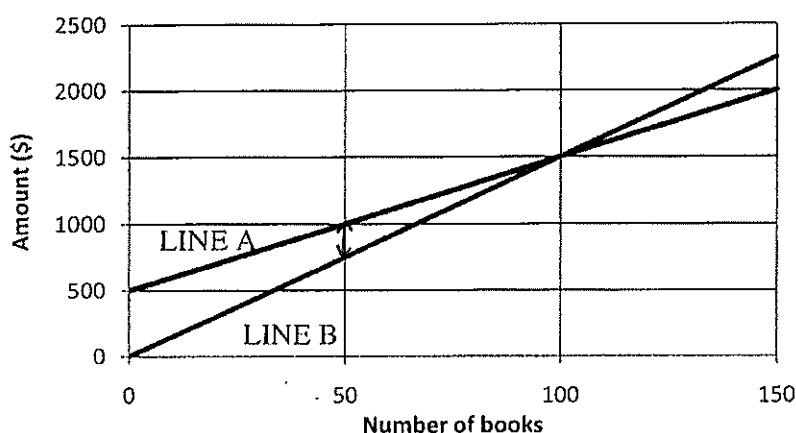
Question 23 (10 marks)

Please start a separate writing booklet.

(a) Simplify $\frac{w^6}{3w^2} \times w^6 = \frac{w^{12}}{3}$

1

- (b) Ravi has just written a new summary book to help his classmates and friends prepare for his HSC.
It initially cost him \$500 to produce the book and a further \$10 per copy. The cost (C), in dollars, can be represented by the equation $C = 500 + 10n$ where n is the number of books sold.
Ravi is hoping to sell the books at \$15 each.



The graph above is a model that Ravi used to help him make decisions about the financial success of his project.

- (i) What does LINE B on the graph represent? *sales or revenue* 1

- (ii) Explain the significance of the point where the two lines intersect. *break-even point - the point at which he starts making a profit.* 1

- (iii) Using the graph, or otherwise, find the approximate loss if only 50 books are sold. *If only 50 books are sold, he will lose approximately \$250* 1

- (c) Lily has 200 ordinary shares in Watergex with a face value of \$1.00. The shares have a market value of \$4.34 and this year, Watergex paid a dividend of 32 cents per share. Calculate the dividend yield correct to ONE decimal place. 2

$$\frac{0.32}{4.34} \times 100\% = 7.37\% \approx 7.4\%$$

Question continued over page.....

- (d) A Health Survey calculated the Body Mass Index (BMI) for 200 men and women.

The results are displayed in the two-way table below.

	Men	Women	TOTALS
Normal	33	40	73
Overweight	42	36	77
Obese	25	24	49
TOTALS	100	100	200

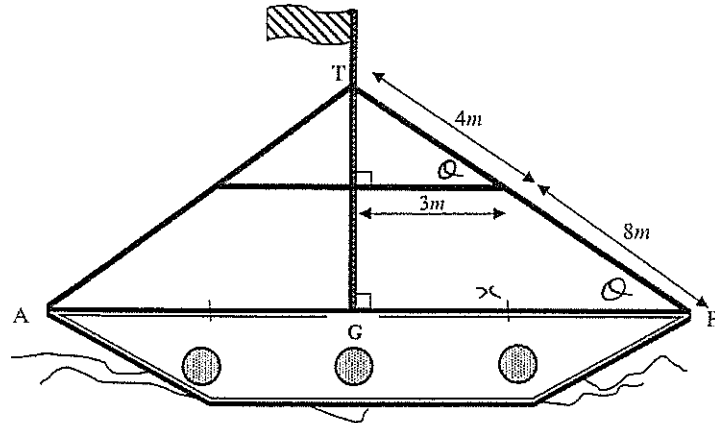
- (i) How many men were classified as overweight? 42 1
- (ii) What percentage of those surveyed were women? 50% 1
- (iii) What fraction of women are classified as overweight or obese? 60% 1
- (iv) If a person is selected at random from the obese group, find the probability that the person selected is male. 1

$$P(\text{obese male}) = \frac{25}{49}$$

Question 24 (10 marks)

Please start a separate writing booklet.

(a) Observe the following image



The mast (TG) on a ship stands in the centre of the ship and at right angles to the deck AB. The lengths of the beams supporting the mast are shown on the diagram above.

- (i) Show that the ship's deck has a length of 18 metres. 2
- (ii) Calculate the angle of elevation of the mast from the ship's deck at the point B. (Give your answer correct to the nearest minute) 2
- (iii) Use the cosine rule to determine the size of angle ATB, where the supporting beams meet at the top of the mast.(Give your answer correct to the nearest minute) 3

$$(i) \cos \theta = \frac{3}{4} = \frac{x}{12}$$

$$\therefore x = 12 \times \frac{3}{4}$$

$$= 9$$

$$\therefore \text{Deck length} = 2 \times 9$$

$$= 18 \text{ m}$$

$$(ii) \cos \theta = \frac{9}{12}$$

$$\theta = \cos^{-1} \left(\frac{9}{12} \right)$$

$$= 41.409622 \dots$$

$$\approx 41^{\circ} 25' \text{ (nearest min)}$$

Angle of elevation

Question continued over page..... = 41^{\circ} 25'

$$(iii) \cos T = \frac{12^2 + 12^2 - 18^2}{2 \times 12 \times 12}$$

$$= -0.125$$

$$T = \cos^{-1}(-0.125)$$

$$\approx 97^{\circ} 11'$$

$$\therefore \angle ATB \approx 97^{\circ} 11'$$

- (b) The number of goals scored by Nathan in each soccer game last season is recorded in the frequency distribution table below.

The mean of the data is approximately 1.96.

Score	Frequency
0	6
1	4
2	5
3	3
4	6

- (i) Is the collected data above continuous or discrete? Explain your answer.

discrete. They are distinct values.

1

- (ii) Calculate the population standard deviation, correct to TWO decimal places.

$$= 1.5132 \dots \approx 1.51$$

1

- (iii) Nathan's friend, Matthew, plays for another soccer team.

1

The mean and population standard deviation for Matthew's season were 1.42 and 0.8 respectively.

Who was the more consistent goal scorer? Justify your answer

Matthew was the more consistent goal scorer.

There was a smaller standard deviation in his scores, which means there was a smaller spread.

Question 25 (10 marks)

Please start a separate writing booklet.

- (a) Before starting a fitness program, 16 people were asked to complete as many push-ups as possible in one minute. After six weeks in the fitness program, the participants were again asked to complete as many push-ups as possible in one minute.

The results are displayed in the back-to-back stem-and-leaf plot below.

Number of Push-ups 1/5 = 15

Before		After
9 6 3 1	1	5
9 9 8 8 7 5 1	2	2 3
2 1 0 0	3	1 2 6 7 7
1	4	4 4 7 9 9
	5	0 8
	6	3

Afterwards, the measures of location and spread were higher, i.e. the average was higher, and the data was less consistent. (higher s.d.) but the distribution became more symmetrical

Compare and contrast the TWO sets of data by examining the shape and skewness of the distribution and the measures of location and spread.

Before: $\bar{x} = 25.63$, median = 28, mode = 28, 29, 30 s.d. = 7.55
After: $\bar{x} = 39.81$, median = 40.5, mode = 37, 44, 49 s.d. = 12.78

Positively skewed

Symmetric distribution

- (b) Fiona is planning to sail from Baker Island (0° , 176°W) to Nauru (0° , 166°E)

(i) Find the shortest distance between Baker Island and Nauru. 1

(ii) It takes Fiona 48 hours to sail the shortest distance from Baker Island to Nauru. 2

If she leaves Baker Island at 8:00am on Monday, what is the local time and day in Nauru, on her arrival. (Ignore time zones)

$$(i) 176^\circ + 166^\circ = 342^\circ$$

$$\text{Shortest angular distance} = 360^\circ - 342^\circ = 18^\circ$$

$$\frac{18}{360} \times 2\pi \times 6400 = 2010.61 \approx 2010.6 \text{ km.}$$

$$(ii) 18 \times 4 = 72 \text{ mins}$$

Question continued over page.....

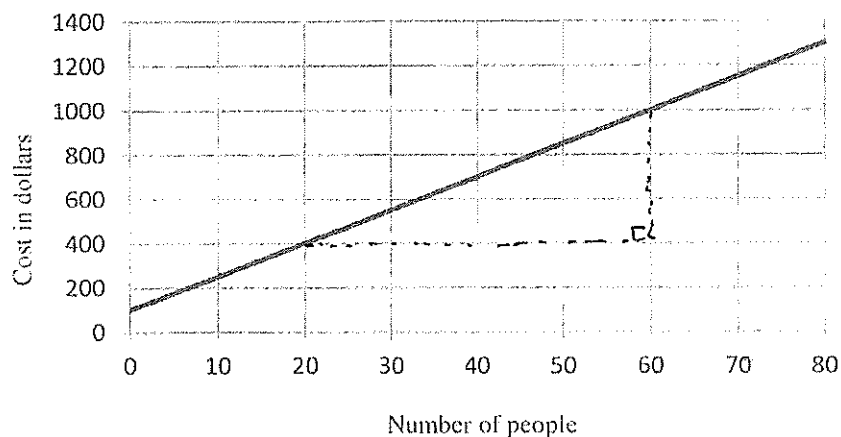
$$\text{Time in Nauru} = 8:00 \text{ am MON} - 72 \text{ mins} + 2 \text{ days} - 1 \text{ day}$$

$$= 6:48 \text{ am WED}$$

$$= 6:48 \text{ am TUE}$$

$$\therefore \text{LOCAL TIME IN NAURU} = 6:48 \text{ am on TUESDAY}$$

- (c) Abbey is holding her 18th Birthday party at a local restaurant. The graph below models the cost of Abbey's party at this restaurant.



- (i) What is the initial cost to hire the restaurant? ~ \$100
- (ii) What is the gradient of the line? What does it represent? $\frac{300}{40} = 7.5$
- (iii) If the restaurant increases the cost per person, what effect will this have on the line?

1

2

1

It represents a cost of \$7.50 per person.

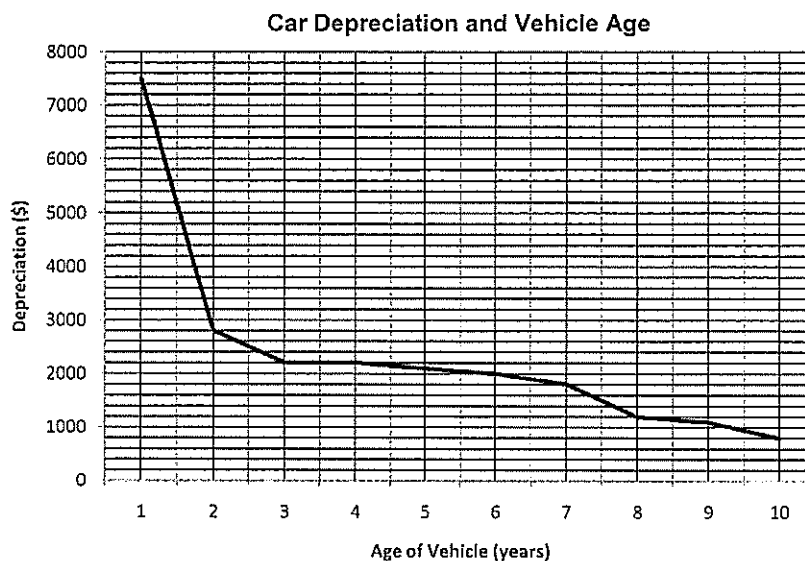
The line would be steeper.

The gradient would increase.

Question 26 (10 marks)

Please start a separate writing booklet.

- (a) A new car is purchased for \$30 000.
The depreciation of a car in its first 10 years is shown in the following graph.



- (i) What is the value of the car after 1 year? $30000 - 7500 = \$22500$ 1
- (ii) What is the value of the car after 2 years? $22500 - 2800 = \$19700$ 1
- (iii) What is the percentage loss in the value of the car after 2 years? 2
- (iv) Show by calculations, that by the end of the third year, the car has lost another 11.2% of its value. 2
- (v) Outline the loss in value of a new car over the first 10 years. 1

(iii) $\frac{10300}{30000} \times 100 = 34.3\%$

(iv) $19700 - 2200 = \$17500$

By then, the car has lost another $\dots \frac{2200}{19700} \times 100$

Question continued over page.....

$= 11.167$
 $\approx 11.2\%$

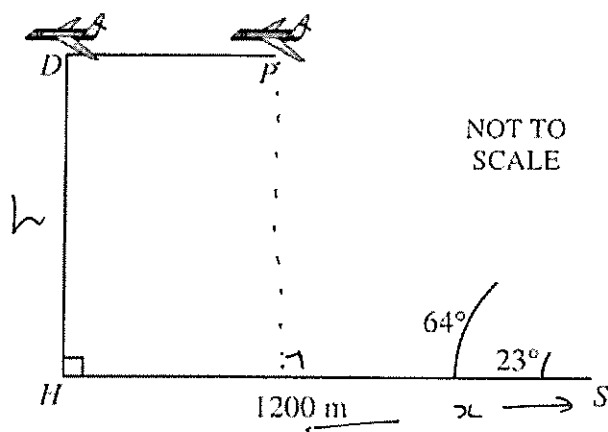
$\therefore$ By the end of the 3rd year, the car has lost another 11.2% of its value. 17

- (v) It is greatest in the first year. It loses more than 50% of the value it loses in 10 years in the first year.

(b)

3

Sean, S, is 1200 metres from his home, H, when he first sees an aeroplane. The angle of elevation from Sean to the plane at P is 64° . Five minutes later the plane is directly above Sean's home at D. The angle of elevation from Sean to D is 23° .



How far did the aeroplane travel from P to D, to the nearest metre?

End of Examination

$$\tan 23^\circ = \frac{h}{1200}$$

$$h = 1200 \times \tan 23^\circ$$

$$= 509.369 \dots \text{ m.}$$

$$\tan 64^\circ = \frac{509.369 \dots}{x}$$

$$x = \frac{509.369 \dots}{\tan 64^\circ}$$

$$= 248.436 \dots \text{ m}$$

$$1200 - 248.436 = 951.563 \approx 951.6 \text{ m}$$

18

$\therefore$ The aeroplane travelled 951.6 m (nearest m)