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Student Number

2016

TRIAL HIGHER SCHOOL CERTIFICATE
EXAMINATION

General 2 Mathematics

2nd August 2016

General Instructions

- Reading time – 5 minutes
- Working time $2\frac{1}{2}$ hours
- Write using blue or black pen
Black pen is preferred
- Board approved calculators may be used
- A formula sheet is provided at the back of this paper
- In Questions 26-30 show relevant mathematical reasoning and/or calculations

Total Marks – 100

Section I - Pages 2 - 8

25 marks

- Attempt Questions 1 – 25
- Allow about 35 minutes for this section

Section II - Pages 9 - 25

75 marks

- Attempt Questions 26 – 30
- Allow about 1 hour and 55 minutes for this section

Question	Mark
1- 25	/25
26	/15
27	/15
28	/15
29	/15
30	/15
Total	/100

THIS QUESTION PAPER MUST NOT BE REMOVED FROM THE EXAMINATION ROOM

This assessment task constitutes 40% of the Higher School Certificate Course Assessment.

Section I

25 marks

Attempt Questions 1 – 25

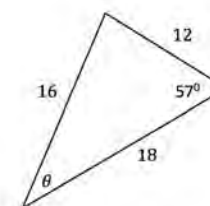
Allow about 35 minutes for this section

Use the multiple-choice answer sheet for Questions 1 – 25 (Detach from paper)

- 1) In NSW, standard number plates have black characters on a yellow background. The black characters are made up of three letters and three numbers. The number of car plates possible is :

- (A) 11 232 000
(B) 12 812 904
(C) 17 576 000
(D) 7 862 400

- 2) The size of the angle θ is nearest to



NOT TO
SCALE

- (A) 63°
(B) 39°
(C) 0.63
(D) 34°

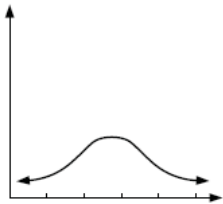
- 3) Kiki weighs 55.5 kg (measured to the nearest 0.1 kg). The percentage error for this measurement is:

- (A) 0.5%
(B) 0.45%
(C) 0.18%
(D) 0.09 %

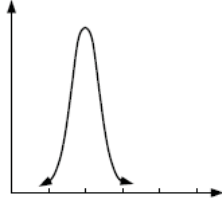
- 4) Benny borrowed \$2 500 for 8 months. His total repayments were \$2730. What was the simple interest rate per annum?

(A) 0.0115 %
 (B) 0.138 %
 (C) 11.5 %
 (D) 13.8 %

- 5) A



B



The above normal curves are drawn with the same scale on both axes. Comparing the curves, the correct statement is:

(A) A has a higher mean and larger standard deviation than B.
 (B) A has a higher mean and smaller standard deviation than B.
 (C) A has a lower mean and larger standard deviation than B.
 (D) A has a lower mean and smaller standard deviation than B.

- 6) For $P = E\sqrt{\frac{m}{r}}$, which equation represents r as the subject of the formula?

(A) $r = m\frac{E^2}{P^2}$
 (B) $r = m + \frac{E^2}{P^2}$
 (C) $r = \frac{E}{P}\sqrt{m}$
 (D) $r = \frac{P}{E\sqrt{m}}$

- 7) The back-to-back stem and leaf plot displays the results of 10MRED and 10MBLUE in the same Mathematics test.

10MRED		10MBLUE
5 1 0	3	
8 8 7 7 5 1	4	8
9 7 7 7 5 3 3 1 0	5	5 6
7 4 4 4 4 3 2	6	0 3 4 6 7 8
9 7 3	7	1 2 2 4 5 6 7 7 9
	8	0 1 3 4 5 5 8 8
	9	2 3

Which statement is NOT true:

(A) Data for 10MBLUE is negatively skewed.
 (B) The median of 10MRED is 54.
 (C) The range for 10MRED is 49.
 (D) The mean for 10M BLUE is higher than the mean of 10MRED

- 8) For a fundraising event a school hires a cinema to show the premiere of a movie. Hiring the cinema costs \$500. People are charged \$10 each to attend the movie. How many people need to attend for the school to break even?

(A) 50
 (B) 500
 (C) 510
 (D) 5000

- 9) Which of the following is the equation of the straight line with a gradient of -2 and a y-intercept of 2 ?

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

- 10) A patient is prescribed 0.4g of a medication per day. Each 10mL liquid capsule has the medication in the concentration 20mg/mL. How many capsules should the patient take per day?

(A) 5
(B) 2
(C) 1
(D) 4

- 11) Clark's formula below is used to calculate the required dosages of medicine for children.

$$\text{Dosage} = \frac{\text{weight}(kg) \times \text{dosage}(\text{adult})}{70}$$

Calculate the dosage of a cough medicine for a child who weighs 30kg using Clark's rule if the adult dosage is 14mg.

(A) 6mg
(B) 4mg
(C) 5mg
(D) 3mg

- 12) During a flood, 1.5 hectares of land was covered by water to a depth of 10cm. How many kilolitres of water covered the land?

(A) 15
(B) 15 000
(C) 150
(D) 1 500

- 13) A 2400 W bar heater is used on average 5 hours a day during the winter quarter (92 days). Calculate the cost of using the heater during winter if power is charged at the rate of \$0.29/kWh.

(A) \$320.16
(B) \$64.03
(C) \$32.02
(D) \$640.32

- 14) Alan earns an annual salary of \$62400 p.a. How much does he earn each fortnight?

(A) \$2400
(B) \$1200
(C) \$5200
(D) None of the above

- 15) Matt earns a salary of \$54706 and works 38 hours per week. Sam earns \$982 per week for working 37 hours. Which of the following is true?

(A) Sam gets the higher pay
(B) Matt and Sam earn the same amount after tax.
(C) Sam has a lower gross income than Matt.
(D) Matt's hourly pay is higher than Sam's by more than \$10

- 16) Which of the following statement regarding overtime pay is NOT true?

(A) Double time rate is always paid when an employee is working overtime.
(B) Time and a half is always 75% of double pay.
(C) Double time is calculated by multiplying normal pay rate by 2.
(D) Time and a half is 1.5 times the normal hourly rate.

- 17) When Hannah takes holidays for four weeks she receives her normal pay plus 17.5% annual leave loading.

Given that Hannah receives \$6500 for her four week holiday, her annual salary (excluding leave loading) is:

(A) \$ 1382.98
(B) \$ 71914.89
(C) \$ 26000
(D) Not enough information

18) Which of the following is NOT an example of a quantitative continuous data type?

- (A) Height of buildings
- (B) Body Mass
- (C) Annual Rainfall
- (D) Shirt Sizes

19) Jessica is finding trends using the data she collected. Which step of statistical inquiry is Jessica working on?

- (A) Organising Data
- (B) Writing a Report
- (C) Summarising Data
- (D) Analysing Data

20) Coca Cola wants to collect a stratified sample of their products to ensure their packaging machines are not overfilling their fizzy drinks. The following table shows the average hourly production of each fizzy drink line.

Drink	Coke	Fanta	Sprite	Lift
Production	80	65	45	40

How many bottles of Fanta should be drawn out if a sample of 20 is required?

- (A) 4
- (B) 5
- (C) 6
- (D) 7

21) If it costs \$5.81 to run a 15 Megajoule heater for 1 hour, how much would it cost for a 25 Megajoule heater to be on from 6pm to 11pm?

- (A) \$9.68
- (B) \$29.05
- (C) \$48.42
- (D) \$58.10

22) The floor of a basketball court is to be painted. What is the best estimate of the area to be painted?

- (A) 5 square metres
- (B) 500 square metres
- (C) 5 000 square metres
- (D) 50 000 square metres

23) When the values $u = -2$, $a = 9.8$ and $s = 6$ are substituted into the formula $v^2 = u^2 + 2as$, what is the resulting value of v correct to 1 decimal place?

- (A) $v = 121.6$
- (B) $v = 113.6$
- (C) $v = 11.0$
- (D) $v = 10.7$

24) Which factor does not affect the cost of compulsory third party car insurance?

- (A) Colour of the vehicle.
- (B) Type of vehicle.
- (C) Where the vehicle owner lives.
- (D) Age of the youngest driver.

25) A car that originally cost \$55 000 depreciates at a rate of 10% per annum. Using the declining balance method of depreciation, by how much will the value of the car have fallen after 4 years?

- (A) \$33 000
- (B) \$22 000
- (C) \$36 085.50
- (D) \$18 914.50

5
A 2
A 55

Answer the questions in the spaces provided. Your responses should include relevant mathematical reasoning and/or calculations.

Extra writing space is provided on page 26. If you use this space, clearly indicate which question you are attempting.

2 15 marks

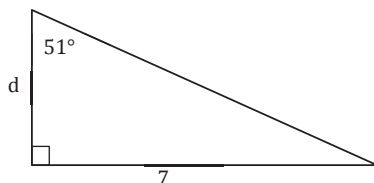
c) Expand $3a(6a^3 - b^5)$

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d) Calculate the value of d correct to 1 decimal place.

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Question 26 continued

e) Solve the equation $\frac{3x+2}{2} = 5(1-2x)$

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f) Solve these simultaneous equations to find the values of x and y .

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$$y = 3x - 2$$

$$2x - 3y - 20 = 0$$

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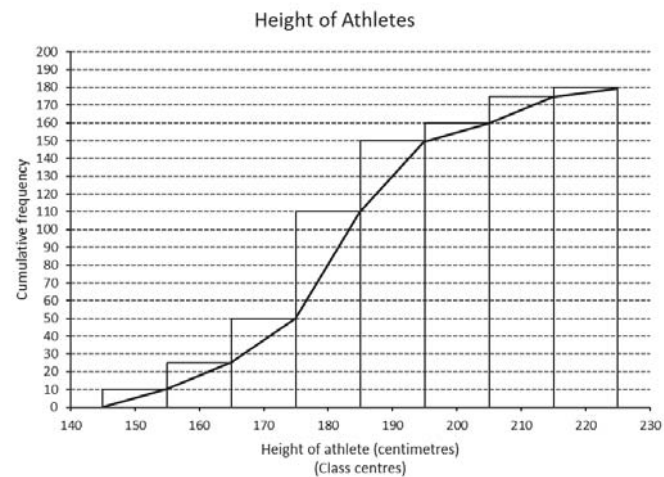
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Question 26 continues on page 11

Question 26 (continued)

The heights in centimetres of 180 athletes were measured, grouped into classes and then displayed using the cumulative frequency histogram shown.

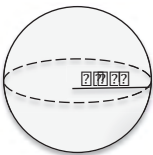


On the diagram, draw the lines needed to find the lower quartile and upper quartile heights.

The amount of time, T required to demolish a building varies inversely with the number of people, n in the demolition team. If it takes 8 people 3 days to demolish a factory, how many people will be needed to complete the same demolition in 4 days?

Question 26 (continued)

A lolly in the shape of a sphere has radius, $r = 1.5$ centimetres and volume, $V = 4.5 \times \pi$ cubic centimetres.



What would be the new height, h of the lolly if it was reshaped as a cylinder with the same volume and radius as the original spherical lolly?

(15 marks)

Adam is planning to buy a luxury sports car with a budget of \$100 000.

Purchase price: \$94 000
Registration cost: \$1140
Dealer delivery charge: \$3000

Stamp duty is calculated at \$4.50 for every \$100 of the purchase price, or part there of. Calculate the amount of stamp duty Adam has to pay.

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Luxury car tax is charged as follows:

- 8% of the purchase price up to and including \$90 000
- 12% of any amount of the purchase price over \$90 000

Calculate the amount of luxury car tax charged on this car.

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Question 27 (continued)

How much would Adam have to pay in total to buy the car? Would he go over his budget?

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Adam decides to borrow \$50 000 at a flat rate of 6.5% p.a. If the loan has to be repaid in equal monthly instalments over two years, calculate the monthly repayments.

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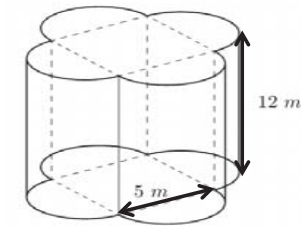
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Question 27 (continued)

Garrick's new car is powered by electricity. A fully charged battery allows the car to run for 430 km . A full recharge of the battery costs \$18.50 while a bus pass costs \$26 for 5 one way trips. Given that Garrick lives 48 km from work, is it cheaper for him to drive or is it cheaper to take the bus?

Question 27 (continued)

The base of a water tank is in the shape of a square with semicircles on each side of the square. The side length of the square is 5 m and the height of the water tank is 12 m .



What is the capacity of the tank to the nearest litre?

During a thunderstorm 35 mm of rain falls onto a roof with an area of 630 m^2 and is then collected in the water tank in part i) above. By how much does the water level in the tank rise?

(15 marks)

Kerry is playing a game that involves drawing a ball out of a bag. The bag contains 2 red balls, 1 green ball and 1 blue ball.

He pays \$2 to play the game. He wins \$1 if he draws a red ball, \$0.30 if he draws a green ball and \$0.40 if he draws a blue ball,

Calculate Kerry's financial expectation for the game.

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Queensland Tourism uses the slogan "Beautiful one day, perfect the next".

Mr Tsang decides to investigate the validity of this claim. Mr Tsang decides that 'Beautiful' and 'Perfect' both mean sunny.

A typical town in Queensland has a probability of 0.6 of having sunny weather on any given day.

Draw a probability tree representing the weather of two consecutive days for a typical town in Queensland.

Is the statement "Beautiful one day, perfect the next" accurate? Justify your answer with calculations.

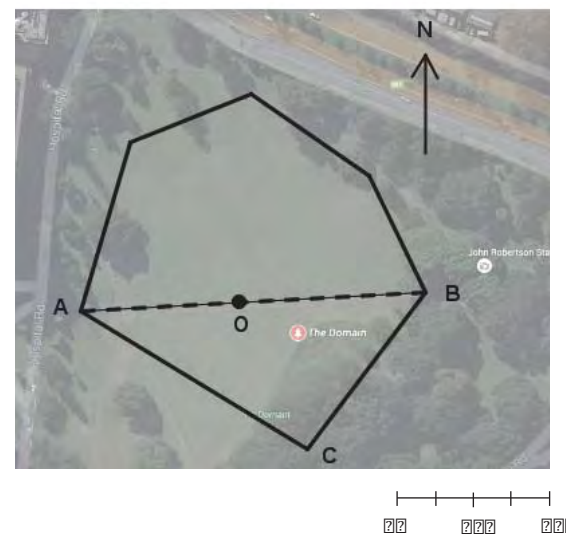
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Question 28 (continued)

Michael is organising a comeback concert for 'Midnight Oil' in The Domain. He has fenced parts of the domain as shown in diagram below.



The dashed line represents a pathway that needs to be kept clear for emergency access. Using the scale provided, estimate the length of the path. (Give your answer correct to the nearest metre.)

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The triangle indicated by ABC represents the 'Gold Class' ticket area. Standing at O, Michael measures the bearing of B to be 87° . The bearing of C from B is 217° . Show that the size of angle ABC is approximately 50°

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Question 28 (continued)

Given that the length BC is 106 metres, find the area of triangle ABC giving your answer correct to the nearest square metre.

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An aerial photograph of one of the lakes in the Menindee Lakes system is shown below.



The average depth of AB is 1.4 metres, the average depth of FC is 2.2 metres and the average depth of DE is 0.9 metres.

Using one application of Simpson’s rule estimate the volume of the lake correct to the nearest cubic metre.

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15 marks)

Write 3 factors that affect the Blood Alcohol Content (BAC).

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Alfonso has a mass of 87 kg and holds a provisional license. He started drinking alcohol at 7 pm. His blood alcohol content (BAC) at 11 pm is estimated to be 0.08. How many standard drinks has he consumed in 4 hours (answer to the nearest whole drink)?

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Alfonso knows that his blood alcohol content must be zero for him to drive. Using the formula below, calculate the earliest time he can drive home.

$$\text{Number of hours} = \frac{BAC}{0.015}$$

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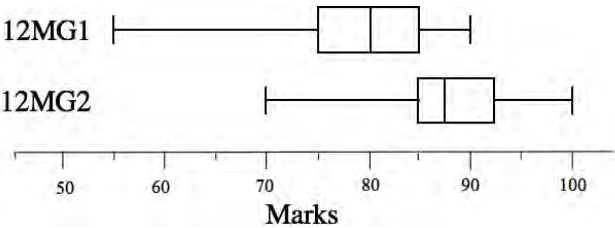
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Question 29 (continued)

The following box and whisker plots give the breakdown of Mathematics test results of two classes 12MG1 and 12MG2 in Hopeful High. There are 24 students in each classes.



How many students achieved a mark of 85 or more in 12MG2? Justify your answer.

2

Mr Smith claims that 12MG2 achieved better results compared to 12MG1. Is he correct?

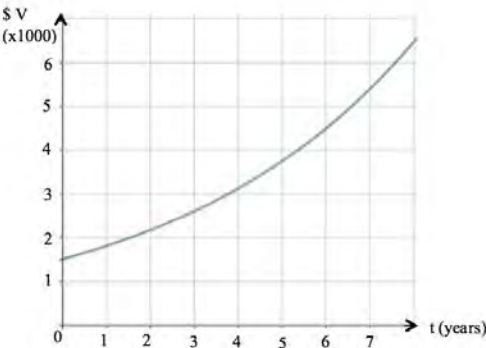
Justify your answer by referring to the summary statistics and the spread of the distribution.

Question 29 (continued)

Madam Coco has an antique vase collection. She knows that the rate of increase in the value of the vases in her collection has been constant for many years. On a recent trip to Greece she purchases a vase and adds it to her collection.

The rate of increase in value of the vase is shown in the following graph.

An exponential expression $V = A(1.2)^t$ can be used to find the value (\$V) of the vase after a given number of years (t)



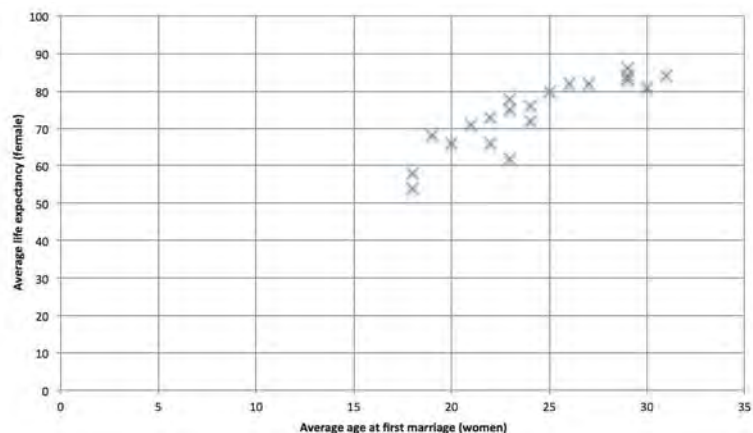
What is the value of A and what does it represent?

What is the yearly growth rate?

Calculate the value of the vase in 10 years (answer to the nearest dollar)

(15 marks)

The scatterplot shows the relationship between the average age of first marriage for women in years and average female life expectancy in years for 20 countries.



For the given data, the correlation coefficient, r , is 0.88. What does this indicate about the relationship between the average age at first marriage and average life expectancy for women for the 20 countries?

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For the data representing life expectancy for women, Q_L is 67 and the interquartile range is 15. Swaziland has an average female life expectancy of 44 years. Would this country be an outlier for this set of data? Justify your answer with calculations.

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Question 30 (continued)

The average life expectancy for the 20 countries in the scatterplot are:

54, 58, 62, 66, 66, 68, 71, 72, 73, 75, 76, 78, 80, 81, 82, 82, 83, 84, 84, 86

Complete the table below by calculating the mean, $\bar{y}$ and the population standard deviation, σ_y of this data. Calculate both values to two decimal places.

The table also shows the mean, $\bar{x}$ and the population standard deviation, σ_x of the age of first marriage for women for the same 15 countries.

	$\bar{x} = 24.15$	$\sigma_x = 3.92$
	$\bar{y} =$	$\sigma_y =$

Using the values from the table in part (iii), show that the equation of the least-squares line of best fit is $y = 2.03x + 25.03$

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On the scatterplot, draw the least-squares line of best fit, $y = 2.03x + 25.03$.

Using this line, or otherwise, estimate the life expectancy in a country which has an average age of first marriage for women of 25.

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Question 30 (continued)

Give one limitation of the line in relation to its context.

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Lucy states that she is not going to get married until she is at least 30 because it will lead to her living a longer life. Do you agree with her statement? Explain.

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If a 26 megabyte (MB) file takes 7 minutes and 6 seconds to download, find the download speed to the nearest kilobit per second (kbps).

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HSC General 2 Mathematics Trial 2016

Section I – Multiple Choice Answer Sheet

Use this multiple-choice answer sheet for questions 1 – 25. Detach this 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 the correct answer by writing the word *correct* and drawing an arrow as follows.

A ☒ B ☒ C ☐ D ☐
 correct

Start Here →

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

Section II

75 marks

Attempt Questions 26 – 30

Allow about 1 hour and 55 minutes for this section

Answer the questions in the spaces provided. Your responses should include relevant mathematical reasoning and / or calculations.

Extra writing space is provided on page 26 - 27. If you use this space, clearly indicate which question you are attempting.

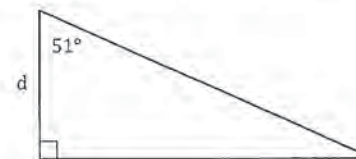
Question 26 (15 marks)

- a) Expand $3a(6a^3 - b^5)$

$$18a^4 - 3ab^5$$

1 mark
correct
answer

- b) Calculate the value of d correct to 1 decimal place.



$$\tan 51^\circ = \frac{7}{d}$$

$$\frac{1}{\tan 51} = \frac{d}{7}$$

1 mark correct
trig ratio

$$d = \frac{7}{\tan 51}$$

1 mark correct
answer

$$= 5.6684...$$

$$= 5.7 \text{ (1 d.p.)}$$

(no penalty for
incorrect rounding)

Question 26 continues on page 10

Use SOH CAH TOA or Pythagoras' Theorem in right-angled triangles.

Question 26 (continued)

- c) Solve the equation $\frac{3x+2}{2} = 5(1-2x)$

3

$$\frac{3x+2}{2} = 5 - 10x$$

1 mark expand brackets correctly

$$3x + 2 = 10 - 20x$$

1 mark further progress to a solution

$$23x + 2 = 10$$

$$23x = 8$$

1 mark final answer

$$x = \frac{8}{23}$$

Learn to deal with fractions in algebra.

- d) Solve these simultaneous equations to find the values of x and y .

3

$$\begin{array}{l} y = 3x - 2 \quad \text{--- ①} \\ 2x - 3y - 20 = 0 \quad \text{--- ②} \end{array}$$

sub ① into ②

$$2x - 3(3x - 2) - 20 = 0$$

1 mark correct substitution

$$2x - 9x + 6 - 20 = 0$$

$$-7x - 14 = 0$$

$$-7x = 14$$

$$x = -2$$

1 mark
1 provisional correct

sub $x = -2$ into ①

$$\begin{aligned} y &= 3(-2) - 2 \\ &= -8 \end{aligned}$$

1 mark
other provisional correct

Question 26 continues on page 11

Solution is $x = -2$, $y = -8$

Take care with negatives

-10-

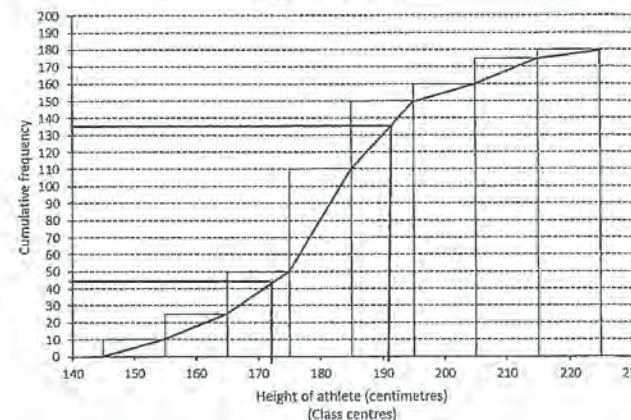
Don't forget second provisional value.

Question 26 (continued)

- e) The heights in centimetres of 180 athletes were measured, grouped into classes and then displayed using the cumulative frequency histogram shown.

2

Height of Athletes



1 mark

1 mark

On the diagram, draw the lines needed to find the lower quartile and upper quartile heights.

- f) The amount of time, T , required to demolish a building varies inversely with the number of people, n , in the demolition team. If it takes 8 people 3 days to demolish a factory, how many people will be needed to complete the same demolition in 4 days?

2

$$T = \frac{k}{n}$$

$$T = \frac{24}{n}$$

$$3 = \frac{k}{8}$$

when $T = 4$,

$$k = 24$$

$$4 = \frac{24}{n}$$

1 mark for k

$$n = \frac{24}{4}$$

= 6 people

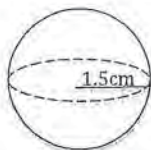
1 mark for n

Question 26 continues on page 12

Question 26 (continued)

- g) A lolly in the shape of a sphere has radius, $r = 1.5$ centimetres and volume, $V = 4.5 \times \pi$ cubic centimetres.

2



What would be the new height, h of the lolly if it was reshaped as a cylinder with the same volume and radius as the original spherical lolly?

$$V_{\text{sphere}} = 4.5\pi$$

$$V_{\text{cylinder}} = Ah$$

$$= \pi r^2 h$$

1 mark
expression
for volume

$$4.5\pi = \pi \times 1.5^2 \times h$$

$$h = \frac{4.5\pi}{1.5^2 \pi}$$

$$= 2 \text{ cm}$$

1 mark
value of h .

Use the formulae sheet

$$\text{Area of a circle, } A = \pi r^2$$

Question 27 (15 marks)

- a) Adam is planning to buy a luxury sports car with a budget of \$100 000.

Porsche Boxster

Purchase price: \$94 000

Registration cost: \$1140

Dealer delivery charge: \$3000

- i) Stamp duty is calculated at \$4.50 for \$100 of the purchase price, or there part of. Calculate the amount of stamp duty Adam has to pay. 1

$$94000 \div 100 = 940$$

① Correct Solution

$$\Rightarrow 940 \times 4.5 = \$4230$$

- ii) Luxury car tax is charged as follows: 2

- 8% of the purchase price up to and including \$90 000
- 12% of the purchase price over \$90 000

Calculate the amount of luxury car tax charged on this car.

$$8\% \times 90000 = \$7200$$

$$12\% \times 4000 = \$480$$

$$\text{Total} = \$7680$$

① Breaking down
the calculation
into two parts

① Correct Solution

Question 27 continues on page 14

Question 27 (continued)

- iii) How much would Adam have to pay in total to buy the car? Would he go over his budget? 2

$$94000 + 1140 + 3000 + 4230 + 7680$$

$$= \$110050 \quad \textcircled{1} \text{ Correct Solution}$$

Yes, he went over his budget by $\$10050$.
 * Most students did not justify.
 * Correct Conclusion with justification.

- iv) Adam decided to borrow \$50 000 of at a flat rate loan of 6.5% p.a. If the loan has to be repaid in equal monthly instalments over two years, calculate the monthly repayments. 3

$$P = \$50000$$

$$r = 6.5\% \text{ p.a.} \quad I = 50000 \times 6.5\% \times 2$$

$$n = 2 \text{ yr} \quad = \$6500 \quad \textcircled{1} \text{ Correct Calculation of Interest}$$

$$\text{Total} = 50000 + 6500$$

$$= \$56500 \quad \textcircled{1} \text{ Add on the principal}$$

$$\text{Monthly instalments} = \$56500 \div 24$$

$$= \$2354.17 \quad \textcircled{1} \text{ Divide by 24}$$

* Most students forgot the principal.
 * A number of students used compound interest formula.

Question 27 continues on page 15

Question 27 (continued)

- b) Garrick's new car is powered by electricity. A fully charged battery allows the car to run for 430 km. A full recharge of the battery costs \$18.50 while a bus pass costs \$26 for 5 trips. Given that Garrick lives 48 km from work, is it cheaper for him to drive or is it cheaper to take the bus? 2

$$5 \text{ trips} = 48 \times 5 = 240 \text{ km}$$

$$\Rightarrow 240 \div 430 = 0.55814 \text{ of a full charge.}$$

$$\Rightarrow \text{Electricity cost} = 0.55814 \times 18.5$$

$$= \$10.33$$

$\Rightarrow$ Driving is cheaper because it only cost \$10.33 for 5 trips comparing to the bus that cost \$26.

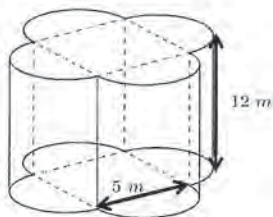
* Some calculation to convert values into a common unit of measure
 i.e. \$ per km, \$ per trip

* Conclusion with justification, referring to the values they calculated.

* Most students did not refer to their calculation.
 Some students did not do any calculations but drew a conclusion using the values in the question which were not awarded marks.

Question 27 (continued)

- c) The base of a water tank is in the shape of a square with semicircles on each side of the square. The sides of the square are 5 m and the height of the water tank is 12 m.



- i) What is the capacity of the tank in the nearest litre?

3

$$\text{Cross-Section Area} = 5^2 + 2 \times (\pi \times 2.5^2) \\ = 64.27 \text{ m}^2 \quad \textcircled{1} \text{ Calculate Cross-Section}$$

$$\Rightarrow \text{Volume} = 64.27 \times 12 \\ = 771.24 \text{ m}^3 \quad \textcircled{1} \text{ Calculate Volume}$$

$$771.24 \text{ m}^3 = 771239 \text{ L} \quad \textcircled{1} \text{ Correct Conversion}$$

★ Most students did not convert to litres.

- ii) During a thunderstorm 35mm of rain falls onto a roof with an area of 630 m² and is then collected in the water tank in part i) above. How much has the water level risen in the water tank?

2

$$\text{Amount of rain} = 35 \times 10^{-3} \times 630 \\ = 22.05 \text{ m}^3 \quad \textcircled{1} \text{ Calculate the volume of rain}$$

$$\Rightarrow \text{Water level} = 22.05 \div 64.27$$

$$= 0.343 \text{ m}$$

$$= 34.3 \text{ cm} \quad \textcircled{1} \text{ Calculate the change in water height.}$$

★ Most students did not calculate the water level.

Question 28 (15 marks)

- a) Kerry is playing a game that involves drawing a ball out of a bag. The bag contains 2 red balls, 1 green ball and 1 blue ball.

2

He pays \$2 to play the game. He wins \$1 if he draws a red ball, \$0.30 if he draws a green ball and \$0.40 if he draws a blue ball.

Calculate Kerry's financial expectation for the game.

$$F.E = \left(\frac{1}{2} \times 1\right) + \left(\frac{1}{4} \times 0.3\right) + \left(\frac{1}{4} \times 0.4\right) - 2 \\ = -\$1.33$$

• some added \$2
• some did not subtract \$2

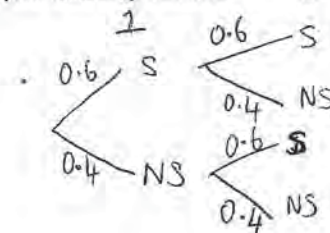
She loses -\$1.33 on average per game.

- b) Queensland Tourism uses the slogan "Beautiful one day, perfect the next". Mr Tsang decides to investigate the validity of this claim. Mr Tsang decides that 'Beautiful' and 'Perfect' both mean sunny.

A typical town in Queensland has a probability of 0.6 of having sunny weather on any given day.

- (i) Draw a probability tree representing the weather of two consecutive days for a typical town in Queensland.

2



quite a number got this correct, but some did not label the outcomes.

- (ii) Is the statement "Beautiful one day, perfect the next" accurate? Justify your answer with calculations.

2

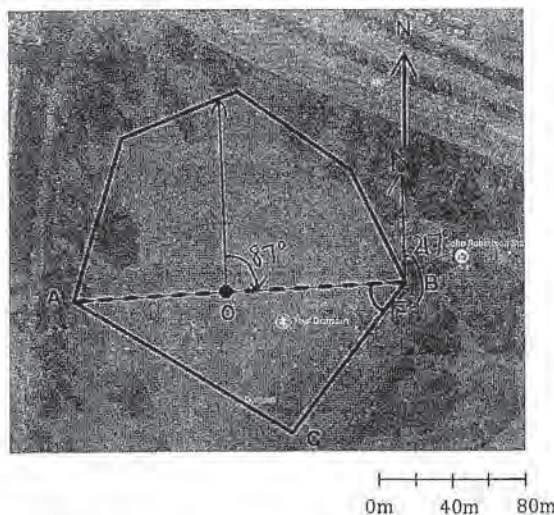
$$P(SS) = 0.6 \times 0.6 \\ = 0.36$$

Not accurate as there is only a 36% chance.

Question 28 continues on page 18

Question 28 (continued)

- c) Michael is organising a comeback concert for 'Midnight Oil' in The Domain. He has fenced parts of the domain as shown in diagram below.



- (i) The dashed line represents a pathway that needs to be kept clear for emergency access. Using the scale provided, estimate the length of the path. (Give your answer correct to the nearest metre.)

$$29 \text{ mm} = 80 \text{ m} \quad AB = 65 \text{ mm}$$

$$1 \text{ mm} = \frac{80}{29} \text{ m} \quad 65 \times \frac{80}{29} = 179 \text{ m}$$

• accuracy in measuring lengths was poor

- (ii) The triangle indicated by ABC represents the 'Gold Class' ticket area. Standing at O, Michael measures the bearing of B to be 87° . The bearing of C from B is 217° . Show that the size of angle ABC is approximately 50°

$$\angle OBN = 180 - 87^\circ \text{ (co-interior)}$$

$$= 93^\circ$$

$$\angle ABC = 360 - 217 - 93$$

Question 28 continues on page 19

$$= 50^\circ$$

• some estimated the other lengths and used cosine formula if correct or accepted
• some got 55° or 56° and by doing working and approximating to 50°

Question 28 (continued)

- iii) Given that the length BC is 106 metres, find the area of triangle ABC giving your answer correct to the nearest square metre.

$$\text{Area} = \frac{1}{2} \times 179 \times 106 \times \sin 50^\circ$$

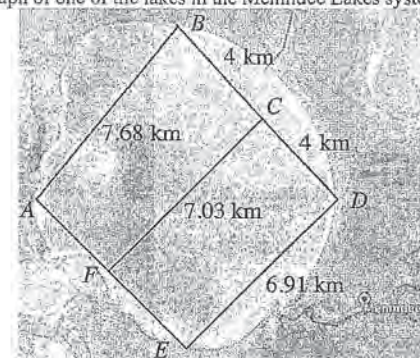
$$= 7267.46 \text{ m}^2$$

• Some in correct formula used

• Estimating the perpendicular height and using $\frac{1}{2}bh$ was accepted

• marks awarded for error carried forward

- d) An aerial photograph of one of the lakes in the Menindee Lakes system is shown below.



The average depth of AB is 1.4 metres, the average depth of FC is 2.2 metres and the average depth of DE is 0.9 metres.

Using one application of Simpson's rule estimate the volume of the lake correct to the nearest cubic metre.

$$V = \frac{4000}{3} (7680 \times 1.4 + 4 \times 7030 \times 2.2 + 6910 \times 0.9)$$

$$= 105\,113\,333.3 \text{ m}^3$$

$$= 105\,113\,333 \text{ m}^3$$

• many mixed up the units

Question 29 (15 marks)

- (a) (i) Write 3 factors that affect the Blood Alcohol Content (BAC).

done well

Gender, health, fitness, liver function - 2 marks
weight of the person, number of standard drinks consumed in a given time - 1 mark
3 reasons given

- (ii) Alfonso has a mass of 87 kg and holds a provisional license. He started drinking alcohol at 7 pm. His blood alcohol content (BAC) at 11 pm is estimated to be 0.08. How many standard drinks has he consumed in 4 hours (answer to the nearest whole drink)?

Some usual trial & error. They must show a value before and after the correct answer

$0.08 = \frac{10N - 7.5(4)}{6.8 \times 87}$ - 3 marks
Correct working out and answer
 $47.328 = 10N - 7.5 \times 4$ - 2 marks
significant progress toward solution
 $10N = 77.328$
 $N = 7.7328$ - 1 mark correct substitution
 $\therefore 8$ standard drinks

- (iii) Alfonso knows that his blood alcohol content must be zero for him to drive. Using the formula below, calculate the earliest time he can drive home.

$$\text{Number of hours} = \frac{\text{BAC}}{0.015}$$

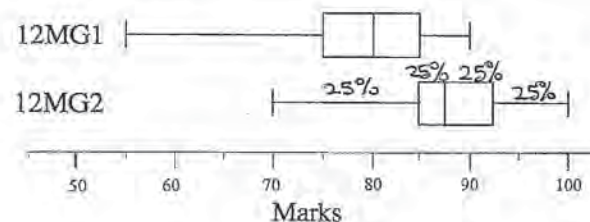
Number of hours = $\frac{0.08}{0.015}$ - 2 marks
Correct answer with working out
 $= 5.33 \dots h$ - 1 mark finding
 $= 5h 20min$ 5h 20min

11 pm + 5h 20min = 4.20 am next day

Question 29 continues on page 21

Question 29 (continued)

- b) The following box and whisker plots give the breakdown of Mathematics test results of two classes 12MG1 and 12MG2 in Hopeful High. There are 24 students in each class.



- (i) How many students achieved a mark of 85 or more in 12MG2? Justify your answer.

2

done well

$75\% \text{ of } 24 = 24 \times \frac{75}{100}$ 2 marks correct answer and statistic
 $= 18 \text{ students}$ out 75%
1 mark stating 75% or 18 student

- (ii) Mr Smith claims that 12MG2 achieved better results compared to 12MG1. Is he correct?

2

Yes

Justify your answer by referring to the summary statistics and the spread of the distribution.

	12MG1	12MG2
Range	90 - 35 = 35	100 - 70 = 30
Median	80	85
Over 85	25% of scores	75% of the scores
Mean	as the result of part i lower than 12MG2	higher mean (result of part i)

2 marks commenting on either of the following: 2 - median, range, referring part i commenting on median.

Must justify the reasons with calculations and values

1 mark reason given

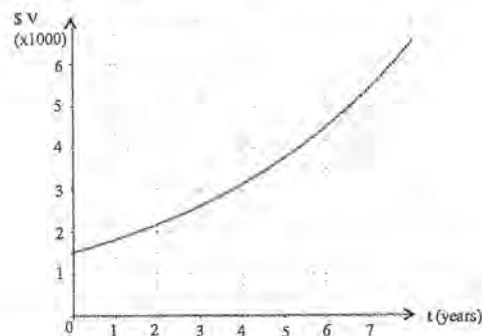
Question 29 continues on page 22

Question 29 (continued)

- c) Madam Coco has an antique vase collection. She knows that the rate of increase in the value of the vases in her collection has been constant for many years. On a recent trip to Greece she purchases a vase and adds it to her collection.

The rate of increase in value of the vase is shown in the following graph.

An exponential expression $V = A(1.2)^t$ can be used to find the value (\$) of the vase after a given number of years (t)



Failed to realise that A is purchase or original price

- (i) What is the value of A and what does it represent?

A : Purchase price of the vase - 2 marks correctly defines A and the value
\$1500
1 mark one correct answer given

- (ii) What is the yearly growth rate?

$$1.2 = 1 + 0.2 \quad 20\% \\ = 100\% + 20\%$$

1 mark correct answer

- (iii) Calculate the value of the vase in 10 years (answer to the nearest dollar)

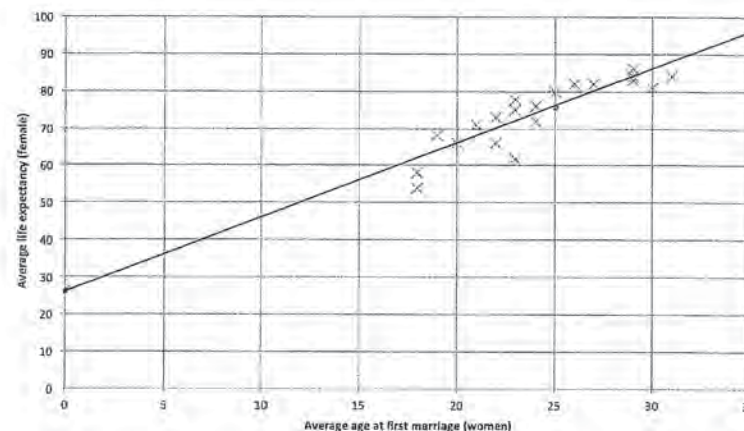
$$V = 1500 (1.2)^{10} \\ = \$9287.60$$

$$= \$9288 \text{ nearest dollar}$$

1 mark
Correct answer with working out

Question 30 (15 marks)

- a) The scatterplot shows the relationship between the average age of first marriage for women in years and average female life expectancy in years for 20 countries.



- i) For the given data, the correlation coefficient, r , is 0.88. What does this indicate about the relationship between the average age at first marriage and average life expectancy for women for the 20 countries?

• Mostly done well

There is a strong positive correlation between the two variables or the later a woman gets married the longer the life expectancy
1 mark for correct answer

- ii) For the data representing life expectancy for women, Q_L is 67 and the interquartile range is 15. Swaziland has an average female life expectancy of 44 years. Would this country be an outlier for this set of data? Justify your answer with calculations.

• Some did not use the formula

• Others did not realise that being less than the number calculated meant it was an outlier.

$$\text{Outlier} = 67 - 1.5 \times 15 \\ = 44.5$$

Swaziland is an outlier because it is less than 44.5

2 marks for correct conclusion from correct working

1 mark for incorrect calculation with justified aligning with answer

Question 30 continues on page 24

Question 30 (continued)

iii) The average life expectancy for the 20 countries in the scatterplot are:

54, 58, 62, 66, 66, 68, 71, 72, 73, 75, 76, 78, 80, 81, 82, 82, 83, 84, 84, 86

Complete the table below by calculating the mean, $\bar{y}$ and the population standard deviation, σ_y of this data. Calculate both values to two decimal places.

The table also shows the mean, $\bar{x}$ and the population standard deviation, σ_x of the age of first marriage for women for the same 15 countries.

	Mean	Standard deviation
Age at first marriage	$\bar{x} = 24.15$	$\sigma_x = 3.92$
Life expectancy	$\bar{y} = 74.05$	$\sigma_y = 9.05$

• Mostly done well.

1 mark for each correct answer

iv) Using the values from the table in part (iii), show that the equation of the least-squares line of best fit is $y = 2.03x + 25.03$

$$\text{gradient} = 0.88 \times \frac{9.05}{3.92} \quad y\text{-int} = 74.05 - 2.03 \times 24.15$$

$$= 2.03 \quad = 25.03$$

$$\text{Therefore } y = 2.03x + 25.03$$

2 marks for correct answer with working
1 mark for correct use of 1 formula

• Some had incorrect working and tried to pretend it was correct.
• Others did not use the formula.

v) On the scatterplot, draw the least-squares line of best fit, $y = 2.03x + 25.03$, when $x = 25$, $y = 75.78$

2 marks for correct line
1 mark for straight line through y-intercept of 25.03

vi) Using this line, or otherwise, estimate the life expectancy in a country which has an average age of first marriage for women of 25.

$$75 \text{ years (from graph)} \quad \text{or} \quad y = 2.03(25) + 25.03$$

$$= 75.78$$

1 mark for correct answer

• Mostly done well.

Question 30 continues on page 25

Question 30 (continued)

vii) Give one limitation of the line in relation to its context.

A number of answers including:

- life expectancy and age are not continuous (cannot be less than 0 or greater than 130)
- the line cannot be used to extrapolate beyond the range used to create the line.

viii) Lucy states that she is not going to get married until she is at least 30 because it will lead to her living a longer life. Do you agree with her statement? Explain.

No, correlation does not always mean causation.
Getting married later does not lead to a longer life.

1 mark for correct answer with justification

b) If a 26 megabyte (MB) file takes 7 minutes and 6 seconds to download, find the download speed to the nearest kilobit per second (kbps).

• Most common error was not converting down to bytes before converting to bits.

$$\text{Speed} = \frac{26 \times 1024 \times 1024 \times 8}{426} \quad 7 \text{ mins} = 420 \text{ secs}$$

$$= 511\,980.77 \text{ bps}$$

$$\frac{511\,980.77}{1000} = 511.98 \dots$$

$$= 512 \text{ kbps}$$

3 marks for correct answer with working
2 marks for significant progress towards answer
1 mark for correct conversion to bytes or kilobytes

Majority did not know how to attempt this question.

End of Exam ☺