Caringbah High School

Year 12 2026

Mathematics Standard 2

HSC Trial Examination

General Instructions

- Reading time – 10 minutes
- Working time – 150 minutes
- Write using a blue or black pen
- Calculators approved by NESA may be used
- A reference sheet is provided
- For questions in Section II, show relevant mathematical reasoning and/or calculations
- Marks may not be awarded for partial or incomplete answers

Total marks – 100

Section I **15 marks**

Attempt Questions 1-15

Mark your answers on the answer sheet provided.

Section II **85 marks**

Attempt Questions 16-41

Write your answers for each question in the space provided. Extra writing space is available on pages 30-32.

Student Number: _____ Class:_____

Marker's Use Only		
Section I	**Section II**	**Total**
/15	/85	/100

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Section I

15 marks

Attempt Questions 1-15

Allow about 25 minutes for this section

Use the multiple-choice answer sheet for Questions 1–15

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1. Jane purchased a new laptop for her business at the end of 2023 for $3 990. Use the declining balance method to determine the value of the laptop at the end of 2025, using the depreciation rate of 30% per annum.

The value of the laptop to the nearest dollar is:

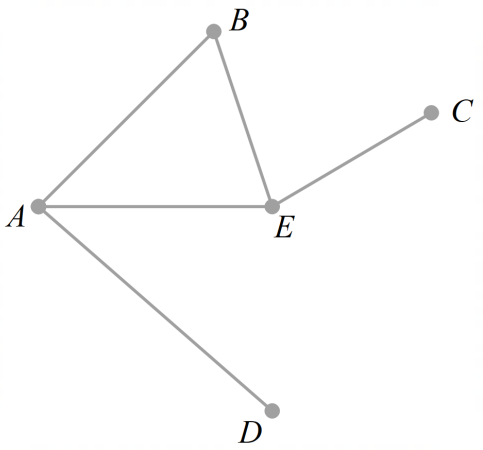
(A) $558

(B) $1 197

(C) $1 955

(D) $2 394

2. What is the degree of vertex A in this network diagram?



(A) 4

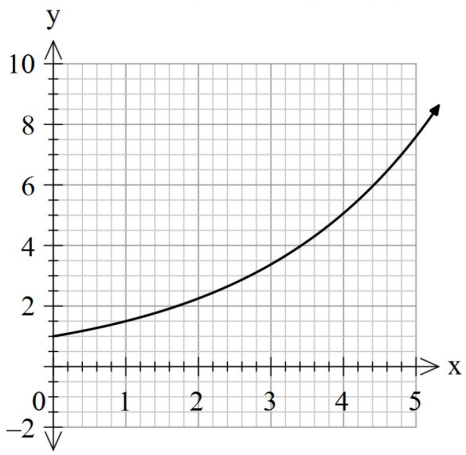
(B) 3

(C) 2

(D) 1

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3. The following graph shows the graph of $y = a^x$, for some number a that is greater than 1.



Which would be the closest value of $0.5(a^{4.2})$?

(A) 6

(B) 5.5

(C) 3

(D) 2.75

4. Stanley wants to know the present value of an annuity which will earn 3% per annum, compounded monthly. In ten years' time, the future value will be \$5 000. Which calculation will result in the correct answer?

(A) $N = \dfrac{5\,000}{(1 + 0.03)^{10}}$

(B) $N = \dfrac{5\,000}{(1 + 0.03)^{120}}$

(C) $N = \dfrac{5\,000}{\left(1 + \dfrac{0.03}{12}\right)^{10}}$

(D) $N = \dfrac{5\,000}{\left(1 + \dfrac{0.03}{12}\right)^{120}}$

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5. A statistician was hired to estimate the number of fish in a lake. In his first sample, 2 400 fish were taken from the lake, tagged and returned to the lake. The next day, a random sample of 5 000 fish were caught and contained 1 955 tagged fish.
The approximate number of fish in the lake was calculated to be:

(A) 9 355

(B) 7 400

(C) 6 138

(D) 6 955

6. Ben bought a new fridge for $1 500. It has an energy consumption of 482 kWh per year. Energy is charged at a rate of $0.33/kWh.
How much, in total, will it cost to purchase then run this fridge for 4 years?

(A) $636.24

(B) $1 659.06

(C) $2 136.24

(D) $6 636.24

7. A model car is 20 cm in length. The model is built to a scale of 1 : 28.
What is the actual length of the car?

(A) 5.6 cm

(B) 71 cm

(C) 5.6 m

(D) 7.1 m

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8. Frank takes out a reducing-balance loan of $57 500 to fund his business. The loan is to be repaid over 6 years in equal quarterly repayments. The interest rate charged is 8% per annum, compounding quarterly.

The table below shows the present value interest factors for a loan of $1 000 for various interest rates, r, and number of periods, N.

Table of present value interest factors for $1 000				
r / N	Interest rate per period (as a decimal)			
	0.02	0.04	0.06	0.08
20	0.016351	0.013590	0.011469	0.009818
24	0.018914	0.015246	0.012550	0.010528
28	0.021281	0.016663	0.013406	0.011051
32	0.023468	0.021787	0.014084	0.011434

What is the value of the quarterly repayments Frank is required to make?

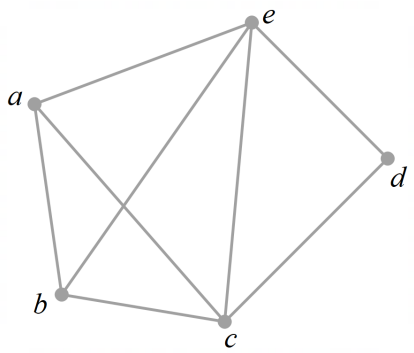
(A) $3 040.08

(B) $3 450.76

(C) $5 461.63

(D) $5 856.59

9. Consider the network diagram.



Which of the following is true?

(A) A trail that uses every edge of the network only once exists because the network contains exactly two odd vertices.

(B) A trail that uses every edge of the network only once exists because the network contains at least two odd vertices.

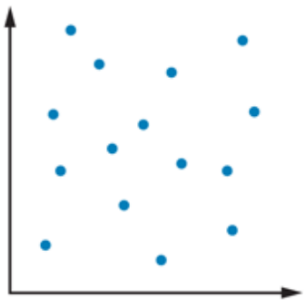
(C) A circuit that uses every edge of the network only once exists because the network contains exactly two odd vertices.

(D) A circuit that uses every edge of the network only once exists because the network contains at least two odd vertices.

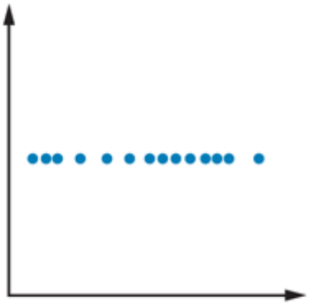
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10. Which scatterplot has a zero correlation coefficient?

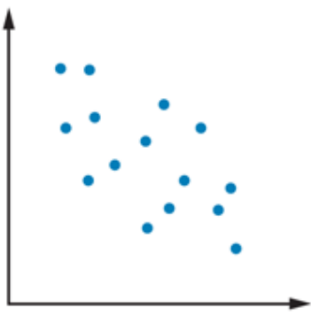
(A)



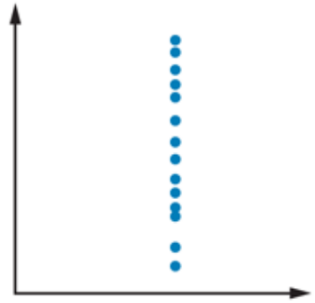
(B)



(C)



(D)



11. A ball is thrown into the air and its height, h m, at time, t s, is given by the equation $h = -4t^2 + 16t$. After how many seconds does the ball reach its maximum height?

(A) 4

(B) 3

(C) 2

(D) 1

12. Sarah received an inheritance of $420 000 and divided it between herself and her two children in the ratio 3 : 2 : 2. How much did Sarah receive?

(A) $180 000

(B) $140 000

(C) $120 000

(D) $60 000

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13. Matthias' car consumes an average of 11 litres of fuel per 100 kilometres for city driving, and 8 litres per 100 kilometres for country driving.
If Matthias takes a trip where he travels 62 kilometres in the city and 230 kilometres in the country, what is his expected fuel consumption?

(A) 28.66 L

(B) 25.22 L

(C) 32.16 L

(D) 27.74 L

14. The sugar content of a brand of lolly is normally distributed with a mean of 4.5 mg. 2.5% of lollies have a sugar content greater than 4.9 mg. What is the standard deviation of the lolly distribution?

(A) 0.12 mg

(B) 0.4 mg

(C) 0.2 mg

(D) 0.11 mg

15. To build a house, Ben and Anita borrow $800 000 at 5.25% p.a. over 30 years, with monthly repayments of $4 417.63. What is the total amount of interest that they will pay?

(A) $1 590 347

(B) $132 528.90

(C) $790 347

(D) $1 260 000

End of Section I

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Section II

85 marks
Attempt Questions 16–38
Allow about 2 hours and 5 minutes for this section

Your responses should include relevant mathematical reasoning and/or calculations.
Extra writing space is available on pages 28-32.

Question 16 (2 marks)

An eight-sided die was rolled 100 times and the results recorded in the table below.

Number Obtained	1	2	3	4	5	6	7	8
Frequency	22	21	19	15	12	7	3	1

(a) What is the relative frequency of rolling a 5? **1**

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(b) Describe the distribution of the results (as positively or negatively skewed, or symmetrical). **1**

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Question 17 (2 marks)

Solve the following simultaneously: **2**

$$4x - y = 3$$
$$2x + y = 15$$

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Question 18 (3 marks)

Koa buys 800 shares in the Snail Trail Adventure Company. The shares were trading at $13.54 per share. The brokerage fee for purchasing the shares was 3% of the purchase price.

(a) The Snail Trail Adventure Company declared an annual dividend yield of 5.5%. How much did Koa receive? **1**

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(b) Koa sold her shares for $15.60 per share and paid $200 brokerage on the sale. What net profit does she make from the shares, taking into account purchase, sale, fees and dividends? **2**

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Question 19 (3 marks)

The maximum daily temperatures during the summer months in Manilla, NSW are recorded. These maximum temperatures are normally distributed with a mean of 33.8°C and a standard deviation of 4.1°C.

(a) What temperature has a z-score of -1? **1**

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(b) What percentage of summer days in Manilla would you expect to be between 29.7°C and 42.0°C? **2**

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Question 20 (2 marks)

An intravenous drip is delivering 30 drops/min. There are 15 drops/mL and 1.2 L of liquid to be delivered. How long will the drip take to deliver the required dose? **2**

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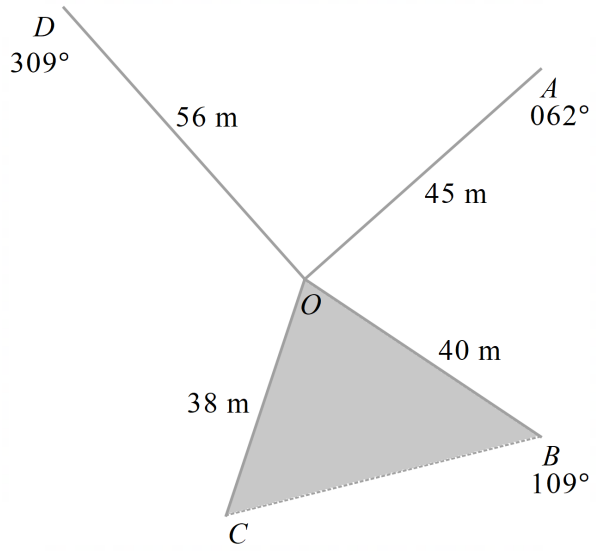
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Question 21 (3 marks)

The following sketch was made during a radial survey of a field. **3**



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The area of ΔBOC is 748 m². Find the bearing of C from O, to the nearest degree, noting that $\angle BOC$ is acute.

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Question 22 (2 marks)

A recipe for making large batches of chocolate chip cookies requires flour and sugar in the ratio of 3:2. **2**

If the recipe claims 2 cups of flour will make 25 cookies, how much sugar is needed to make 60 cookies?

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Question 23 (5 marks)

Victoria takes out a loan of \$120 000 at 6% p.a. Interest (I) is calculated monthly. She will make a repayment (R) of \$1250 each month. Victoria draws up a table showing the progress she makes repaying the loan over the first 5 months.

Months	Principal (P)	Interest (I)	$P + I$	$P + I - R$
1	120 000.00	600.00	120 600.00	119 350.00
2	119 350.00	596.75	119 946.75	118 696.75
3	118 696.75	593.48	119 290.23	118 040.23
4	118 040.23	590.20	118 630.43	117 380.43
5	A	B		C

(a) Find the values of A, B and C. **3**

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(b) By what percentage had Victoria reduced the principal of the loan at the end of 5 months, correct to 1 decimal place? **2**

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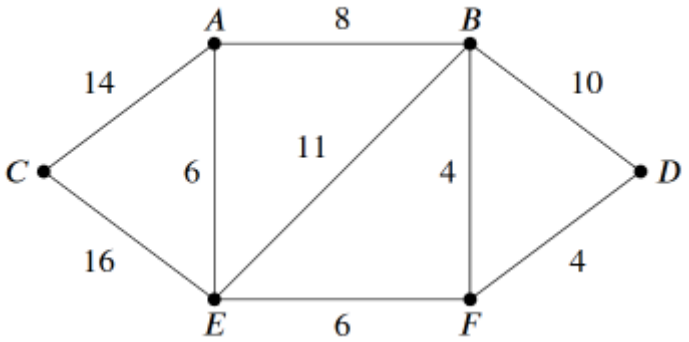
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Question 24 (4 marks)

Six computer terminals in different offices of a building need to be connected to each other with internet cabling. The six terminals are represented as ***A, B, C, D, E*** and ***F*** in the network diagram below.



The numbers in the network diagram show the length of cable, in metres, which is needed to connect two particular computer terminals.

(a) Before the cable was laid, a consultant was asked to determine the minimum amount of cable needed to connect the terminals. She decided to draw a minimum spanning tree for the cable network. **1**

Briefly describe how drawing a minimum spanning tree would help the consultant.

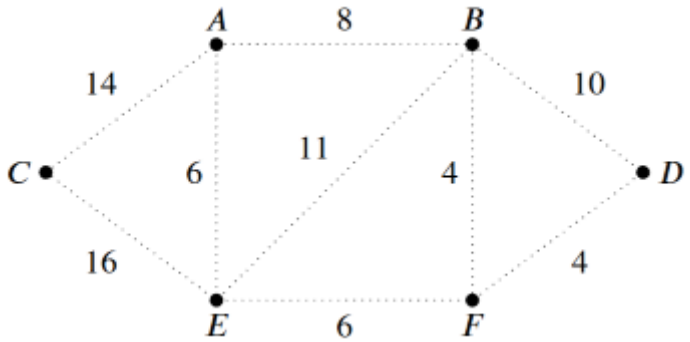
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(b) On the diagram below, draw the minimum spanning tree for the network. **1**



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(c) The cable can be supplied and laid for this network at a cost of $17.30 per metre. What is the minimum possible cost of laying the cable? **2**

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Question 25 (2 marks)

The length of a pole is measured at 45 cm to the nearest centimetre. What is the percentage error of this measurement? Give your answer correct to 2 significant figures. **2**

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Question 26 (2 marks)

Make x the subject of the formula below, leaving your answer as a simplified fraction. **2**

$$\frac{x+y}{y} = \frac{y}{a} + \frac{a}{y}$$

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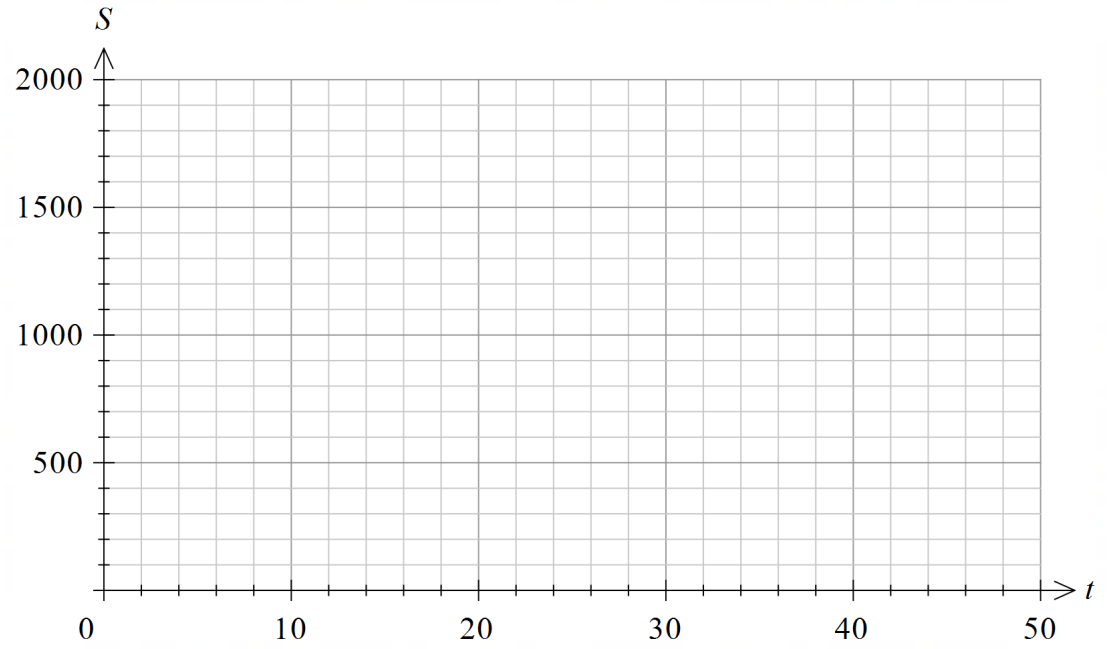
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Question 27 (4 marks)

Riley has \$100. He starts to save \$25 each week to buy a new racing bike.
His savings can be modelled by $S = 100 + 25t$, where S is the dollars saved and t is the time in weeks from when he started saving money.

(a) On the grid below, draw the graph of this model and label it as Riley's savings. **1**



(b) Amelia, Riley's sister, wanted to start saving 8 weeks after Riley began saving. **2**
She initially had no money, but saves \$40 per week.
By drawing a line on the grid above, or otherwise, find the value of t when the siblings have the same amount of money.

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(c) Using the graph, or otherwise, find the value of t when Amelia's savings is \$300 more than Riley's savings. **1**

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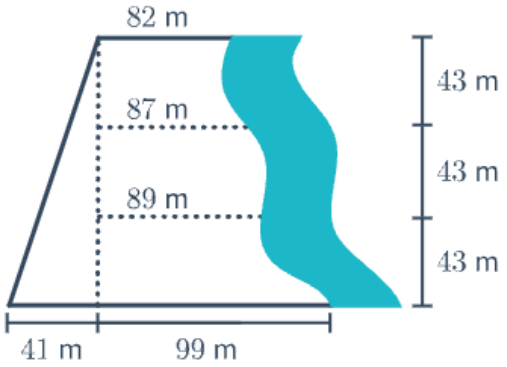
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Question 28 (4 marks)

A surveyor provided the following diagram, with measurements, for a property they mapped out.



(a) Find the approximate total area of the property by using three applications of the trapezoidal rule, leaving your answer in square meters. **3**

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(b) The average weekly rainfall is 34 mm. Calculate the total volume of water that falls on the land in cubic metres. Round your answer to 2 decimal places **1**

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Question 29 (5 marks)

Lieutenant Smith mapped out an orienteering course for the Bravo cadets. He left point *A* on a bearing of 050° and walked for 7 km and placed marker *B*. From point *B* he then left on a bearing of 120° and walked for 8 km to a point *C*.

(a) Draw a diagram to represent this information **1**

(b) Find the distance from point *C* to point *A*, to once decimal place **2**

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(c) What is the bearing of *C* from *A*. **2**

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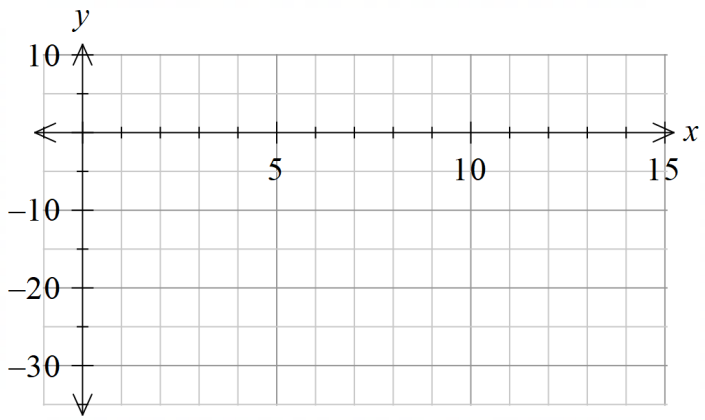
Question 30 (4 marks)

Consider the function $y = -x^2 + 12x - 32$

(a) Complete the table of values below: **1**

x	0	4	8	12
y				

(b) Using the table above, or otherwise, graph the function **1**



(c) Using the graph or otherwise, find the coordinates of the turning point of the function. **2**

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Question 31 (2 Marks)

(a) If m is inversely proportional to n, and $m = 10$ when $n = 25$.

Find k, the constant of proportionality. **1**

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(b) What is the value of n when $m = 50$? **1**

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Question 32 (4 marks)

The basal metabolic rate (BMR) of a person refers to the minimum amount of energy (in kilojoules) needed to sustain basic bodily functions (that is, to keep the person alive) for a 24-hour period.

The energy output needed is then given by:

Energy out = basal metabolic rate (BMR) × physical activity level (PAL)

The Harris-Benedict Model can be used to estimate BMR, in kJ/day. It is given by:

- $\text{BMR}_{\text{male}} = 278 + 57.5W + 20.9H - 28.2A$
- $\text{BMR}_{\text{female}} = 278 + 40.0W + 7.7H - 19.6A$

where W is weight (in kg), H is height (in cm) and A is age (in years).

(a) A 25-year-old woman weighs 62 kg and she has a height of 159 cm. Use the Harris-Benedict Model to estimate the woman's BMR, to the nearest kJ/day. **2**

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(b) The woman undertakes an activity with a PAL of 12.8. What would be the amount of energy expended in one hour of undertaking this activity, to the nearest kJ? **2**

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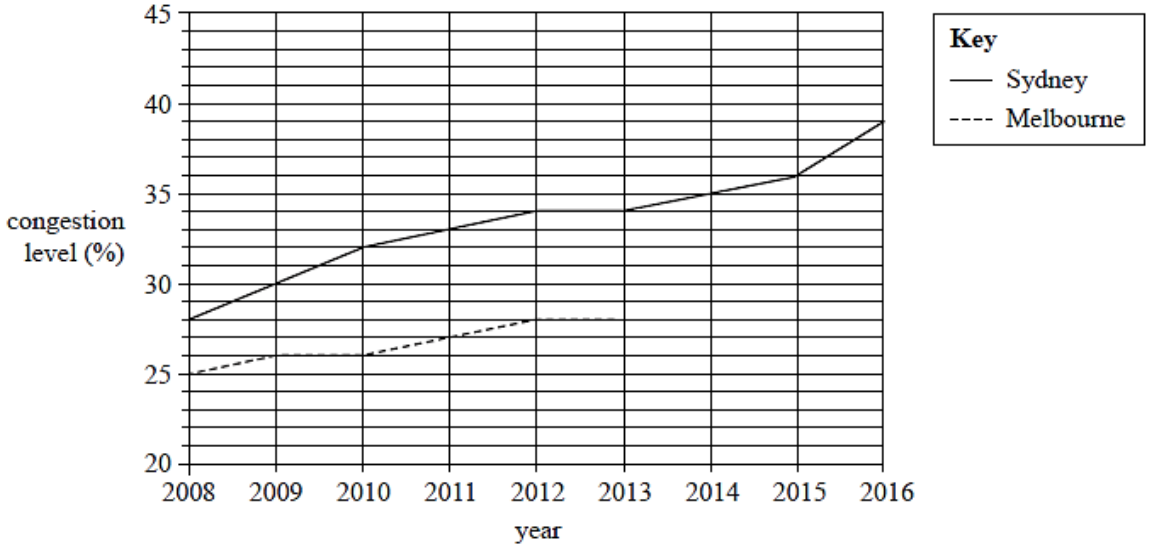
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Question 33 (4 marks)

The table below shows the yearly average traffic congestion levels in two cities, Melbourne and Sydney, during the period 2008 to 2016.

Also shown is a time series plot of the same data. The time series plot for Melbourne is incomplete.

	Congestion Level (%)								
Year	2008	2009	2010	2011	2012	2013	2014	2015	2016
Melbourne	25	26	26	27	28	28	28	29	33
Sydney	28	30	32	33	34	34	35	36	39



Data: TomTom International BV, <www.tomtom.com/en_gb/trafficindex>

(a) Use the data in the table to complete the **time series plot above** for Melbourne. **1**

(b) A line of best fit is used to model the trend line in the same series plot for Sydney. The equation is:

$$\text{congestion level} = -2\,280 + 1.15 \times \text{year}$$

i) Draw this line on the time series plot above. **1**

ii) Determine the average rate of increase in percentage congestion level for the period 2008 to 2016 inclusive. **1**

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iii) Use the equation to predict when the percentage congestion in Sydney will be 43% **1**

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Question 34 (4 marks)

Zahli is charged 17.52% p.a. interest, compounded daily, on her credit card, with no interest-free period. Interest is charged from, and including, the date of purchase to, and including, the date of payment. She checks her balance on the 18th of June and finds an outstanding balance of $2344.52. On the 25th of June she makes a $210.00 purchase, and on the 8th of July she makes a purchase of $53.20. **4**

How much will be owing on Zahli's credit card when she is due to make her next payment on the 15th of July?

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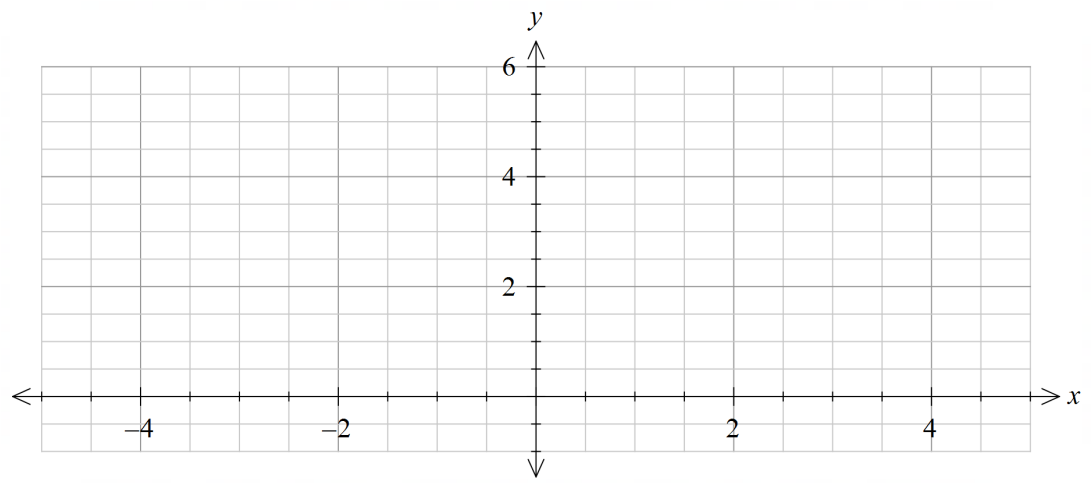
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Question 35 (3 marks)

By using graphical means, or otherwise, find and label the point of intersection of $x + 3y = 1$ and $y = 2x + 5$. **3**



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Question 36 (2 marks)

Ingrid lives in Spain, located (50°N, 1°E). She is trading in US stocks with her broker in New York, which is located at (40°N, 74°W). **2**

The New York stock exchange closes at 4:30 p.m. New York time.

What is the latest time and day, in Spain, that Ingrid can place an order through her broker?

Note: You may use the fact that 15° = 1 hour time difference. Ignore daylight savings.

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Question 37 (2 Marks)

Atlas sat for three Geography tests during Year 12. The table below shows his results and the class's average mark and standard deviation for the tests.

	Atlas' Mark	Average Mark	Standard deviation
Test 1	82	73	6
Test 2	87	75	10
Test 3	x	72	8

(a) In which test, Test 1 or Test 2, did Atlas perform better compared to the rest of the class? Justify your answer. **1**

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(b) When compared to the rest of the class. Atlas' performance in Test 3 is equivalent to his performance in Test 1. What is his mark for Test 3? **1**

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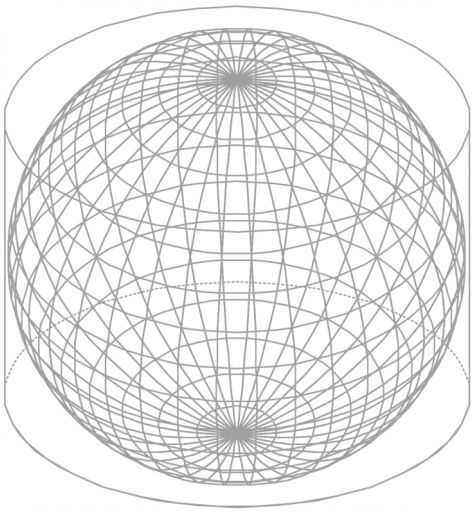
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Question 38 (4 Marks)

A sphere fits exactly into a cylindrical container as shown below.



For questions **a – c**, please round your answers to the nearest whole number.

(a) If the diameter of the sphere is 20 cm, what is its volume? **1**

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(b) What is the volume of the cylinder? **2**

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(c) What percentage of space is the sphere taking up inside the cylinder? **1**

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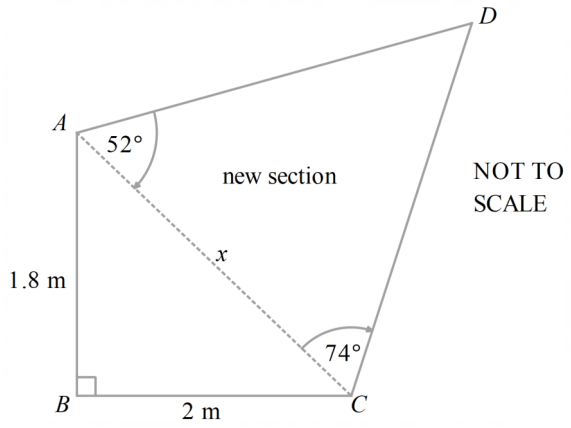
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Question 39 (5 marks)

Hebe owns a chicken enclosure in the shape of a right-angled triangle. The hypotenuse of the triangle is given by x, and its two other sides have lengths 1.8 m and 2 m. **5**

Hebe wants to give the chickens more space to roam by removing the fence that forms the hypotenuse of the right-angled triangle, AC, and adding a new triangular section to the enclosure, as shown in the diagram.



Find the area of the new triangular section, ΔACD, of the enclosure and the length of the fencing, in metres, required to construct AC and DC. Give your answers correct to three decimal places.

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Question 40 (4 marks)

Eight basketball players had their height and arm span measured.

Height (x cm)	175	184	200	183	172	187	190	178
Arm span (y cm)	170	185	195	182	174	188	190	177

(a) Calculate, correct to 4 decimal places, Pearson's correlation coefficient, r, for this data set. **1**

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(b) Find the equation of the least-squares regression line for this data. Round any calculations to 3 decimal place. **2**

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(c) Use your equation to estimate the height, to the nearest centimetre, of someone with an arm span of 181 cm. **1**

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Question 41 (4 Marks)

The table below shows the future value of an annuity with a contribution of \$1 at the end of each period. **4**

Period	0.75%	1.00%	1.50%	2.00%	2.50%	3.00%
1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
2	2.00750	2.01000	2.01500	2.02000	2.02500	2.03000
3	3.02256	3.03010	3.04523	3.06040	3.07563	3.09090
4	4.04523	4.06040	4.09090	4.12161	4.15252	4.18363
5	5.07556	5.10101	5.15227	5.20404	5.25633	5.30914
6	6.11363	6.15202	6.22955	6.30812	6.38774	6.46841
7	7.15948	7.21354	7.32299	7.43428	7.54743	7.66246
8	8.21318	8.28567	8.43284	8.58297	8.73612	8.89234

Sasa opened an account and deposited \$15 000 at the end of each year for 6 years.
At the end of the 7^{th} year, he deposited \$20 000 in the same account and continued to deposit \$20 000 at the end of each year until the end of the 10^{th} year.
He made no more deposits after the 10^{th} year.
The money in his account was earning interest at 2.5% per annum, compounded annually.
How much money will Sasa have in his account at the end of 15 years?

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End of Examination

Extra Writing Space

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Caringbah High School

Year 12 2026

Mathematics Standard 2

HSC Trial Examination

General Instructions

- Reading time – 10 minutes
- Working time – 150 minutes
- Write using a blue or black pen
- Calculators approved by NESA may be used
- A reference sheet is provided
- For questions in Section II, show relevant mathematical reasoning and/or calculations
- Marks may not be awarded for partial or incomplete answers

Total marks – 100

Section I **15 marks**
Attempt Questions 1-15
Mark your answers on the answer sheet provided.

Section II **85 marks**
Attempt Questions 16-41
Write your answers for each question in the space provided. Extra writing space is available on pages 30-32.

Student Number: _____ **Class:**_____

Marker's Use Only		
Section I	**Section II**	**Total**
/15	/85	/100

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Section I

15 marks

Attempt Questions 1-15

Allow about 25 minutes for this section

Use the multiple-choice answer sheet for Questions 1–15

---

1. Jane purchased a new laptop for her business at the end of 2023 for $3 990. Use the declining balance method to determine the value of the laptop at the end of 2025, using the depreciation rate of 30% per annum.

The value of the laptop to the nearest dollar is:

$FV = 3990(1 - 0.3)^2$

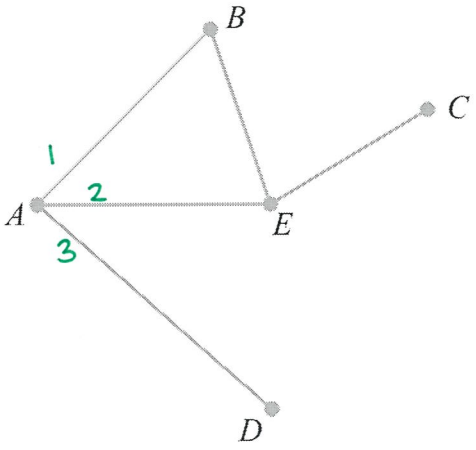
(A) $558

(B) $1 197

(C) $1 955

(D) $2 394

2. What is the degree of vertex A in this network diagram?



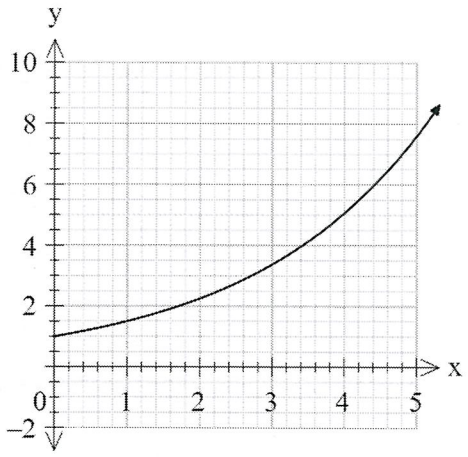
(A) 4

(B) 3

(C) 2

(D) 1

3. The following graph shows the graph of $y = a^x$, for some number a that is greater than 1.



Which would be the closest value of $0.5(a^{4.2})$?

(A) 6

0.5 x 5.5

(B) 5.5

(C) 3

(D) 2.75

4. Stanley wants to know the present value of an annuity which will earn 3% per annum, compounded monthly. In ten years' time, the future value will be \$5 000. Which calculation will result in the correct answer?

(A) $N = \dfrac{5\,000}{(1 + 0.03)^{10}}$

(B) $N = \dfrac{5\,000}{(1 + 0.03)^{120}}$

(C) $N = \dfrac{5\,000}{\left(1 + \dfrac{0.03}{12}\right)^{10}}$

(D) $N = \dfrac{5\,000}{\left(1 + \dfrac{0.03}{12}\right)^{120}}$

5. A statistician was hired to estimate the number of fish in a lake. In his first sample, 2 400 fish were taken from the lake, tagged and returned to the lake. The next day, a random sample of 5 000 fish were caught and contained 1 955 tagged fish.
The approximate number of fish in the lake was calculated to be:

(A) 9 355

(B) 7 400

(C) 6 138

(D) 6 955

$\frac{2400}{x} = \frac{1955}{5000}$

6. Ben bought a new fridge for $1 500. It has an energy consumption of 482 kWh per year. Energy is charged at a rate of $0.33/kWh.
How much, in total, will it cost to purchase then run this fridge for 4 years?

(A) $636.24

(B) $1 659.06

(C) $2 136.24

(D) $6 636.24

$C = 1500 + 482 \times 0.33 \times 4$

7. A model car is 20 cm in length. The model is built to a scale of 1 : 28.
What is the actual length of the car?

(A) 5.6 cm

(B) 71 cm

(C) 5.6 m

(D) 7.1 m

$\frac{20}{x} = \frac{1}{28}$

8. Frank takes out a reducing-balance loan of $57 500 to fund his business. The loan is to be repaid over 6 years in equal quarterly repayments. The interest rate charged is 8% per annum, compounding quarterly.

The table below shows the present value interest factors for a loan of $1 000 for various interest rates, r, and number of periods, N.

Table of present value interest factors for $1 000				
r / N	Interest rate per period (as a decimal)			
	0.02	0.04	0.06	0.08
20	0.016351	0.013590	0.011469	0.009818
24	0.018914	0.015246	0.012550	0.010528
28	0.021281	0.016663	0.013406	0.011051
32	0.023468	0.021787	0.014084	0.011434

What is the value of the quarterly repayments Frank is required to make?

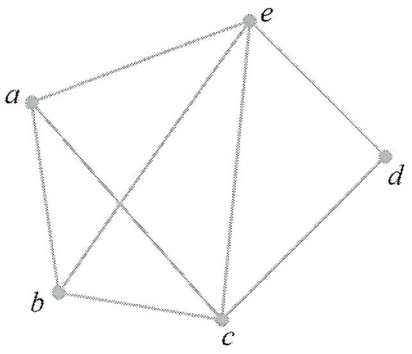
(A) $3 040.08 $M \times 0.018914 = 57.5$

(B) $3 450.76

(C) $5 461.63

(D) $5 856.59

9. Consider the network diagram.



Which of the following is true?

(A) A trail that uses every edge of the network only once exists because the network contains exactly two odd vertices.

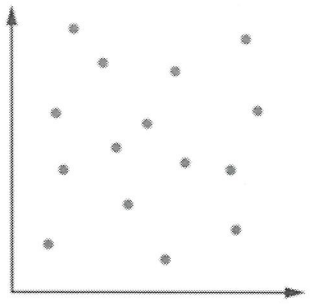
(B) A trail that uses every edge of the network only once exists because the network contains at least two odd vertices.

(C) A circuit that uses every edge of the network only once exists because the network contains exactly two odd vertices.

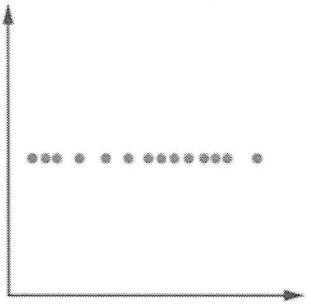
(D) A circuit that uses every edge of the network only once exists because the network contains at least two odd vertices.

10. Which scatterplot has a zero correlation coefficient?

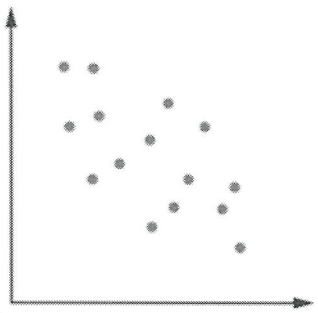
(A)



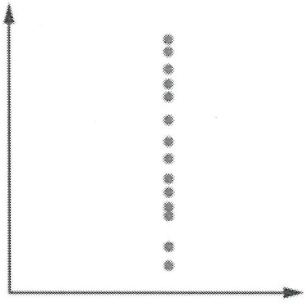
(B)



(C)



(D)



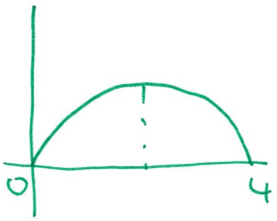
11. A ball is thrown into the air and its height, h m, at time, t s, is given by the equation $h = -4t^2 + 16t$. After how many seconds does the ball reach its maximum height?

(A) 4

(B) 3

(C) 2

(D) 1



12. Sarah received an inheritance of \$420 000 and divided it between herself and her two children in the ratio 3 : 2 : 2. How much did Sarah receive?

(A) \$180 000

(B) \$140 000

(C) \$120 000

(D) \$60 000

$3+2+2=7$

$420000 \div 7 \times 3$

$=$

13. Matthias' car consumes an average of 11 litres of fuel per 100 kilometres for city driving, and 8 litres per 100 kilometres for country driving.
If Matthias takes a trip where he travels 62 kilometres in the city and 230 kilometres in the country, what is his expected fuel consumption?

$0.62 \times 11 + 2.3 \times 8$

(A) 28.66 L

(B) 25.22 L

(C) 32.16 L

(D) 27.74 L

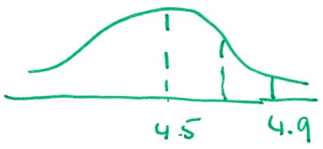
14. The sugar content of a brand of lolly is normally distributed with a mean of 4.5 mg. 2.5% of lollies have a sugar content greater than 4.9 mg. What is the standard deviation of the lolly distribution?

(A) 0.12 mg

(B) 0.4 mg

(C) 0.2 mg

(D) 0.11 mg



15. To build a house, Ben and Anita borrow $800 000 at 5.25% p.a. over 30 years, with monthly repayments of $4 417.63. What is the total amount of interest that they will pay?

$30 \times 12 \times 4\,417.63 - 800\,000$

(A) $1 590 347

(B) $132 528.90

(C) $790 347

(D) $1 260 000

End of Section I

Section II

85 marks
Attempt Questions 16–38
Allow about 2 hours and 5 minutes for this section

Your responses should include relevant mathematical reasoning and/or calculations.
Extra writing space is available on pages 28-32.

Question 16 (2 marks)

An eight-sided die was rolled 100 times and the results recorded in the table below.

Number Obtained	1	2	3	4	5	6	7	8
Frequency	22	21	19	15	12	7	3	1

(a) What is the relative frequency of rolling a 5? **1**

$\frac{12}{100} = \frac{3}{25}$ or 0.2

(b) Describe the distribution of the results (as positively or negatively skewed, or symmetrical). **1**

positively skewed

Question 17 (2 marks)

Solve the following simultaneously: **2**

$$4x - y = 3$$
$$2x + y = 15$$

$6x = 18$

$x = 3$

$\therefore y = 4(3) - 3$

$= 9$

Question 18 (3 marks)

Koa buys 800 shares in the Snail Trail Adventure Company. The shares were trading at $13.54 per share. The brokerage fee for purchasing the shares was 3% of the purchase price.

(a) The Snail Trail Adventure Company declared an annual dividend yield of 5.5%. **1**
How much did Koa receive?

$800 \times 13.54 \times 0.055 = 595.76$

(b) Koa sold her shares for $15.60 per share and paid $200 brokerage on the sale. **2**
What net profit does she make from the shares, taking into account purchase, sale, fees and dividends?

Sell: $800 \times 15.60 = \$12\,480$

profit $= 12480 + 595.76 - 200 - 800 \times 13.54 \times 1.03$

$= \$1718.80$

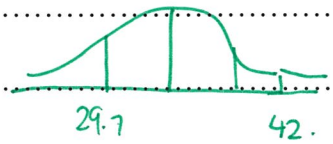
Question 19 (3 marks)

The maximum daily temperatures during the summer months in Manilla, NSW are recorded. These maximum temperatures are normally distributed with a mean of 33.8°C and a standard deviation of 4.1°C.

(a) What temperature has a z-score of -1? **1**

$33.8 - 4.1 = 29.7°$

(b) What percentage of summer days in Manilla would you expect to be between 29.7°C and 42.0°C? **2**



$= 34 + 34 + 13.5$

$= 81.5\%$

Question 20 (2 marks)

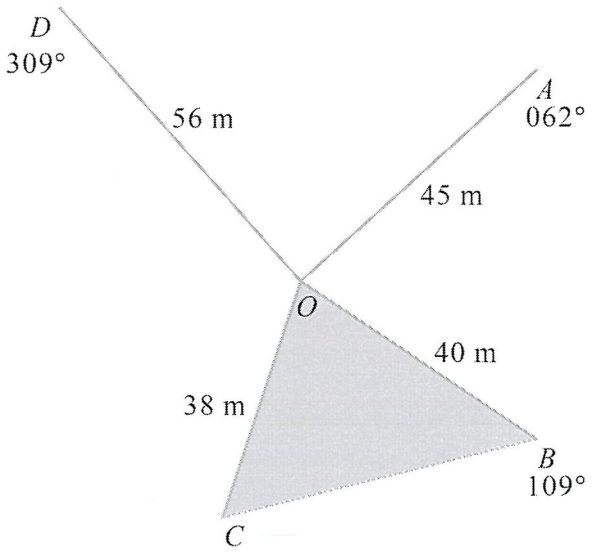
An intravenous drip is delivering 30 drops/min. There are 15 drops/mL and 1.2 L of liquid to be delivered. How long will the drip take to deliver the required dose? **2**

$15 \times 1200 = 18000$ drops

$\div 30 = 600$ min / 10 hours

Question 21 (3 marks)

The following sketch was made during a radial survey of a field. **3**



NOT TO SCALE

The area of ΔBOC is 748 m². Find the bearing of C from O, to the nearest degree, noting that $\angle BOC$ is acute.

$748 = \frac{1}{2} \times 38 \times 40 \times \sin C$

$\sin C = \frac{187}{190}$

$C = 80°$

$\therefore$ bearing $= 189°$

Question 22 (2 marks)

A recipe for making large batches of chocolate chip cookies requires flour and sugar in the ratio of 3:2. **2**

If the recipe claims 2 cups of flour will make 25 cookies, how much sugar is needed to make 60 cookies?

25 cookies = 2 cups

1 cookie = $\frac{2}{25}$ cups

60 cookies = 4.8 cups flour

$\frac{3}{2} = \frac{4.8}{s}$

$s = 3.2$ cups sugar

Question 23 (5 marks)

Victoria takes out a loan of \$120 000 at 6% p.a. Interest (I) is calculated monthly. She will make a repayment (R) of \$1250 each month. Victoria draws up a table showing the progress she makes repaying the loan over the first 5 months.

Months	Principal (P)	Interest (I)	$P + I$	$P + I - R$
1	120 000.00	600.00	120 600.00	119 350.00
2	119 350.00	596.75	119 946.75	118 696.75
3	118 696.75	593.48	119 290.23	118 040.23
4	118 040.23	590.20	118 630.43	117 380.43
5	A	B		C

(a) Find the values of A, B and C. **3**

$A = 117\,380.43$

$B = 117\,380.43 \times 0.5\% = \$586.90$

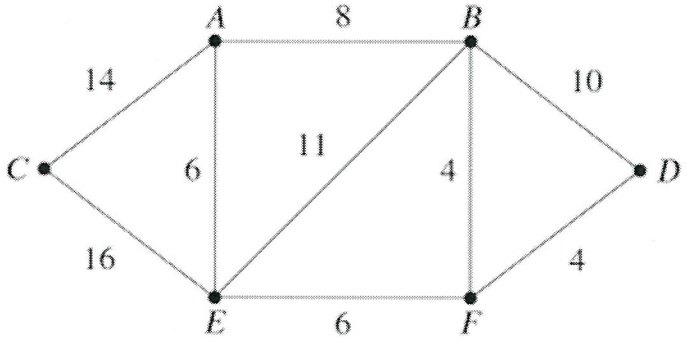
$C = 117\,380.43 + 586.90 - 1250 = \$116\,717.33$

(b) By what percentage had Victoria reduced the principal of the loan at the end of 5 months, correct to 1 decimal place? **2**

$$\frac{120\,000 - 116\,717.33}{120\,000} \times 100\% = 2.7\%$$

Question 24 (4 marks)

Six computer terminals in different offices of a building need to be connected to each other with internet cabling. The six terminals are represented as ***A, B, C, D, E*** and ***F*** in the network diagram below.



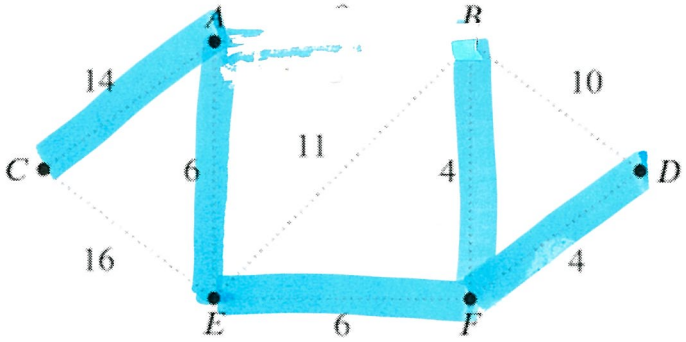
The numbers in the network diagram show the length of cable, in metres, which is needed to connect two particular computer terminals.

(a) Before the cable was laid, a consultant was asked to determine the minimum amount of cable needed to connect the terminals. She decided to draw a minimum spanning tree for the cable network. **1**

Briefly describe how drawing a minimum spanning tree would help the consultant.

A minimum spanning tree connects all computers together with the least length of cable required.

(b) On the diagram below, draw the minimum spanning tree for the network. **1**



(c) The cable can be supplied and laid for this network at a cost of $17.30 per metre. **2**

What is the minimum possible cost of laying the cable?

$(6+4+4+6+14) \times \$17.30$

$= \$588.20$

Question 25 (2 marks)

The length of a pole is measured at 45 cm to the nearest centimetre. What is the percentage error of this measurement? Give your answer correct to 2 significant figures. **2**

$\frac{0.5}{45} \times 100\% = 1.1\%$ 2 sig fig

Question 26 (2 marks)

Make x the subject of the formula below, leaving your answer as a simplified fraction. **2**

$$\frac{x+y}{y} = \frac{y}{a} + \frac{a}{y}$$

$x + y = \frac{y^2}{a} + a$

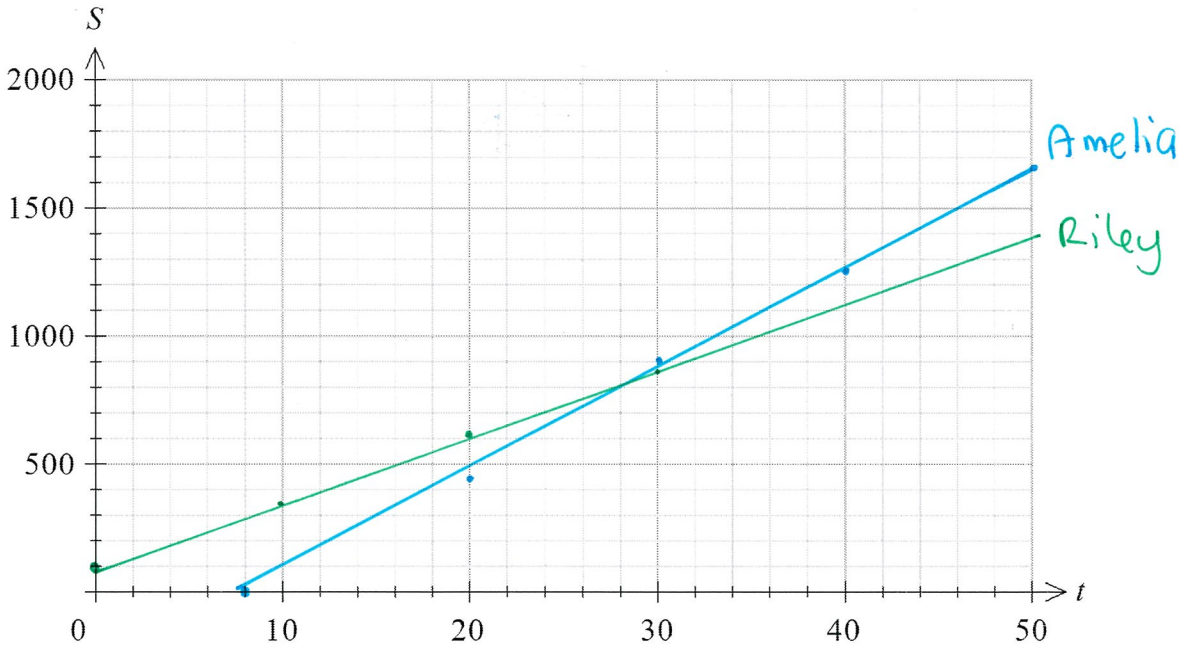
$x = \frac{y^2}{a} + a - y$ or $\frac{y^2 + a^2 - ya}{a}$

Question 27 (4 marks)

Riley has \$100. He starts to save \$25 each week to buy a new racing bike.

His savings can be modelled by $S = 100 + 25t$, where S is the dollars saved and t is the time in weeks from when he started saving money.

(a) On the grid below, draw the graph of this model and label it as Riley's savings. **1**



(b) Amelia, Riley's sister, wanted to start saving 8 weeks after Riley began saving. **2**

She initially had no money, but saves \$40 per week.

By drawing a line on the grid above, or otherwise, find the value of t when the siblings have the same amount of money.

$100 + 25t = -320 + 40t$

$15t = 420$

$t = 28$

28 weeks

(c) Using the graph, or otherwise, find the value of t when Amelia's savings is \$300 more than Riley's savings. **1**

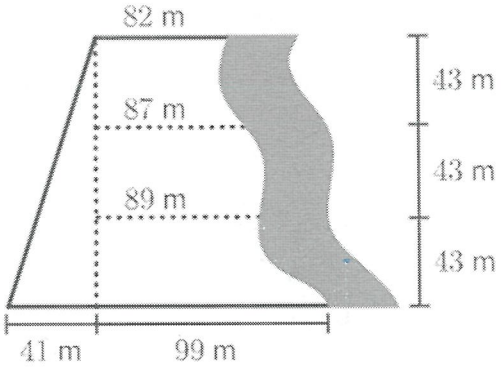
$300 + 100 + 25t = -320 + 40t$

$15t = 720$

$t = 48$

Question 28 (4 marks)

A surveyor provided the following diagram, with measurements, for a property they mapped out.



(a) Find the approximate total area of the property by using three applications of the trapezoidal rule, leaving your answer in square meters. **3**

$A = \frac{1}{2} \times 43 \times 29 + 43\left(\frac{99+89}{2}\right) + 43\left(\frac{89+87}{2}\right)$

$+ 43\left(\frac{87+82}{2}\right)$

$= 14\,104\ m^2$

(b) The average weekly rainfall is 34 mm. Calculate the total volume of water that falls on the land in cubic metres. Round your answer to 2 decimal places **1**

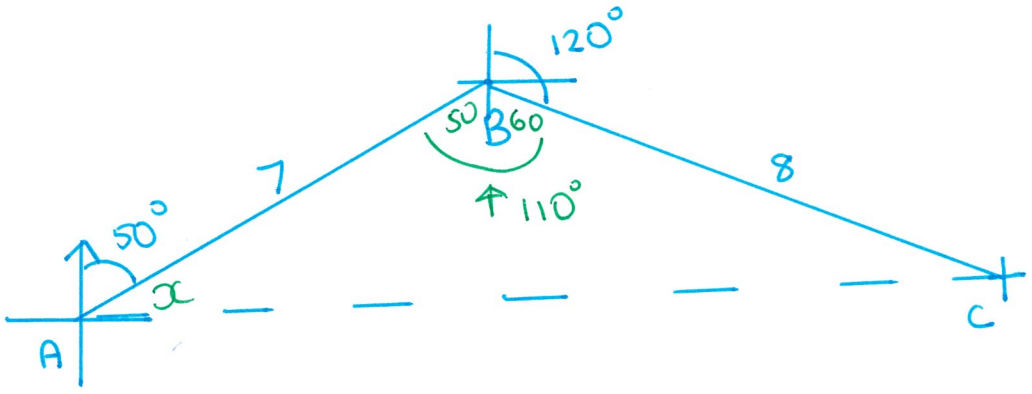
$V = 14104 \times 0.034$

$= 479.54\ m^3$

Question 29 (5 marks)

Lieutenant Smith mapped out an orienteering course for the Bravo cadets. He left point A on a bearing of 050° and walked for 7 km and placed marker B. From point B he then left on a bearing of 120° and walked for 8 km to a point C.

(a) Draw a diagram to represent this information **1**



(b) Find the distance from point C to point A, to once decimal place **2**

$AC^2 = 7^2 + 8^2 - 2 \times 7 \times 8 \times \cos 110°$

$AC = 12.3$ km

(c) What is the bearing of C from A. **2**

$\frac{\sin x}{8} = \frac{\sin 110°}{AC}$

$\sin x = \frac{8 \times \sin 110°}{AC}$

$x = 37.7°$

$\therefore$ bearing $= 87.7°$

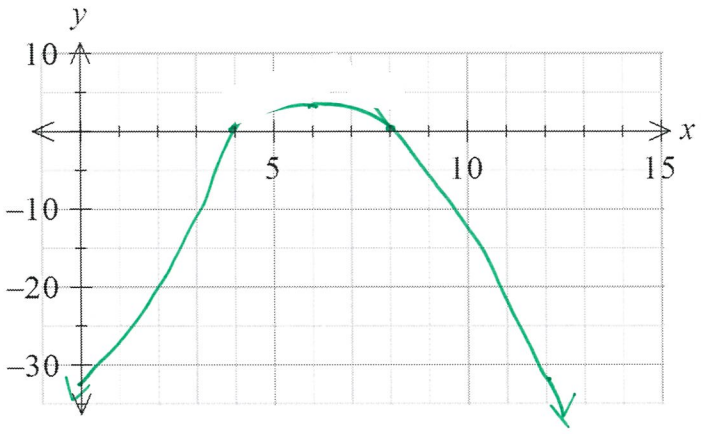
Question 30 (4 marks)

Consider the function $y = -x^2 + 12x - 32$

(a) Complete the table of values below: **1**

x	0	4	8	12
y	−32	0	0	−32

(b) Using the table above, or otherwise, graph the function **1**



(c) Using the graph or otherwise, find the coordinates of the turning point of the function. **2**

T·P = (6, 4)

Question 31 (2 Marks)

(a) If m is inversely proportional to n, and $m = 10$ when $n = 25$.

Find k, the constant of proportionality. **1**

$m = \frac{k}{n}$ $10 = \frac{k}{25}$

$k = 250$

(b) What is the value of n when $m = 50$? **1**

$250 = 50n$

$n = 5$

Question 32 (4 marks)

The basal metabolic rate (BMR) of a person refers to the minimum amount of energy (in kilojoules) needed to sustain basic bodily functions (that is, to keep the person alive) for a 24-hour period.

The energy output needed is then given by:

Energy out = basal metabolic rate (BMR) × physical activity level (PAL)

The Harris-Benedict Model can be used to estimate BMR, in kJ/day. It is given by:

- $BMR_{male} = 278 + 57.5W + 20.9H - 28.2A$
- $BMR_{female} = 278 + 40.0W + 7.7H - 19.6A$

where W is weight (in kg), H is height (in cm) and A is age (in years).

(a) A 25-year-old woman weighs 62 kg and she has a height of 159 cm. Use the Harris-Benedict Model to estimate the woman's BMR, to the nearest kJ/day. **2**

BMR = 278 + 40.0 × 62 + 7.7 × 159 − 19.6 × 25

= 3492 kJ/day

(b) The woman undertakes an activity with a PAL of 12.8. What would be the amount of energy expended in one hour of undertaking this activity, to the nearest kJ? **2**

E.O = 3492 × 12.8 ÷ 24

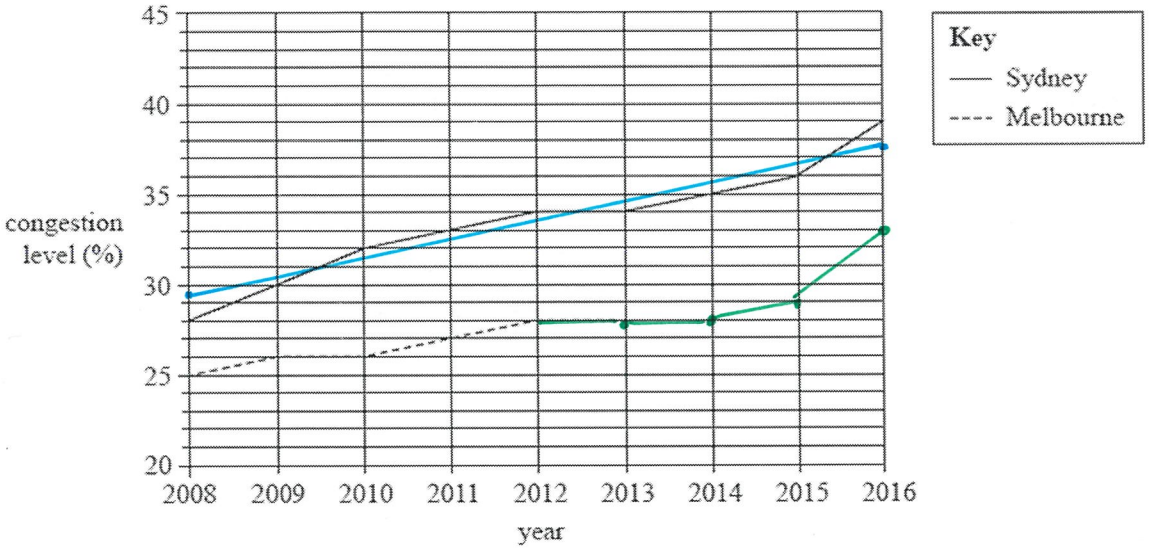
= 1862 kJ

Question 33 (4 marks)

The table below shows the yearly average traffic congestion levels in two cities, Melbourne and Sydney, during the period 2008 to 2016.

Also shown is a time series plot of the same data. The time series plot for Melbourne is incomplete.

	Congestion Level (%)								
Year	2008	2009	2010	2011	2012	2013	2014	2015	2016
Melbourne	25	26	26	27	28	28	28	29	33
Sydney	28	30	32	33	34	34	35	36	39



Data: TomTom International BV, <www.tomtom.com/en_gb/trafficindex>

(a) Use the data in the table to complete the **time series plot above** for Melbourne. **1**

(b) A line of best fit is used to model the trend line in the same series plot for Sydney. The equation is:

$$\text{congestion level} = -2\,280 + 1.15 \times \text{year}$$

i) Draw this line on the time series plot above. **1**

ii) Determine the average rate of increase in percentage congestion level for the period 2008 to 2016 inclusive. **1**

$\frac{38.4 - 29.2}{2016 - 2008} = 1.15\%$

iii) Use the equation to predict when the percentage congestion in Sydney will be 43% **1**

$43\% = -2280 + 1.15\,year$

$year = 2020$

Question 34 (4 marks) 0.048% per day.

Zahli is charged 17.52% p.a. interest, compounded daily, on her credit card, with no interest-free period. Interest is charged from, and including, the date of purchase to, and including, the date of payment. She checks her balance on the 18th of June and finds an outstanding balance of $2344.52. On the 25th of June she makes a $210.00 purchase, and on the 8th of July she makes a purchase of $53.20. **4**

How much will be owing on Zahli's credit card when she is due to make her next payment on the 15th of July?

18 June – 15 July = 28 days $2344.52 \times 1.00048^{28} +$

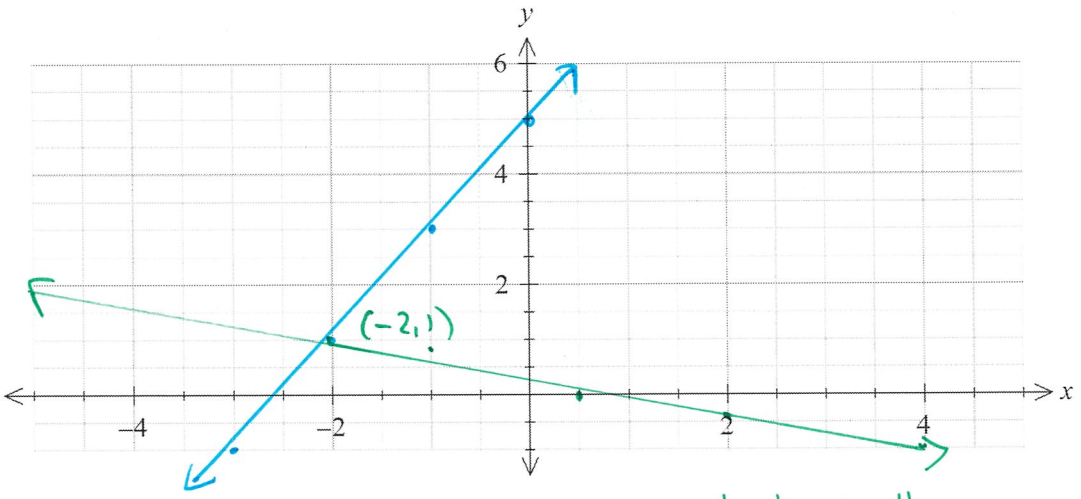
25 → 15 = ~~19~~ 21 days $210 \times 1.00048^{21} +$

8 – 15 = 8 days 53.20×1.00048^{8}

$\$2641.77$

Question 35 (3 marks)

By using graphical means, or otherwise, find and label the point of intersection of $x + 3y = 1$ and $y = 2x + 5$. **3**



algebraically

$x + 3(2x + 5) = 1$

$x + 6x + 15 = 1$

$7x = -14$

$x = -2$

$\therefore y = -4 + 5$

$= 1.$

Question 36 (2 marks)

Ingrid lives in Spain, located (50°N, 1°E). She is trading in US stocks with her broker in New York, which is located at (40°N, 74°W). **2**

The New York stock exchange closes at 4:30 p.m. New York time.

What is the latest time and day, in Casablanca, that Ingrid can place an order through her broker?

Note: You may use the fact that 15° = 1 hour time difference. Ignore daylight savings.

$74°W \rightarrow 1°E = 75°$

$= 5$ hour difference.

NY S

4.30pm $\Rightarrow$ 9.30pm same day

Question 37 (2 Marks)

Atlas sat for three Geography tests during Year 12. The table below shows his results and the class's average mark and standard deviation for the tests.

	Atlas' Mark	Average Mark	Standard deviation
Test 1	82	73	6
Test 2	87	75	10
Test 3	x	72	8

(a) In which test, Test 1 or Test 2, did Atlas perform better compared to the rest of the class? Justify your answer. **1**

$T_1 = \frac{82-73}{6}$ $T_2 = \frac{87-75}{10}$

$= 1.5$ $= 1.2$

Test 1 was better.

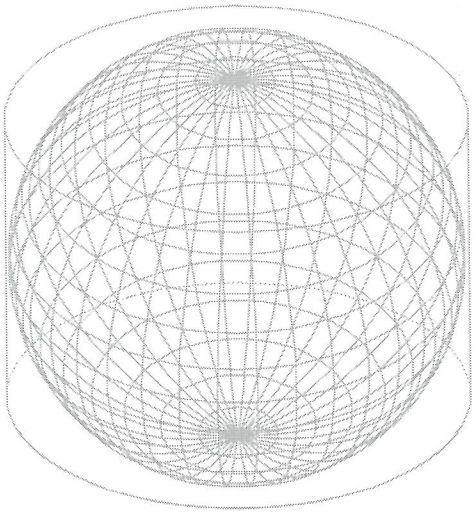
(b) When compared to the rest of the class. Atlas' performance in Test 3 is equivalent to his performance in Test 1. What is his mark for Test 3? **1**

T_3 $1.5 = \frac{x-72}{8}$

$x = 84$

Question 38 (4 Marks)

A sphere fits exactly into a cylindrical container as shown below.



For questions **a** – **c**, please round your answers to the nearest whole number.

(a) If the diameter of the sphere is 20 cm, what is its volume? **1**

$V = \frac{4}{3}\pi \times 10^3$

$= 4189\ cm^3$

(b) What is the volume of the cylinder? **2**

$V = \pi \times 10^2 \times 20$

$= 6283\ cm^3$

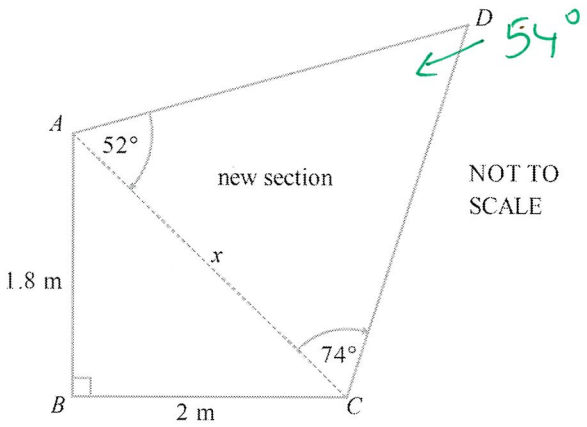
(c) What percentage of space is the sphere taking up inside the cylinder? **1**

$\frac{4189}{6283} \times 100\% = 67\%$

Question 39 (5 marks)

Hebe owns a chicken enclosure in the shape of a right-angled triangle. The hypotenuse of the triangle is given by x, and its two other sides have lengths 1.8 m and 2 m. **5**

Hebe wants to give the chickens more space to roam by removing the fence that forms the hypotenuse of the right-angled triangle, AC, and adding a new triangular section to the enclosure, as shown in the diagram.



Find the area of the new triangular section, ΔACD, of the enclosure and the length of the fencing, in metres, required to construct AC and DC. Give your answers correct to three decimal places.

$x = \sqrt{1.8^2 + 2^2}$

$= \sqrt{7.24}$ m

$\frac{CD}{\sin 52} = \frac{x}{\sin 54}$

$CD = \frac{\sqrt{7.24}\sin 52}{\sin 54}$

Area $= \frac{1}{2} \times x \times CD \times \sin 74°$

$= 3.389\ m^2$

Question 40 (4 marks)

Eight basketball players had their height and arm span measured.

Height (x cm)	175	184	200	183	172	187	190	178
Arm span (y cm)	170	185	195	182	174	188	190	177

(a) Calculate, correct to 4 decimal places, Pearson's correlation coefficient, r, for this data set. **1**

$r = 0.9545$

(b) Find the equation of the least-squares regression line for this data. Round any calculations to 3 decimal place. **2**

$A = 15.994$

$B = 0.907$

$y = 15.994 + 0.907x$

(c) Use your equation to estimate the height, to the nearest centimetre, of someone with an arm span of 181 cm. **1**

$181 = 15.994 + 0.907x$

$x = 181.9$ cm (1 dp)

Question 41 (4 Marks)

The table below shows the future value of an annuity with a contribution of \$1 at the end of each period. **4**

Period	0.75%	1.00%	1.50%	2.00%	2.50%	3.00%
1	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
2	2.00750	2.01000	2.01500	2.02000	2.02500	2.03000
3	3.02256	3.03010	3.04523	3.06040	3.07563	3.09090
4	4.04523	4.06040	4.09090	4.12161	4.15252	4.18363
5	5.07556	5.10101	5.15227	5.20404	5.25633	5.30914
6	6.11363	6.15202	6.22955	6.30812	6.38774	6.46841
7	7.15948	7.21354	7.32299	7.43428	7.54743	7.66246
8	8.21318	8.28567	8.43284	8.58297	8.73612	8.89234

Sasa opened an account and deposited \$15 000 at the end of each year for 6 years.
At the end of the 7th year, he deposited \$20 000 in the same account and continued to deposit \$20 000 at the end of each year until the end of the 10th year.
He made no more deposits after the 10th year.
The money in his account was earning interest at 2.5% per annum, compounded annually.
How much money will Sasa have in his account at the end of 15 years?

\$15000: 15000×6.38774

$= 95\,816.10$

+ compound int: 95816.10×1.025^9

$= 119\,661.18$

\$20000: 20000×4.15252

$= 83050.40$

+ Compound int = 83050.40×1.025^5

$= 93963.90$

$\therefore$ total $= 119661.18 + 93963.90$

$= 213625.08$

End of Examination

Extra Writing Space

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

Extra Writing Space

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

Extra Writing Space

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