NAME: _____

Blacktown Boys' High School

Year 12 2026

Trial Examination

Mathematics Standard 2

General Instructions

- Reading time – 10 minutes
- Working time – 2 hours and 30 minutes
- Write using black pen
- Calculators approved by NESA may be used
- All diagrams are not drawn to scale
- A reference sheet is provided for this paper
- In Questions in Section II, show all relevant mathematical reasoning and/or calculations

Total marks: 100

Section I – 15 marks (pages 3-8)

- Attempt Questions 1 – 15
- Allow about 25 minutes for this section

Section II – 85 marks (pages 9-29)

- Attempt Questions 16 - 39
- Allow about 2 hour and 5 minutes for this section

Assessor: Mr Stevic

Students are advised that this is a trial examination only and cannot in any way guarantee the content or format of the 2026 Higher School Certificate Examination.

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 Hamza invests $12000 at 4% pa compounding monthly. What is the value of his investment (to the nearest dollar) after 7 years?

A. $3360

B. $15360

C. $15791

D. $15870

2 The length of a pencil is measured to be 17.45 cm. What is the absolute error on the length of this pencil?

A. 0.005

B. 0.001

C. 0.05

D. 0.01

3 In a survey of 120 randomly selected Year 12 students it was found that 45 catch the train to go to school. Based on this survey, approximately how many of 6520 Year 12 students would be expected to catch the train to school?

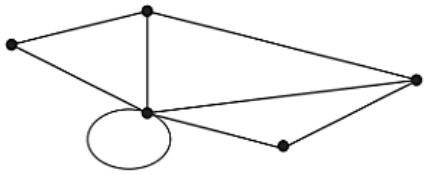
A. 120

B. 2445

C. 6520

D. 17397

4



The number of vertices with an even degree in the network above is

A. 1

B. 2

C. 3

D. 4

5 Given, $p = \dfrac{n^2 - m}{q}$, which of the following expresses n as the subject of the formula.

A. $n = pq + m$

B. $n = \sqrt{pq + m}$

C. $n = \sqrt{pq - m}$

D. $n = pq - m$

6 John lives in Perth. He wants to watch a basketball game being played in Toronto starting at 8.00 pm on Thursday.

If Toronto is 13 hours behind Perth, what is the day and time in Perth when the game starts?

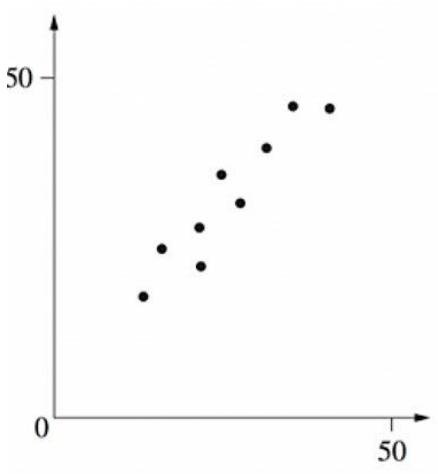
A. 7:00 am Thursday

B. 9:00 am Thursday

C. 7:00 am Friday

D. 9:00 am Friday

7



Which of the following is the best approximation for the correlation coefficient of the set of data above?

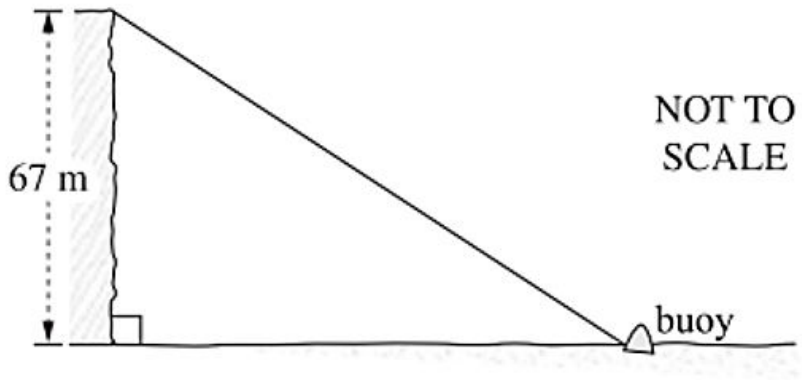
A. 0.3

B. -0.3

C. 0.8

D. -0.8

8 From the top of a cliff 67 metres above the sea level, the angle of depression of a buoy is 38°.



How far is the buoy from the base of the cliff, to the nearest metre?

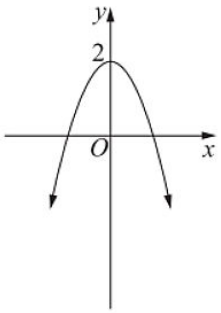
A. 52 m

B. 86 m

C. 41 m

D. 108 m

9 The diagram shows the graph of an equation.



Which of the following equations best represents the graph?

A. $y = x^2 - 2$

B. $y = -x^2 - 2$

C. $y = x^2 + 2$

D. $y = -x^2 + 2$

10 A hire-car company purchased a vehicle 4 years ago for \$9800. Since its purchase, the vehicle has depreciated to \$5200 using the declining balance method. What is the approximate annual rate of depreciation?

A. 15%

B. 17%

C. 27%

D. 73%

11 Sofia purchases 500 shares with a market value of \$6.75 per share. The dividend received for these shares is \$1092.80. The percentage dividend yield is:

A. 0.6%

B. 1.4%

C. 3.2%

D. 32.4%

12 A group of 32 farmers can harvest crops in 15 days. The number of days varies inversely with the number of farmers working at a constant rate. How long would it take a group of 8 farmers to complete the same task?

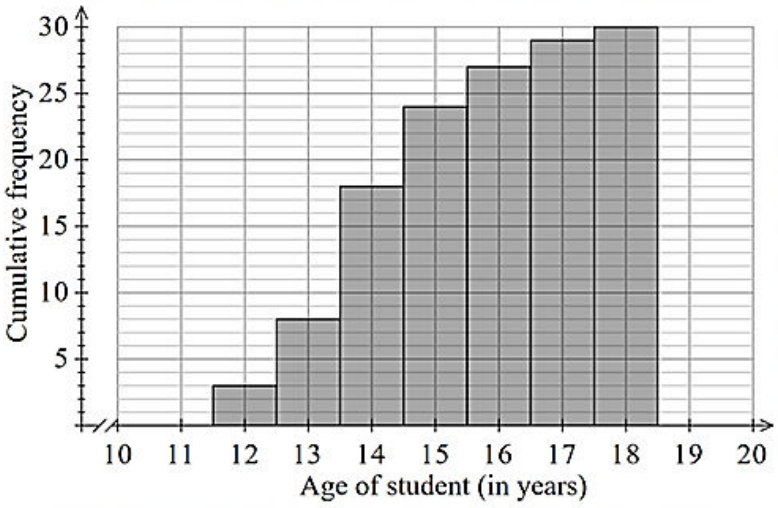
A. 30

B. 48

C. 60

D. 120

13 Below shows a cumulative frequency histogram of the ages of 30 students.



What is approximately the median age of the students?

A. 14

B. 15

C. 16

D. 17

14 The marks in a test were normally distributed. The mean mark was 56 and the standard deviation was 12. What was the percentage of marks higher than 80?

A. 2.5%

B. 5%

C. 95%

D. 97.5%

15 Subhan is going to buy a car and downloads data on fuel efficiency for three models.

Model	*Fuel Consumption (City)*	*Fuel Consumption (Country)*
Tacoma	15.8 L/100km	11.5 L/100km
Firenze	14.4 L/100km	11.4 L/100km
Vortex	15.6 L/100km	11.0 L/100km

In a test drive, he drives all three cars for 40 km on city roads and 120 km on country roads. Based on the data, which car would use the least fuel on the test drive?

A. The Firenze would use the least fuel.

B. The Firenze and the Tacoma are equal in using the least amount of fuel.

C. The Firenze and the Vortex are equal in using the least amount of fuel.

D. The Tacoma would use the least fuel.

End of Section I

Mathematics Standard

Section II Answer Booklet

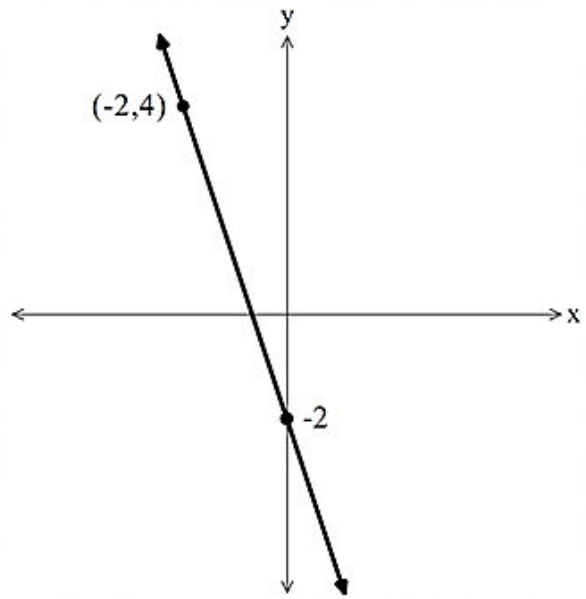
85 marks
Attempt Questions 16-39
Allow about 2 hour 5 minutes for this section

Instructions

- Answer the Questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your response should include relevant mathematical reasoning and/or calculations
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

Question 16 (2 marks)

The diagram below shows the graph of a line. The line passes through a point of $(-2,4)$. **2**



Find the equation of the line, in the form of $y = mx + c$.

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Question 17 (2 marks)

In a kickboxing tournament, the ratio of prize money that the top three competitors receive is $5:3:1$. If the total prize money is for the tournament is $\$81000$, calculate how much each competitor will earn. **2**

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Question 18 (2 marks)

On 27 March 2026, Charlton used his credit card to purchase a TV valued at $1050. He made no other purchases on his credit card during that month. He paid the outstanding amount in full on 19 April 2026. His credit card account does not offer an interest-free period, and interest is charged daily at an annual rate of 18.5%, including the date of purchase and the date of payment. How much interest did Charlton pay on this transaction? Round your answer to the nearest cent. **2**

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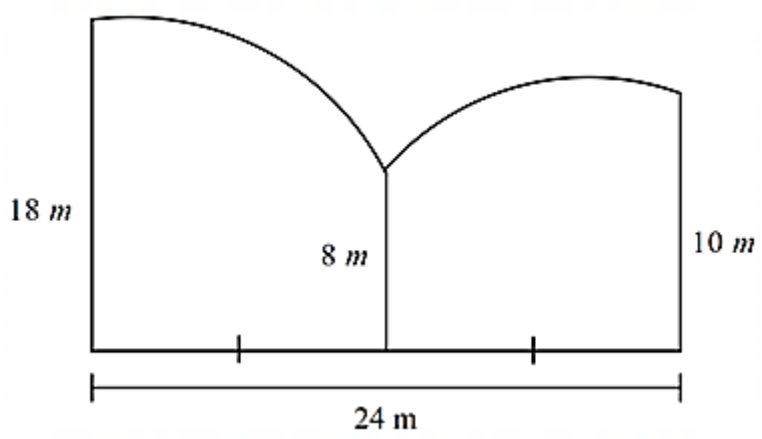
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Question 19 (2 marks)

Using two applications of the trapezoidal rule, estimate the area of the figure below. **2**



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Question 20 (6 marks)

The table shows tax rates for the $2025 - 2026$ financial year.

Taxable income	**Tax on this income**
0 - $18,200	Nil
$18,201 - $45,000	16 cents for each $1 over $18,200
$45,001 - $135,000	$4,288 plus 30 cents for each $1 over $45,000
$135,001 - $190,000	$31,288 plus 37 cents for each $1 over $135,000
$190,001 and over	$51,638 plus 45 cents for each $1 over $190,000

Dino is a financial advisor and receives a yearly salary of $\$162025$. He also receives an income of $\$260$ per month from his share portfolio. Dino purchased an office desk for $\$978$ which is an allowable deduction. He also makes deductions of $\$42$ per fortnight for union fees and $\$66.50$ per week for dry cleaning. He paid PAYG instalments of $\$2590$ per month. He must also pay the Medicare Levy, which is 2% of his taxable income.

(a) Determine Dino's taxable income. **1**

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(b) Using the tax table given above, find the income tax payable. **2**

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(c) Calculate the Medicare Levy that Dino needs to pay. **1**

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(d) Will he have a tax liability or a tax refund? Justify your answer with calculations. **2**

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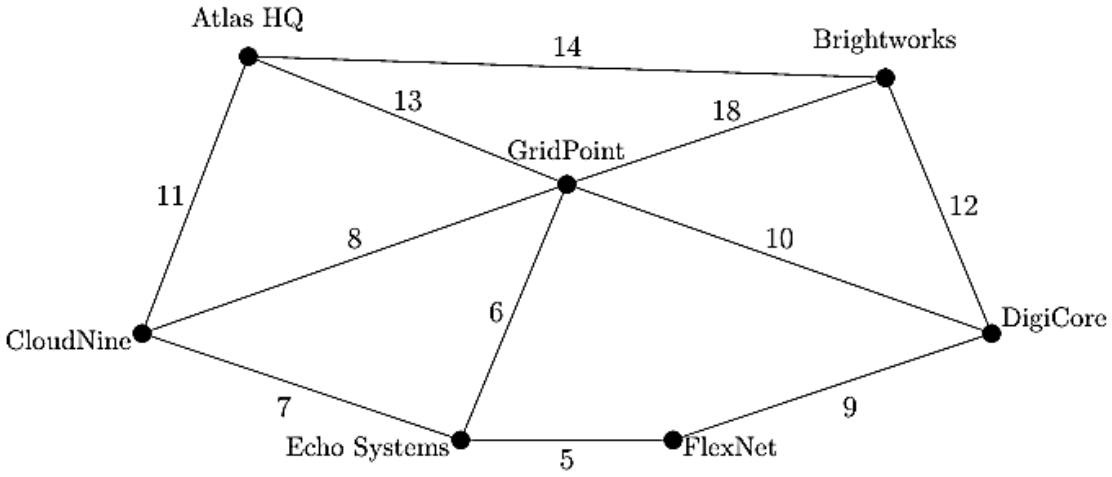
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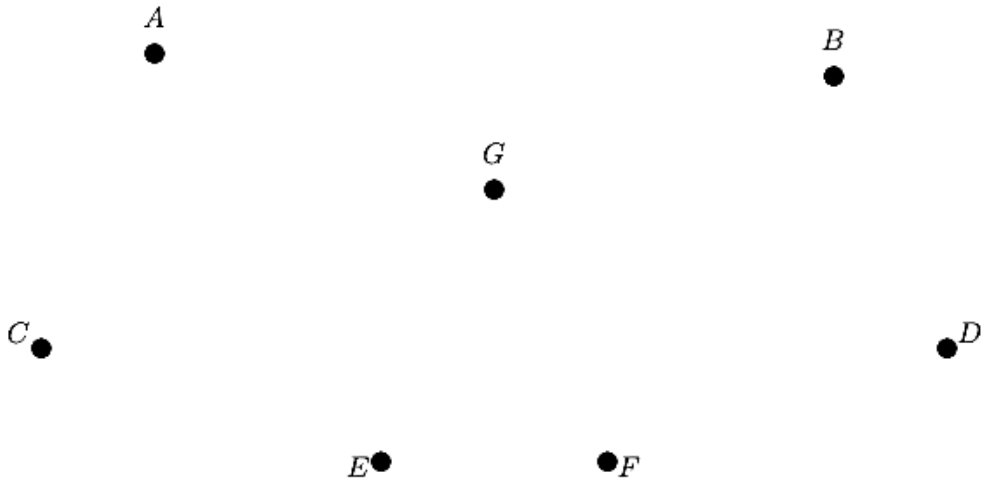
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Question 21 (3 marks)

Mark is a courier for a logistics which delivers between several tech hubs. The diagram below shows the network of offices and the travel times between them in minutes.



(a) Draw a minimum spanning tree for this network below. The initial letter of each office is used. **2**



(b) Determine the total weight of the minimum spanning tree. **1**

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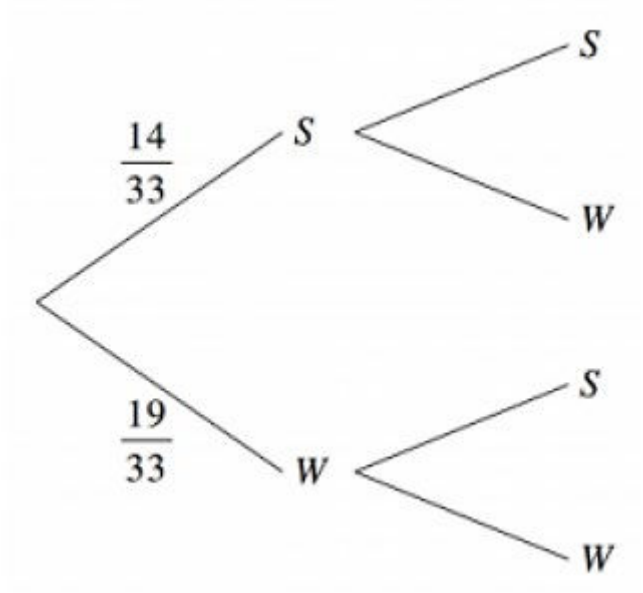
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Question 22 (5 marks)

A box contains 33 scarves made from two different fabrics. There are 14 scarves made from silk (S) and 19 made from wool (W). Two girls each select, at random, a scarf to wear from the box.

(a) Complete the probability tree diagram below. **2**



(b) Calculate the probability that the two scarves selected are both made from silk. **1**

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(c) Calculate the probability that the two scarves selected are made from different fabrics. **2**

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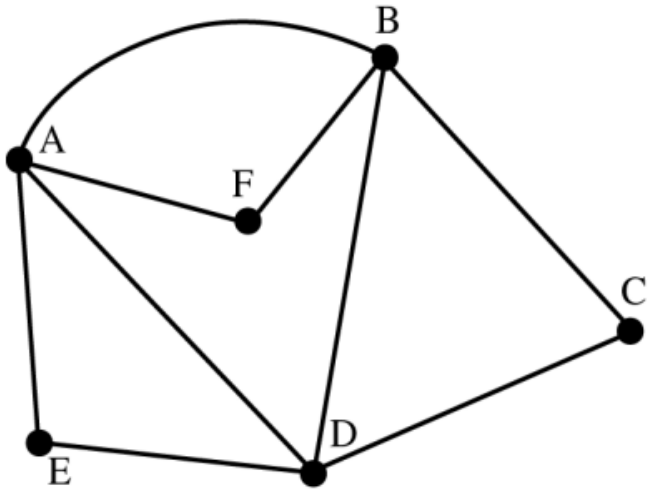
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Question 23 (3 marks)

Pat is an office cleaner who must mop the floors of the hallways joining 6 different offices. The offices are represented as vertices and the hallways as edges on the network diagram below.



(a) One morning he mops the hallways joining the offices in the following order: A-F-B-D-A. Is this a trail, path, circuit, cycle or walk only? **1**

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(b) Every Friday, Pat is required to mop each hallway in the office without repeating a hallway so that the floors can dry efficiently. Identify a Eulerian circuit for this network diagram starting at vertex A that Pat can use and explain why it is a Eulerian circuit. **2**

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Question 24 (4 marks)

One summer, Alex gets a job selling ice creams. Each day, he records the number of ice creams sold and the temperature. This information is shown in the table below.

Temp (°C)	26	27	29	30	32	33	34	37	39	40
Sales (units)	162	172	200	202	253	250	274	311	291	353

(a) Calculate the Pearson's correlation coefficient, correct to two significant figures. **1**

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(b) Write the equation of the least-squares regression line. Let x be the temperature and y be the number of ice creams sold. Give your values correct to two decimal places. **2**

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(c) Comment on the strength of the correlation within the context of this question. **1**

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Question 25 (2 marks)

The table below shows the present value of an annuity with a contribution of \$1. **2**

Present Value of Annuity of \$1				
Period	1%	2%	4%	6%
1	0.9901	0.9804	0.9615	0.9434
2	1.9704	1.9416	1.8861	1.8334
3	2.9410	2.8839	2.7751	2.6730
4	3.9020	3.8077	3.6299	3.4651

Grace pays \$5500 into an annuity at the end of each year for 2 years at 4% p.a., compounded half yearly. What is the present value of her annuity?

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Question 26 (4 marks)

Vic starts drinking at 2 pm. He has 5 schooners of beer over three and a half hours. Each schooner is 1.6 standard drinks, and Vic weights 72 kg. The formula to calculate his Blood Alcohol Content (BAC) is:

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

where N is the number of standard drinks consumed,
H is the number of hours drinking, and
M is the person's mass in kilograms.

(a) Calculate Vic's BAC at 5:30pm. Give your answer correct to 2 decimal places. **2**

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(b) If Vic stops drinking at 5:30pm, determine at what time his Blood Alcohol Content reaches zero. Given your answer correct to the nearest minute. **2**

$$Time\ to\ zero = \frac{BAC}{0.015}$$

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Question 27 (2 marks)

Jen installs an electric water heater which uses electricity at a rate of 450W per hour. She plans on running it for 5 hours per day. If electricity costs 30 cents per kWh, how much does it cost to run the heater for a year? **2**

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Question 28 (3 marks)

The table below shows the mean and standard deviation of a Year 12 cohort in four HSC subjects. **3**

Subject	Mean	Standard Deviation
English	65	10
Mathematics Standard	59	12
Society and Culture	55	8
Drama	68	15

Peter's marks were English 70, Mathematics Standard 66, Society and Culture 60 and Drama 79. In which subject did Peter achieve the best result, relative to the rest of the cohort? Justify with supporting calculations.

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Question 29 (5 marks)

Sarah inherits $70000 and deposits it into a savings account. The account earns 7.2% interest p.a. compounding monthly. Sarah decides to withdraw $100 at the end of each month.

(a) By first writing a recurrence relation for Sarah's investment, calculate the amount of money in the account after the third month. **3**

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(b) Calculate the interest earned in the first three months. **2**

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Question 30 (4 marks)

The table below shows monthly repayments for each $1000 borrowed.

Monthly repayment table

Principal and Interest per $1000 borrowed

Interest rate (per annum)	*Term of loan* (years)					
	5	10	15	20	25	30
6.5%	19.57	11.35	8.71	7.46	6.75	6.32
7.0%	19.80	11.61	8.99	7.75	7.07	6.65
7.5%	20.04	11.87	9.27	8.06	7.39	6.99
8.0%	20.28	12.13	9.56	8.36	7.72	7.34

(a) A couple intends to borrow $732000 to buy an apartment at 7% p.a. over 30 years. How much will the couple repay in total for this loan? **3**

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(b) The couple decide instead to borrow some money at 8% per annum. They agree to repay the loan over 20 years, paying $3875 per month. How much money will they borrow? **1**

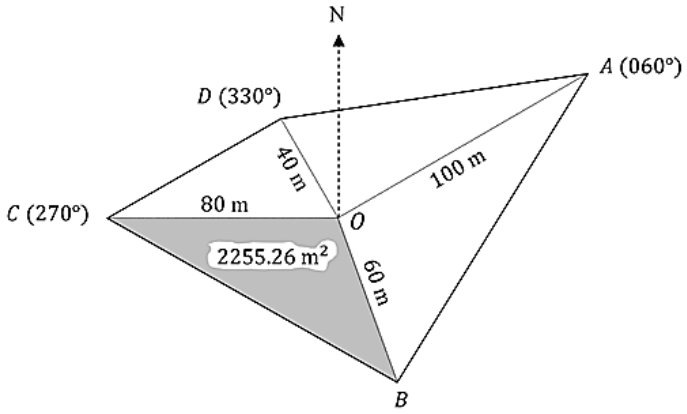
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Question 31 (4 marks)

Part of a compass radial survey shows the position of four corners of a block of land, A, B, C and D, in relation to a point O.



The area of triangle BOC is $2255.26\ \text{m}^2$, and the angle COB is obtuse.

(a) Find the bearing of B from O to the nearest degree. **3**

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(b) Find the length of BC, correct to the nearest metre. **1**

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Question 32 (5 marks)

A bird population, P, is to be modelled using the function $P = 200(1.3)^t$, where t is the time in years.

(a) What is the initial population? **1**

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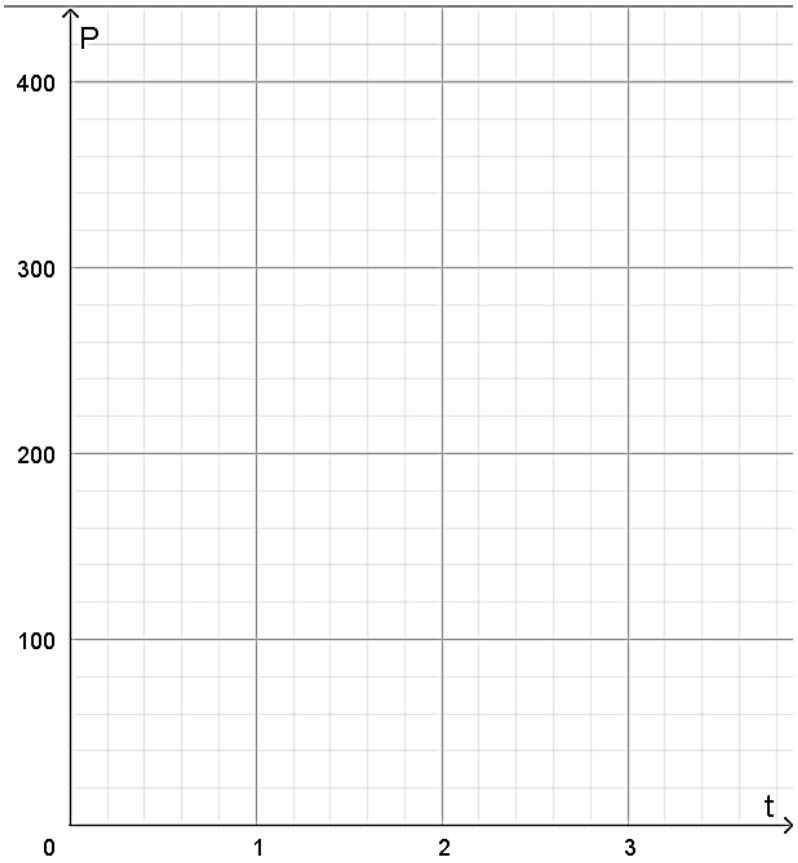
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(b) Find the population after 2 years. **1**

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(c) On the axes below, draw the graph of the population against time, showing the points at $t = 0$ and $t = 2$. **2**



(d) Using the graph or otherwise, estimate how long, to one decimal place, it will take for the population to reach 300. **1**

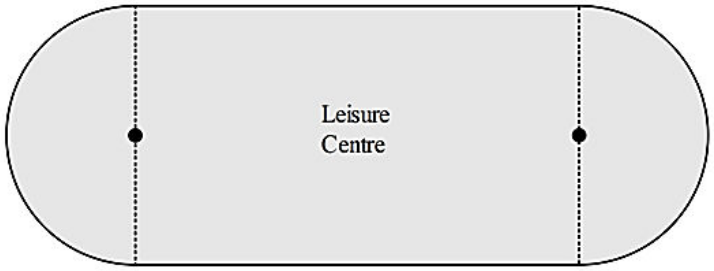
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Question 33 (3 marks)

A new leisure centre in Blacktown is designed with a running track on its perimeter. The track follows the entire outer edge of the shape below, which comprises of a rectangle and two semi-circles. The length of the rectangle is 80m and the radius of the semicircles is 32m.



It takes Louise 6 minutes to walk one lap around the track. What is the average speed of her lap in kilometres per hour? Answer correct to one decimal place. **3**

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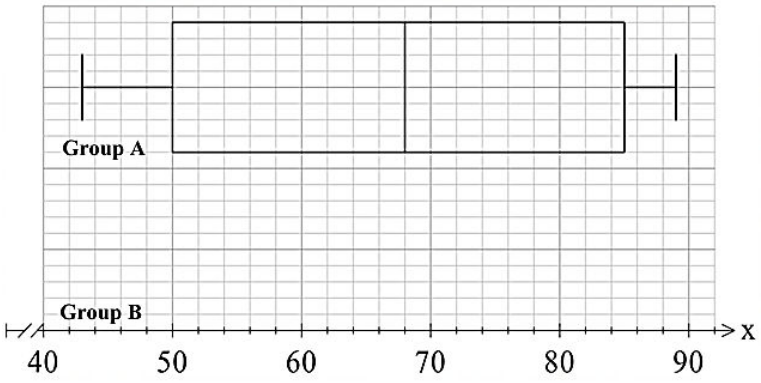
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Question 34 (4 marks)

The box plot below represents the scores of two groups of students, Group A and Group B, in a recent mathematics exam.



(a) Draw the box plot for Group B in the space above using the following data: **1**

Minimum Score: 52, Lower Quartile (Q1): 62, Median: 76,
Upper Quartile (Q3): 86, Maximum Score: 90.

(b) By comparing the two box plots, which group did better in the mathematics test? Justify your answer with reference to the skewness, measures of centre and measures of spread. **3**

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Question 35 (4 marks)

Kara is training for the swim leg of a triathlon and decides to go for a training swim in the harbour. She starts at a jetty J and swims on a bearing of $105°$ for 0.9 km out to a buoy L. She then changes direction and swims on a bearing of $045°$ for a further 1.6 km to buoy M before returning to the jetty J.

(a) What is the total distance that Kara swam, correct to 2 decimal places? **2**

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(b) Find the bearing of the jetty J from the buoy M to the nearest degree. **2**

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Question 36 (5 marks)

Isaac runs a business in which he sells shirts. The income his business generates is \$60 for each shirt sold. To manufacture the shirts, he incurs a cost of \$10 per shirt as well as a one-off manufacturing fee of \$150.

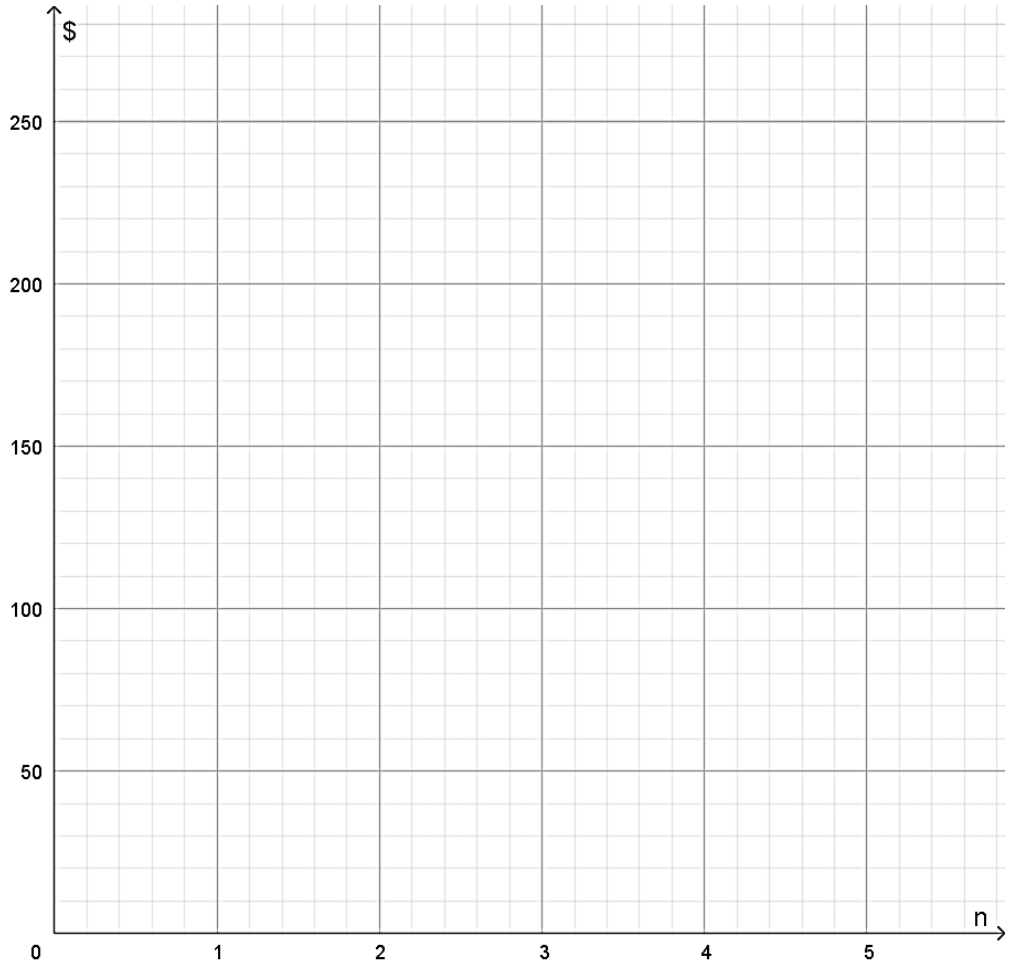
(a) Using n to represent the number of shirts sold and I and C for the income and cost, respectively, write a pair of linear equations for cost and income using the information above. **2**

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(b) Draw both graphs on the axes below and label your graphs. **2**



(c) How many shirts must Isaac sell to break even? **1**

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Question 37 (4 marks)

Michael wishes to buy a used car that has a sale price of $19 820. In addition to the sale price, the following costs are charged: **4**

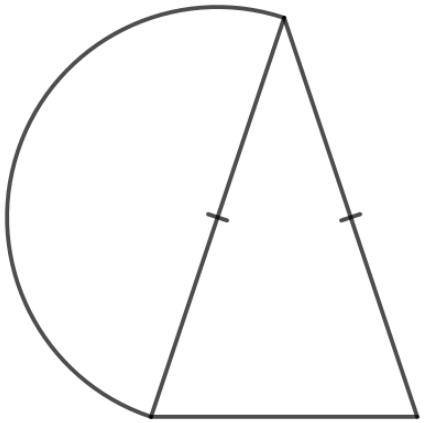
- Transfer of registration $50
- Stamp duty, which is calculated at $3 for every $100, or part thereof, of the sale price.

Michael borrows the total amount to be paid for the car, including transfer of registration and stamp duty. Simple interest at the rate of 6.3% per annum is charged on the loan. The loan is to be repaid in equal monthly repayments over 4 years.

Calculate Michael's monthly repayment.

Question 38 (3 marks)

A company is designing a water bottle with the shape below as its cross-section. It consists of an isosceles triangle with a base 10 cm and a semicircle with a diameter that fits perfectly to one equal side of the isosceles triangle. The area of the triangle is 60 cm^2. **3**



10 cm

If the bottle is to have a depth of 25 cm, calculate the volume of the bottle to two decimal places.

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Question 39 (4 marks)

In a flock of 22400 sheep, the ratio of males to females is 9: 15. The weights of the female sheep are normally distributed with a mean of 78.4 kg and a standard deviation of 5.6 kg. In the flock, 13979 of the female sheep each weigh more than x kg. **4**

Find the value of x.

End of paper

NAME: Solutions

Blacktown Boys' High School

Year 12 2026

Trial Examination

Mathematics Standard 2

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- Calculators approved by NESA may be used
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Total marks: 100

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- Attempt Questions 1 – 15
- Allow about 25 minutes for this section

Section II – 85 marks (pages 9-29)

- Attempt Questions 16 - 39
- Allow about 2 hour and 5 minutes for this section

Assessor: Mr Stevic

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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 Hamza invests $12000 at 4% pa compounding monthly. What is the value of his investment (to the nearest dollar) after 7 years?

A. $3360

B. $15360

C. $15791

D. $15870

$FV = 12000\left(1+\frac{0.04}{12}\right)^{7\times12}$

$= \$15870.16\ldots$

2 The length of a pencil is measured to be 17.45 cm. What is the absolute error on the length of this pencil?

A. 0.005

B. 0.001

C. 0.05

D. 0.01

Precision $= 0.01$

Absolute error $= \frac{1}{2} \times 0.01$

$= 0.005$

3 In a survey of 120 randomly selected Year 12 students it was found that 45 catch the train to go to school. Based on this survey, approximately how many of 6520 Year 12 students would be expected to catch the train to school?

A. 120

B. 2445

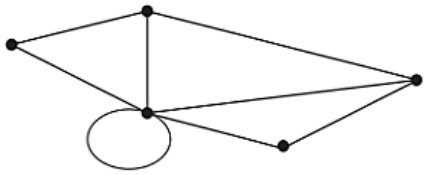
C. 6520

D. 17397

$\frac{45}{120} \times 6520$

$= 2445$

4



The number of vertices with an even degree in the network above is

A. 1

B. 2

C. 3

D. 4

5 Given $p = \dfrac{n^2 - m}{q}$, which of the following expresses n as the subject of the formula.

$pq + m = n^2$

$n = \sqrt{pq+m}$

A. $n = pq + m$

B. $n = \sqrt{pq + m}$

C. $n = \sqrt{pq - m}$

D. $n = pq - m$

6 John lives in Perth. He wants to watch a basketball game being played in Toronto starting at 8.00 pm on Thursday.

If Toronto is 13 hours behind Perth, what is the day and time in Perth when the game starts?

8:00pm + 13hrs

= 9:00am Friday

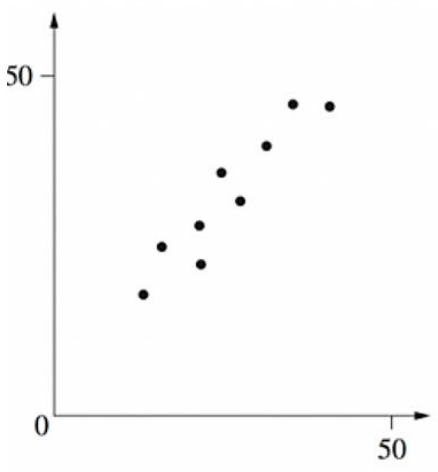
A. 7: 00 am Thursday

B. 9: 00 am Thursday

C. 7: 00 am Friday

D. 9: 00 am Friday

7



Which of the following is the best approximation for the correlation coefficient of the set of data above?

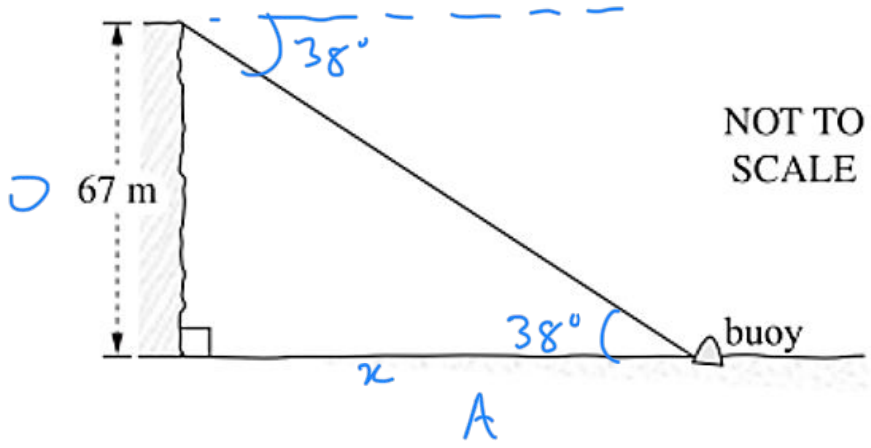
A. 0.3

B. −0.3

C. 0.8

D. −0.8

8 From the top of a cliff 67 metres above the sea level, the angle of depression of a buoy is 38°.



How far is the buoy from the base of the cliff, to the nearest metre?

A. 52 m

B. 86 m

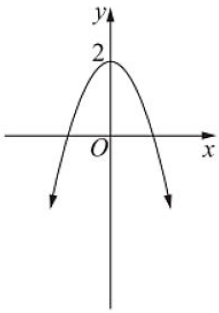
C. 41 m

D. 108 m

$\tan 38 = \frac{67}{x}$

$x = \frac{67}{\tan 38} \approx 86\text{m}$

9 The diagram shows the graph of an equation.



Which of the following equations best represents the graph?

A. $y = x^2 - 2$

B. $y = -x^2 - 2$

C. $y = x^2 + 2$

D. $y = -x^2 + 2$

10 A hire-car company purchased a vehicle 4 years ago for \$9800. Since its purchase, the vehicle has depreciated to \$5200 using the declining balance method. What is the approximate annual rate of depreciation?

$5200 = 9800(1-r)^4$

$1-r = \sqrt[4]{\frac{5200}{9800}}$

$\therefore r = 1 - \sqrt[4]{\frac{5200}{9800}}$

$\approx 15\%$

A. 15%

B. 17%

C. 27%

D. 73%

11 Sofia purchases 500 shares with a market value of \$6.75 per share. The dividend received for these shares is \$1092.80. The percentage dividend yield is:

$DY = \frac{1092.8}{500 \times 6.75} \times 100$

$= 32.4\%$

A. 0.6%

B. 1.4%

C. 3.2%

D. 32.4%

12 A group of 32 farmers can harvest crops in 15 days. The number of days varies inversely with the number of farmers working at a constant rate. How long would it take a group of 8 farmers to complete the same task?

A. 30

B. 48

C. 60

D. 120

$32 = \frac{k}{15}$

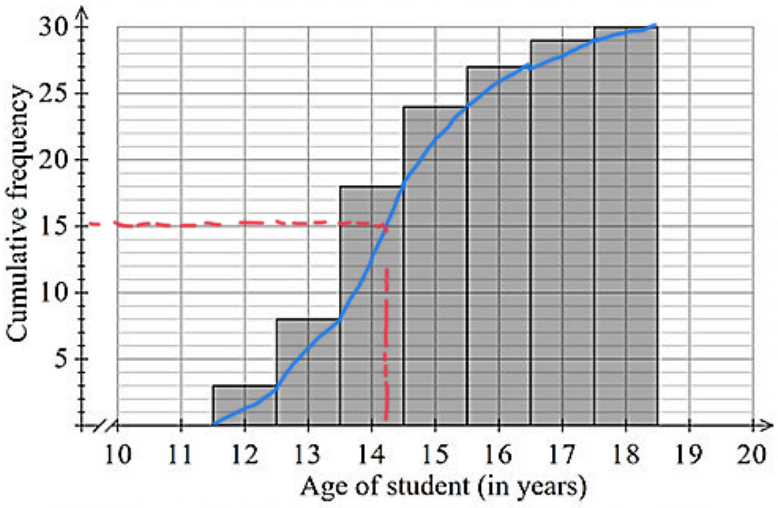
$\therefore k = 32 \times 15$

$= 480$

$F = \frac{480}{d}$

$= \frac{480}{8} = 60$

13 Below shows a cumulative frequency histogram of the ages of 30 students.



What is approximately the median age of the students?

A. 14

B. 15

C. 16

D. 17

14 The marks in a test were normally distributed. The mean mark was 56 and the standard deviation was 12. What was the percentage of marks higher than 80?

A. 2.5%

B. 5%

C. 95%

D. 97.5%

$z = \frac{80-56}{12}$

$= 2$

5% of data above/below 2SD

$\therefore$ 2.5% above 80

15 Subhan is going to buy a car and downloads data on fuel efficiency for three models.

Model	*Fuel Consumption (City)*	*Fuel Consumption (Country)*
Tacoma	15.8 L/100km	11.5 L/100km
Firenze	14.4 L/100km	11.4 L/100km
Vortex	15.6 L/100km	11.0 L/100km

In a test drive, he drives all three cars for 40 km on city roads and 120 km on country roads. Based on the data, which car would use the least fuel on the test drive?

A. The Firenze would use the least fuel.

B. The Firenze and the Tacoma are equal in using the least amount of fuel.

C. The Firenze and the Vortex are equal in using the least amount of fuel.

D. The Tacoma would use the least fuel.

Tacoma: $\left(\frac{40}{100} \times 15.8\right) + \left(\frac{120}{100} \times 11.5\right) = 20.12\text{L}$

Firenze: $\left(\frac{40}{100} \times 14.4\right) + \left(\frac{120}{100} \times 11.4\right) = 19.44\text{L}$

Vortex: $\left(\frac{40}{100} \times 15.6\right) + \left(\frac{120}{100} \times 11\right) = 19.44\text{L}$

End of Section I

Mathematics Standard

Section II Answer Booklet

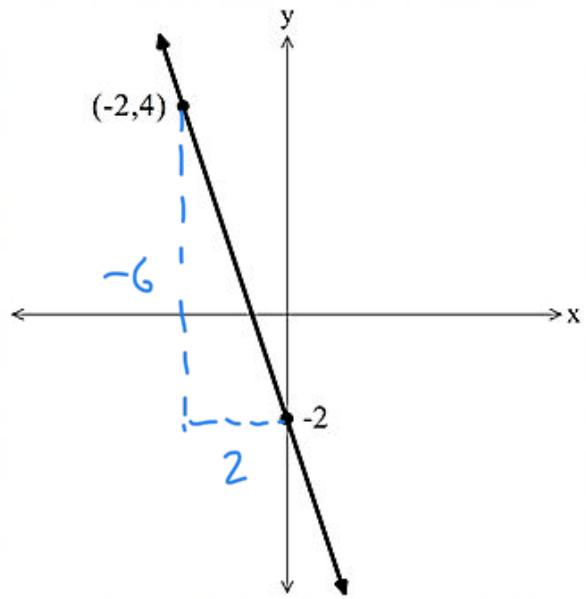
85 marks
Attempt Questions 16-39
Allow about 2 hour 5 minutes for this section

Instructions

- Answer the Questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your response should include relevant mathematical reasoning and/or calculations
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

Question 16 (2 marks)

The diagram below shows the graph of a line. The line passes through a point of $(-2,4)$. **2**



Find the equation of the line, in the form of $y = mx + c$.

$c = -2$

$m = -6/2$ 1 mark - correct y-int or gradient

$= -3$

$\therefore y = -3x - 2$ 2 marks - correct equation

Question 17 (2 marks)

In a kickboxing tournament, the ratio of prize money that the top three competitors receive is $5:3:1$. If the total prize money is for the tournament is \$81000, calculate how much each competitor will earn. **2**

Total Parts $= 3+5+1 = 9$

1 part $= 81000 \div 9 = \$9000$ — (1)

1st place $= 9000 \times 5 = \$45000$

2nd place $= 9000 \times 3 = \$27000$ } All correct 2 marks

3rd place $= 9000 \times 1 = \$9000$

Question 18 (2 marks)

On 27 March 2026, Charlton used his credit card to purchase a TV valued at $1050. He made no other purchases on his credit card during that month. He paid the outstanding amount in full on 19 April 2026. His credit card account does not offer an interest-free period, and interest is charged daily at an annual rate of 18.5%, including the date of purchase and the date of payment. How much interest did Charlton pay on this transaction? Round your answer to the nearest cent. **2**

No. of days = 5+19 = 24 days

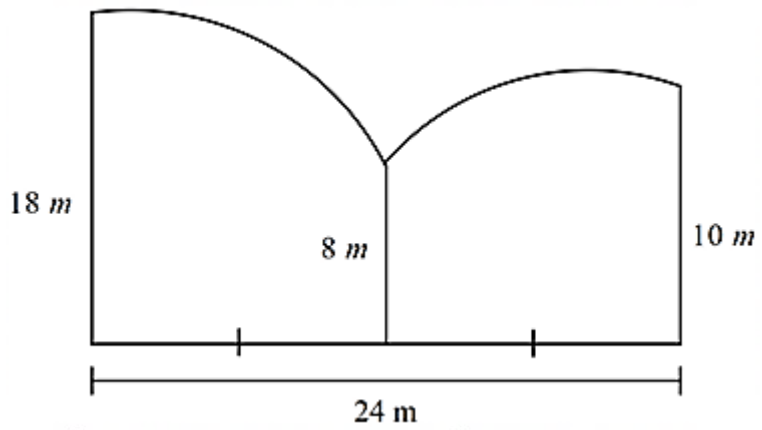
$FV = 1050\left(1+\frac{0.185}{365}\right)^{24}$ — (1)

$= \$1062.85$

Interest = 1062.85 − 1050 = $12.85 — (1)

Question 19 (2 marks)

Using two applications of the trapezoidal rule, estimate the area of the figure below. **2**



$A = \frac{12}{2}(18+8) + \frac{12}{2}(8+10)$

$= 6(26) + 6(18)$

$= 264\ m^2$

1 mark - one correct trapezium or correct substitution for both.

2 marks - all correct

Question 20 (6 marks)

The table shows tax rates for the 2025 – 2026 financial year.

Taxable income	Tax on this income
0 - $18,200	Nil
$18,201 - $45,000	16 cents for each $1 over $18,200
$45,001 - $135,000	$4,288 plus 30 cents for each $1 over $45,000
$135,001 - $190,000	$31,288 plus 37 cents for each $1 over $135,000
$190,001 and over	$51,638 plus 45 cents for each $1 over $190,000

Dino is a financial advisor and receives a yearly salary of $162025. He also receives an income of $260 per month from his share portfolio. Dino purchased an office desk for $978 which is an allowable deduction. He also makes deductions of $42 per fortnight for union fees and $66.50 per week for dry cleaning. He paid PAYG instalments of $2590 per month. He must also pay the Medicare Levy, which is 2% of his taxable income.

(a) Determine Dino's taxable income. **1**

Taxable income = [162025 + (260 × 12)] –
[978 + (42 × 26) + (66.5 × 52)] = $159617 — (1)

(b) Using the tax table given above, find the income tax payable. **2**

31288 + 0.37(159617 − 135000) — (1)
= $40396.29 — (1)

(c) Calculate the Medicare Levy that Dino needs to pay. **1**

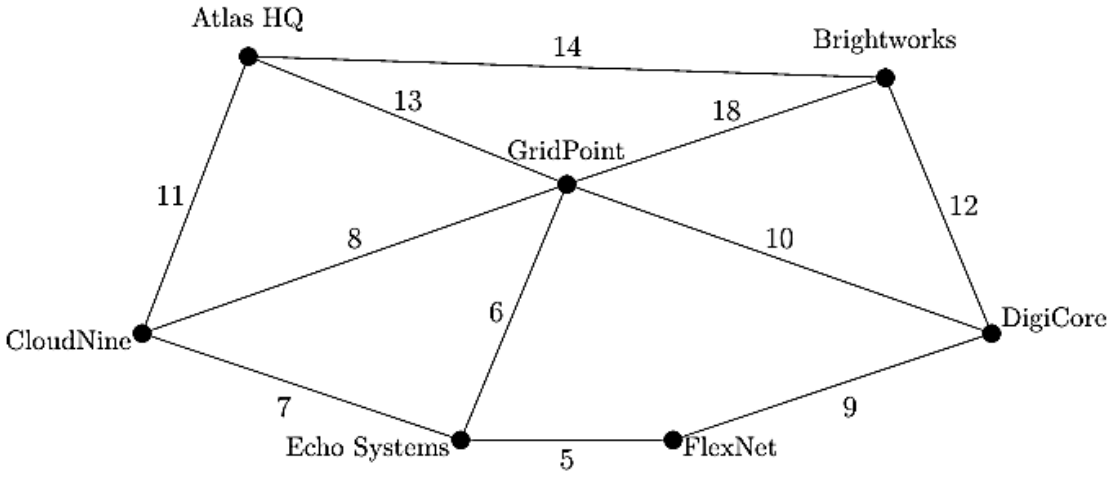
2% × 159617
= $3192.34 — (1)

(d) Will he have a tax liability or a tax refund? Justify your answer with calculations. **2**

Tax paid = 2590 × 12 = $31080 — (1)
40396.29 > 31080
Since tax payable is greater,
he will have a tax liability — (1)

Question 21 (3 marks)

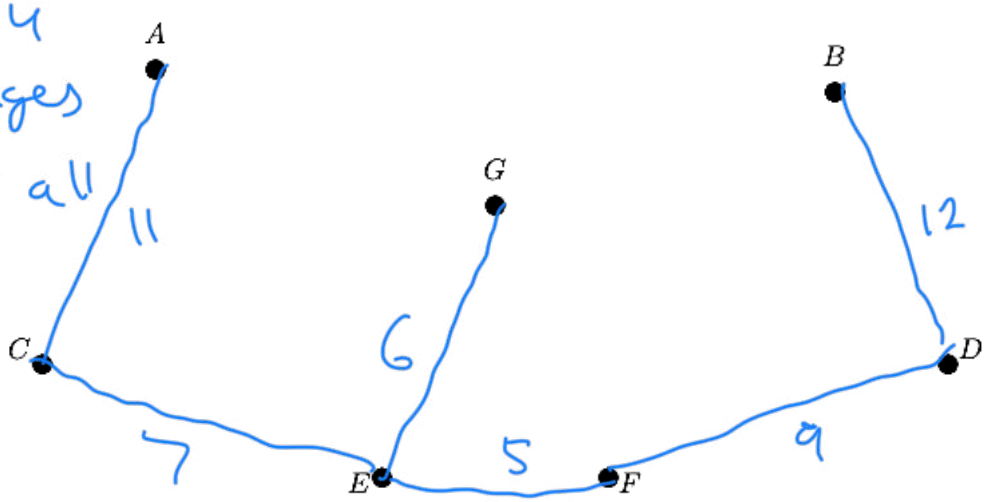
Mark is a courier for a logistics which delivers between several tech hubs. The diagram below shows the network of offices and the travel times between them in minutes.



(a) Draw a minimum spanning tree for this network below. The initial letter of each office is used. **2**

1 mark - 4 correct edges

2 marks - all correct



(b) Determine the total weight of the minimum spanning tree. **1**

11 + 6 + 7 + 5 + 9 + 12

= 50 — (1)

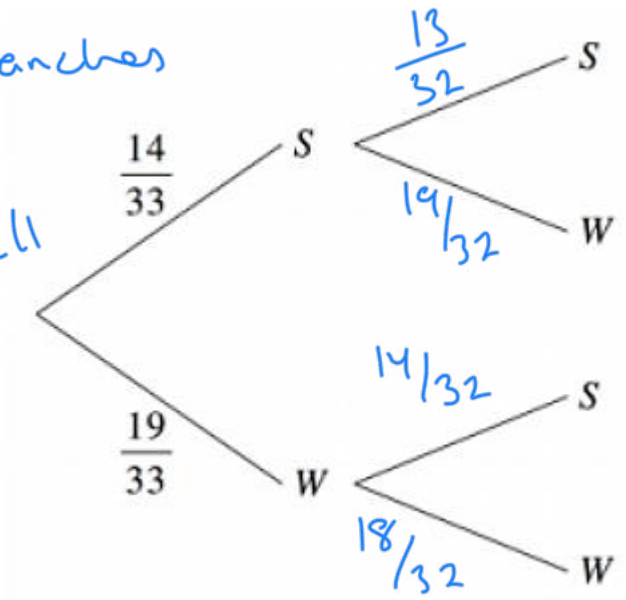
Question 22 (5 marks)

A box contains 33 scarves made from two different fabrics. There are 14 scarves made from silk (S) and 19 made from wool (W). Two girls each select, at random, a scarf to wear from the box.

(a) Complete the probability tree diagram below. **2**

1 mark - 2 branches correct

2 marks - all correct



(b) Calculate the probability that the two scarves selected are both made from silk. **1**

$P(SS) = \frac{14}{33} \times \frac{13}{32}$

$= 91/528$ — (1)

(c) Calculate the probability that the two scarves selected are made from different fabrics. **2**

$P(SW) + P(WS)$

$= (14/33 \times 19/32) + (19/33 \times 14/32)$

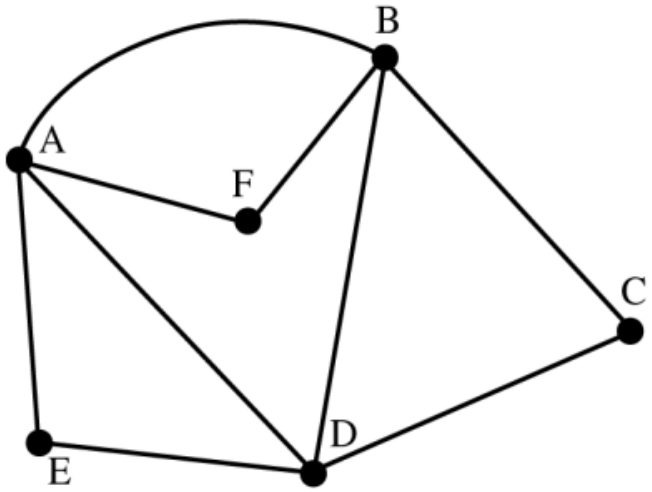
$= \frac{133}{264}$

1 mark - any one piece correct

2 marks - all correct

Question 23 (3 marks)

Pat is an office cleaner who must mop the floors of the hallways joining 6 different offices. The offices are represented as vertices and the hallways as edges on the network diagram below.



(a) One morning he mops the hallways joining the offices in the following order: A-F-B-D-A. Is this a trail, path, circuit, cycle or walk only? **1**

Cycle — (1)

(b) Every Friday, Pat is required to mop each hallway in the office without repeating a hallway so that the floors can dry efficiently. Identify a Eulerian circuit for this network diagram starting at vertex A that Pat can use and explain why it is a Eulerian circuit. **2**

A-B-C-D-E-A-F-B-D-A

This is a Eulerian circuit because all vertices have an even degree.

1 mark - correct Eulerian circuit stated.

2 marks - correct explanation of why graph is a Eulerian circuit.

Question 24 (4 marks)

One summer, Alex gets a job selling ice creams. Each day, he records the number of ice creams sold and the temperature. This information is shown in the table below.

Temp (°C)	26	27	29	30	32	33	34	37	39	40
Sales (units)	162	172	200	202	253	250	274	311	291	353

(a) Calculate the Pearson's correlation coefficient, correct to two significant figures. **1**

0.97 — (1)

(b) Write the equation of the least-squares regression line. Let x be the temperature and y be the number of ice creams sold. Give your values correct to two decimal places. **2**

$A = -161.82$, $B = 12.50$ — (1)

$y = 12.50x - 161.82$ — (1)

(c) Comment on the strength of the correlation within the context of this question. **1**

1 mark - either statement

Strong positive linear. A higher temperature correlates with more sales.

Question 25 (2 marks)

The table below shows the present value of an annuity with a contribution of \$1. **2**

Present Value of Annuity of \$1				
Period	1%	2%	4%	6%
1	0.9901	0.9804	0.9615	0.9434
2	1.9704	1.9416	1.8861	1.8334
3	2.9410	2.8839	2.7751	2.6730
4	3.9020	3.8077	3.6299	3.4651

Grace pays \$5500 into an annuity at the end of each year for 2 years at 4% p.a., compounded half yearly. What is the present value of her annuity?

$n = 2 \times 2 = 4$, $r = 4\% \div 2 = 2\%$

$PV = 5500 \times 3.8077$ — (1)

$= \$20942.35$ — (1)

Question 26 (4 marks)

Vic starts drinking at 2 pm. He has 5 schooners of beer over three and a half hours. Each schooner is 1.6 standard drinks, and Vic weights 72 kg. The formula to calculate his Blood Alcohol Content (BAC) is:

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

where N is the number of standard drinks consumed,
H is the number of hours drinking, and
M is the person's mass in kilograms.

(a) Calculate Vic's BAC at 5:30pm. Give your answer correct to 2 decimal places. **2**

$H = 3.5$, $N = 5 \times 1.6 = 8$, $M = 72$

$BAC = \dfrac{10(8) - 7.5(3.5)}{6.8(72)}$ — (1)

$= 0.1097...$

≈ 0.11 (2 dp) — (1)

(b) If Vic stops drinking at 5:30pm, determine at what time his Blood Alcohol Content reaches zero. Given your answer correct to the nearest minute. **2**

$$Time\ to\ zero = \frac{BAC}{0.015}$$

Time to zero $= \dfrac{0.11}{0.015}$

$= 7.33...$ hrs — (1)

Time it reaches zero = 5:30pm + 7hr 20m

$= 12:50$ am — (1)

Question 27 (2 marks)

Jen installs an electric water heater which uses electricity at a rate of 450W per hour. She plans on running it for 5 hours per day. If electricity costs 30 cents per kWh, how much does it cost to run the heater for a year? **2**

$0.45 \times 5 \times 365 = 821.25 \text{ kWh}$ — (1)

Cost $= 0.3 \times 821.25$

$= \$246.38$ — (1)

Question 28 (3 marks)

The table below shows the mean and standard deviation of a Year 12 cohort in four HSC subjects. **3**

Subject	Mean	Standard Deviation
English	65	10
Mathematics Standard	59	12
Society and Culture	55	8
Drama	68	15

Peter's marks were English 70, Mathematics Standard 66, Society and Culture 60 and Drama 79. In which subject did Peter achieve the best result, relative to the rest of the cohort? Justify with supporting calculations.

English: $z = \frac{70-65}{10} = 0.5$

Maths: $z = \frac{66-59}{12} = 0.583...$

Society and culture: $z = \frac{60-55}{8} = 0.625$

Drama: $z = \frac{79-68}{15} = 0.73$

1 mark - 2 z-scores correct

2 marks - all correct

∴ Performed best in drama because z-score is the highest.

3 marks - all correct + concluding statement

Question 29 (5 marks)

Sarah inherits $70000 and deposits it into a savings account. The account earns 7.2% interest p.a. compounding monthly. Sarah decides to withdraw $100 at the end of each month.

(a) By first writing a recurrence relation for Sarah's investment, calculate the amount of money in the account after the third month. **3**

$r = \frac{0.072}{12} = 0.006$

$A_{n+1} = A_n \times 1.006 - 100$ — (1)

$A_0 = 70000$

$A_1 = 70000 \times 1.006 - 100$

$= \$70320$ — (1)

$A_2 = 70320 \times 1.006 - 100$

$= \$70641.92$

$A_3 = 70641.92 \times 1.006 - 100$

$= \$70965.77$ — (1)

(b) Calculate the interest earned in the first three months. **2**

$I = 70965.77 - 70000$

$= \$965.77$ — (1)

$965.77 - (3 \times 100)$

$= \$665.77$ — (1)

Question 30 (4 marks)

The table below shows monthly repayments for each $1000 borrowed.

Monthly repayment table

Principal and Interest per $1000 borrowed

Interest rate (per annum)	*Term of loan* (years)					
	5	10	15	20	25	30
6.5%	19.57	11.35	8.71	7.46	6.75	6.32
7.0%	19.80	11.61	8.99	7.75	7.07	6.65
7.5%	20.04	11.87	9.27	8.06	7.39	6.99
8.0%	20.28	12.13	9.56	8.36	7.72	7.34

(a) A couple intends to borrow $732000 to buy an apartment at 7% p.a. over 30 years. How much will the couple repay in total for this loan? **3**

$n = 30$, $r = 7\%$ $\therefore$ Intersection $= 6.65$ — (1)

Monthly repayment $= \frac{732000}{1000} \times 6.65$

$= \$4867.8$ — (1)

Total repayments $= 4867.8 \times 12 \times 30$

$= \$1\,752\,408$ — (1)

(b) The couple decide instead to borrow some money at 8% per annum. They agree to repay the loan over 20 years, paying $3875 per month. How much money will they borrow? **1**

Intersection $= 8.36$

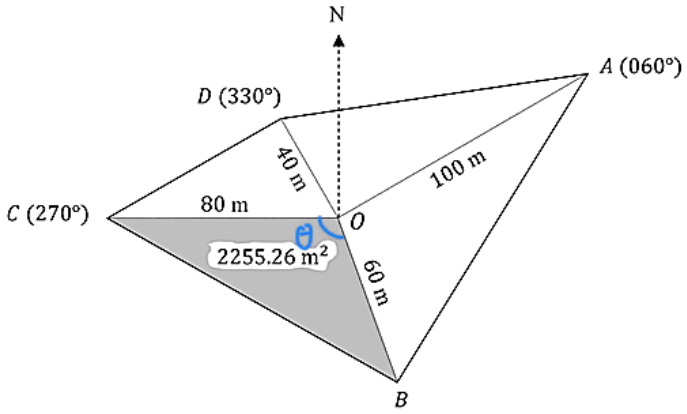
$\frac{\text{Amount borrowed}}{1000} \times 8.36 = 3875$

$\therefore$ Amount borrowed $= \frac{3875 \times 1000}{8.36}$

$= \$463\,516.75$ — (1)

Question 31 (4 marks)

Part of a compass radial survey shows the position of four corners of a block of land, A, B, C and D, in relation to a point O.



The area of triangle BOC is 2255.26 m^2, and the angle COB is obtuse.

(a) Find the bearing of B from O to the nearest degree. **3**

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

$2255.26 = \frac{1}{2} \times 80 \times 60 \times \sin\theta$ — (1)

$\theta = \sin^{-1}\left(\frac{2255.26}{2400}\right)$

$= 70°$

Obtuse angle $= 180 - 70$

$= 110$ — (1)

Bearing of B from A $= 270 - 110$

$= 160°T$ — (1)

(b) Find the length of BC, correct to the nearest metre. **1**

$BC = \sqrt{80^2 + 60^2 - 2(80)(60)\cos(110)}$

$= 115.25\ldots$

≈ 115m — (1)

Question 32 (5 marks)

A bird population, P, is to be modelled using the function $P = 200(1.3)^t$, where t is the time in years.

(a) What is the initial population? **1**

$P = 200(1.3)^0$

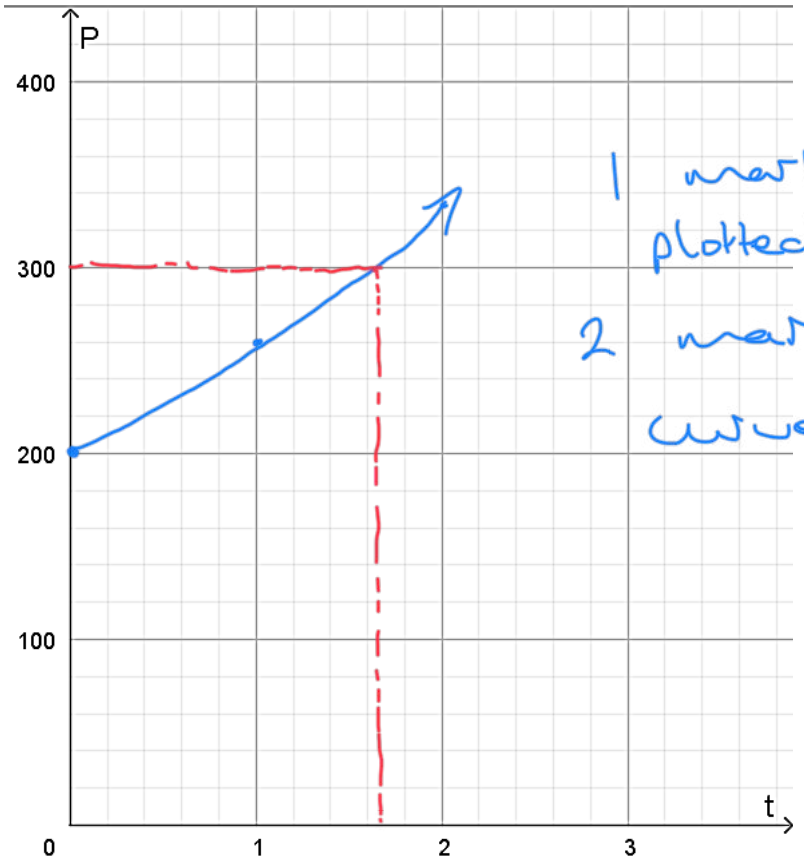
$= 200$ — (1)

(b) Find the population after 2 years. **1**

$P = 200(1.3)^2$

$= 338$ — (1)

(c) On the axes below, draw the graph of the population against time, showing the points at $t = 0$ and $t = 2$. **2**



1 mark - points plotted correctly

2 marks - correct curve

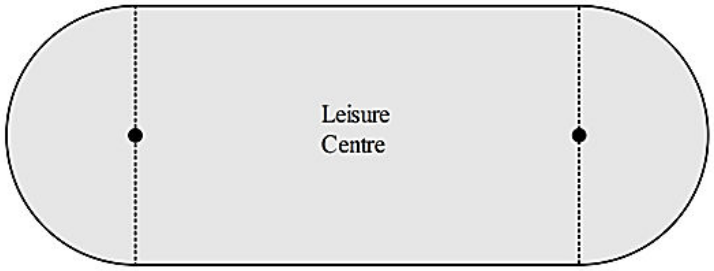
(d) Using the graph or otherwise, estimate how long, to one decimal place, it will take for the population to reach 300. **1**

$t \approx 1.6$ — (1)

Accept between 1.6 and 1.8

Question 33 (3 marks)

A new leisure centre in Blacktown is designed with a running track on its perimeter. The track follows the entire outer edge of the shape below, which comprises of a rectangle and two semi-circles. The length of the rectangle is 80m and the radius of the semicircles is 32m.



It takes Louise 6 minutes to walk one lap around the track. What is the average speed of her lap in kilometres per hour? Answer correct to one decimal place. **3**

Distance = $2 \times 80 + 2\pi \times 32$

$= 361.06\ldots$ m — (1)

Speed = $\frac{361.06\ldots}{6}$

$= 60.17\ldots$ m/min — (1)

$60.17\ldots \div 1000$

$= 0.06017\ldots$ km/min

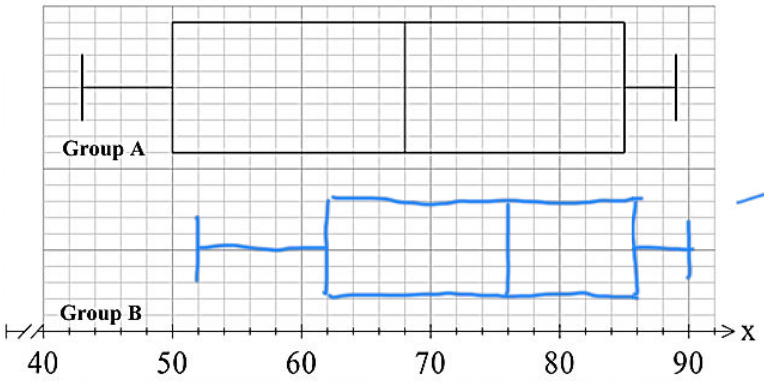
$0.06017\ldots \times 60$

$= 3.61\ldots$ km/h

≈ 3.6 km/h (1 dp) — (1)

Question 34 (4 marks)

The box plot below represents the scores of two groups of students, Group A and Group B, in a recent mathematics exam.



(a) Draw the box plot for Group B in the space above using the following data: **1**

Minimum Score: 52, Lower Quartile (Q1): 62, Median: 76,
Upper Quartile (Q3): 86, Maximum Score: 90.

(b) By comparing the two box plots, which group did better in the mathematics test? Justify your answer with reference to the skewness, measures of centre and measures of spread. **3**

Group B performed better
• Median was higher — (1)
• IQR and range were smaller so results were more consistent — (1)
• Negatively skewed meaning more values towards upper end of data — (1)

Question 35 (4 marks)

Kara is training for the swim leg of a triathlon and decides to go for a training swim in the harbour. She starts at a jetty J and swims on a bearing of 105° for 0.9 km out to a buoy L. She then changes direction and swims on a bearing of 045° for a further 1.6 km to buoy M before returning to the jetty J.

(a) What is the total distance that Kara swam, correct to 2 decimal places? **2**

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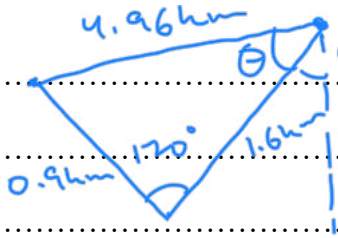
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(b) Find the bearing of the jetty J from the buoy M to the nearest degree. **2**



$\frac{\sin\theta}{0.9} = \frac{\sin 120}{4.96}$

$\theta = \sin^{-1}\left(\frac{0.9\sin 120}{4.96}\right)$

$= 9.04°$ — (1)

Bearing $= 9.04 + 45 + 180 = 234°T$ — (1)

Question 36 (5 marks)

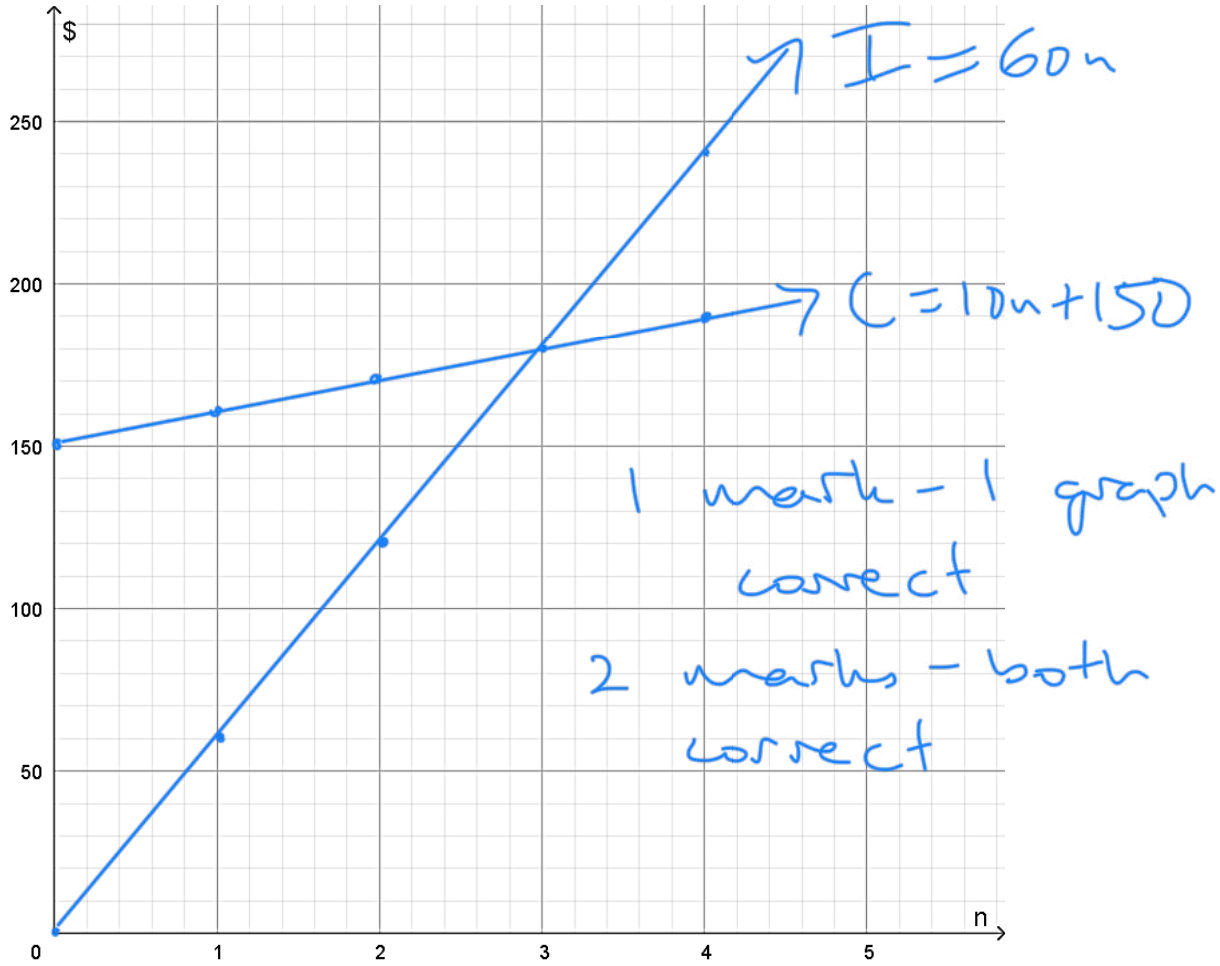
Isaac runs a business in which he sells shirts. The income his business generates is \$60 for each shirt sold. To manufacture the shirts, he incurs a cost of \$10 per shirt as well as a one-off manufacturing fee of \$150.

(a) Using n to represent the number of shirts sold and I and C for the income and cost, respectively, write a pair of linear equations for cost and income using the information above. **2**

$I = 60n$ — (1)

$C = 10n + 150$ — (1)

(b) Draw both graphs on the axes below and label your graphs. **2**



1 mark - 1 graph correct

2 marks - both correct

(c) How many shirts must Isaac sell to break even? **1**

3 shirts — (1)

Question 37 (4 marks)

Michael wishes to buy a used car that has a sale price of $19 820. In addition to the sale price, the following costs are charged: **4**

- Transfer of registration $50
- Stamp duty, which is calculated at $3 for every $100, or part thereof, of the sale price.

Michael borrows the total amount to be paid for the car, including transfer of registration and stamp duty. Simple interest at the rate of 6.3% per annum is charged on the loan. The loan is to be repaid in equal monthly repayments over 4 years.

Calculate Michael's monthly repayment.

Stamp duty = $19900 \times \frac{3}{100}$

$= \$597$ — (1)

Total borrowed = 597 + 50 + 19820

$= \$20467$ — (1)

Interest on loan = $20467 \times 4 \times 6.3\%$

$= 5157.684$

$\approx \$5157.68$

Total to be repaid = 5157.68 + 20467

$= \$25624.68$ — (1)

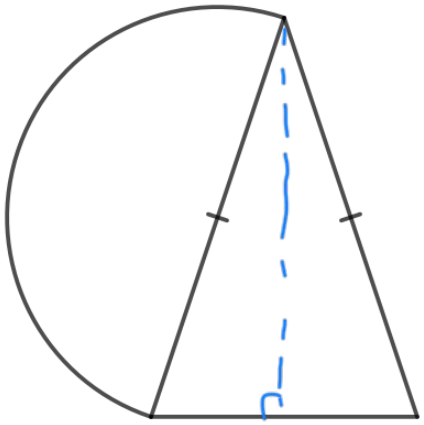
Monthly repayment = $25624.68 \div 4 \div 12$

$= \$533.8475$

$\approx \$533.85$ (2dp) — (1)

Question 38 (3 marks)

A company is designing a water bottle with the shape below as its cross-section. It consists of an isosceles triangle with a base 10 cm and a semicircle with a diameter that fits perfectly to one equal side of the isosceles triangle. The area of the triangle is 60 cm^2. **3**



If the bottle is to have a depth of 25 cm, calculate the volume of the bottle to two decimal places.

$A = \frac{1}{2} \times b \times h$

$60 = \frac{1}{2} \times 10 \times h$

$h = 60/5 = 12\text{ cm}$ — (1)

Diameter of circle $= \sqrt{5^2 + 12^2}$

$= 13\text{ cm}$

Area of cross-section $= 60 + \left(\frac{1}{2} \times \pi \times 6.5^2\right)$ — (1)

$= 126.366...$

Volume $= 126.366... \times 25$

$= 3159.153...\ cm^3$

$\approx 3159.15\ cm^3$ (2 dp)

Question 39 (4 marks)

In a flock of 22400 sheep, the ratio of males to females is 9: 15. The weights of the female sheep are normally distributed with a mean of 78.4 kg and a standard deviation of 5.6 kg. In the flock, 13979 of the female sheep each weigh more than x kg. **4**

Find the value of x.

Total parts $= 9 + 15$

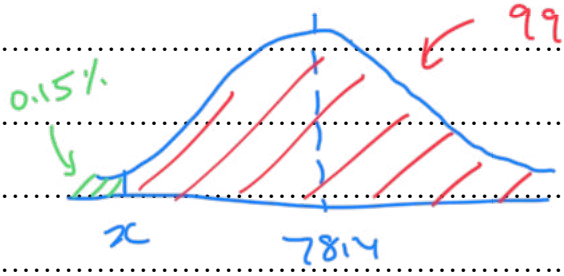
$= 24$

No. of female sheep $= \frac{22400}{24} \times 15$

$= 14000$ — (1)

Percentage of females weighing more than x kg $= \frac{13979}{14000} \times 100$

$= 99.85\%$ — (1)



99.85% of data is above x. By empirical rule, x is 3 standard deviations to the left of mean

i.e. $z = -3$ — (1)

$\therefore \frac{x - 78.4}{5.6} = -3$

$x = -3 \times 5.6 + 78.4$

$= 61.6$ kg — (1)

Also accept 61 kg and 62 kg

End of paper