NAME: _____

Blacktown Boys' High School

2023 Year 12

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 3-9)

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

Section II – 85 marks (pages 10-29)

- Attempt Questions 16 – 37
- Allow about 2 hours and 5 minutes for this section.

Assessor: Chhabra

Students are advised that this is a trial examination only and cannot in any way guarantee the content or format of the 2023 Higher School Certificate Examination.

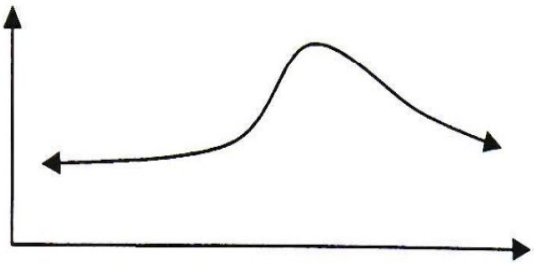
Section I

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

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

1 Which of the following graphs would represent the negative skewed data?

A.



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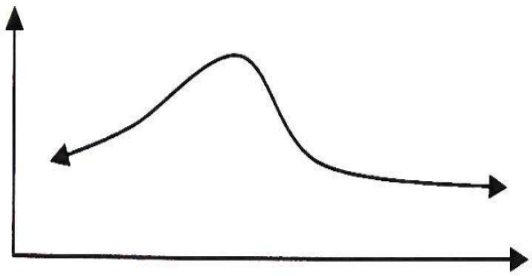

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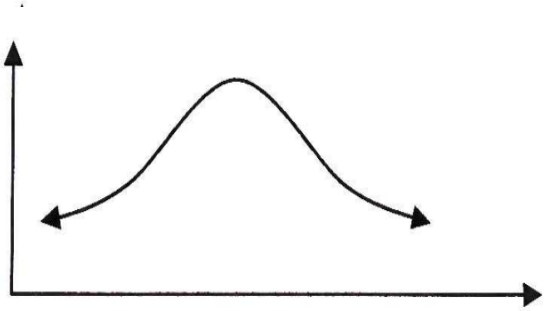

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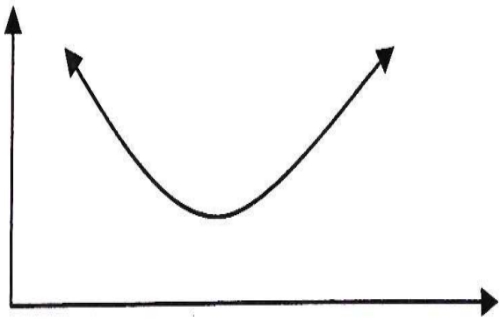


2 Suliman and Ahmad work in Supermarket A and each earned \$800 last week. Suliman worked 4 hours more than Ahmad and was paid double-time for these hours. What is Ahmad's hourly wage if Suliman is paid an hourly wage rate of \$20 ?

A. \$15

B. \$20

C. \$25

D. \$30

3 The stem-and-leaf plot represents the daily sales of car parking tickets from a vending machine. One of the numbers, 65, was left out of data displays. Which statistical measure is most affected by the addition of this score to the data?

5	4 5 7
6	2 4 6 6
7	7 9 9
8	1

A. Mean

B. Median

C. Mode

D. Range

4 Marco invested \$40000 at a rate of 4.8% per annum compounded every 6 months. How much interest did Marco earn on his investment over 5 years?

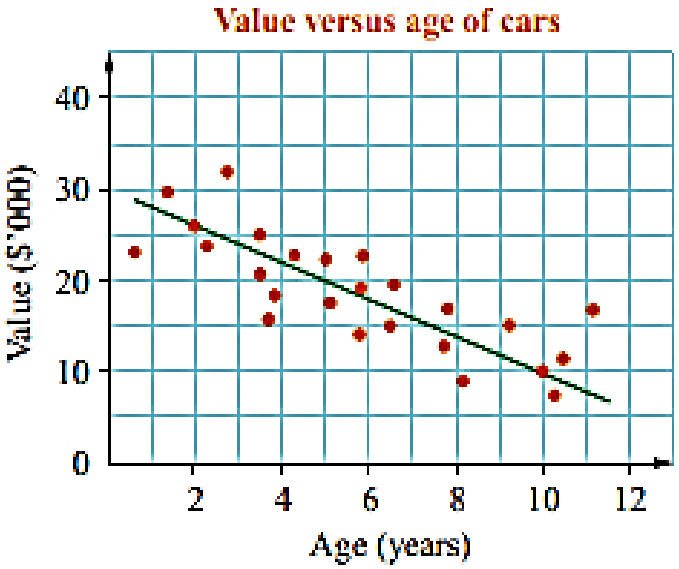
A. $\$40000(1.024)^5 - \$\,40000$

B. $\$40000(1.024)^{10} - \$\,40000$

C. $\$40000(1.048)^5 - \$\,40000$

D. $\$40000(1.048)^{10} - \$\,40000$

5 James collects data and draws a scatter plot showing the age and value for cars.
He also draws a line of best fit.
What is the likely correlation coefficient of the two variables?



A. $r = -0.95$

B. $r = -0.67$

C. $r = 0.95$

D. $r = 0.67$

6 It was found that "The greater number of hours a person spends revising his work, the higher the marks he obtains in the examination".

Which of the following types of correlations will best describe the relationship in the statement above?

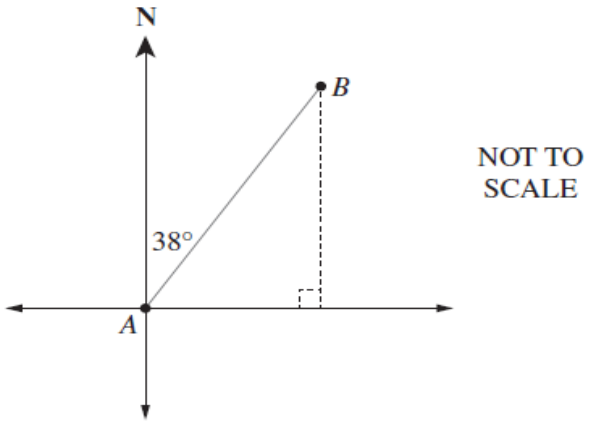
A. Zero correlation

B. Constant correlation

C. Negative correlation

D. Positive correlation

7 The compass bearing of B from A is $N38°E$.



What is the true bearing of A from B ?

A. 128° T

B. 218° T

C. 232° T

D 322° T

8 Marq invested $\$1450$ in an account which pays $12\%\ p.a.$ interest, compounded quarterly, on the 1st of February 2021. He added a further $\$1280$ to the account, on the 1st of February 2022. How much money does he have in the account on 1st February 2023?

A. $\$3252.48$

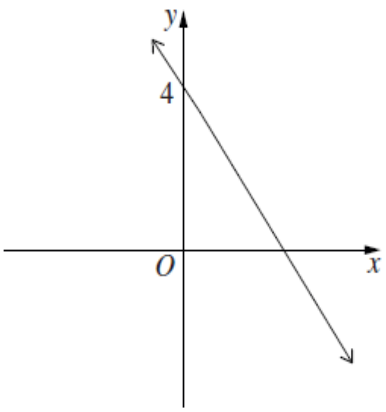
B. $\$2911.99$

C. $\$3277.47$

D. $\$5604.25$

9 Which one of the following best represents the graph of $y = -3x + 4$?

A.



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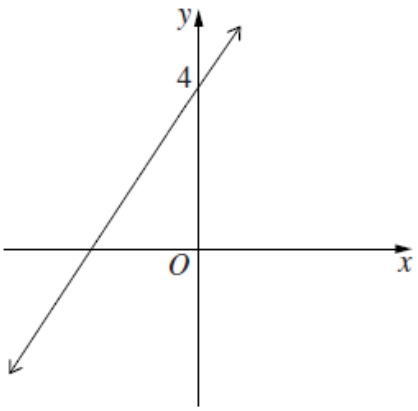

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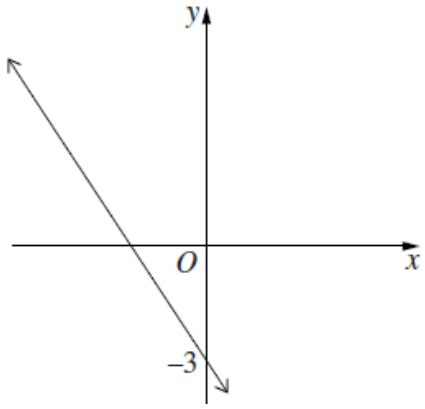

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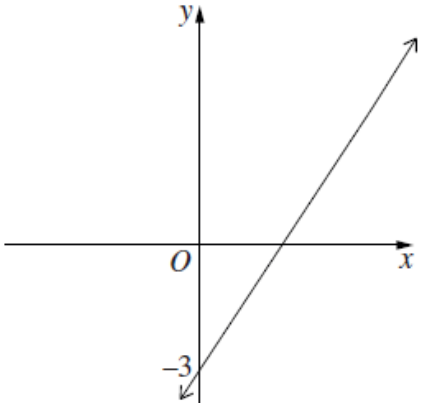

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10 When the equation $y = \dfrac{3 - 2w}{6}$ is transposed to make w the subject, the result is:

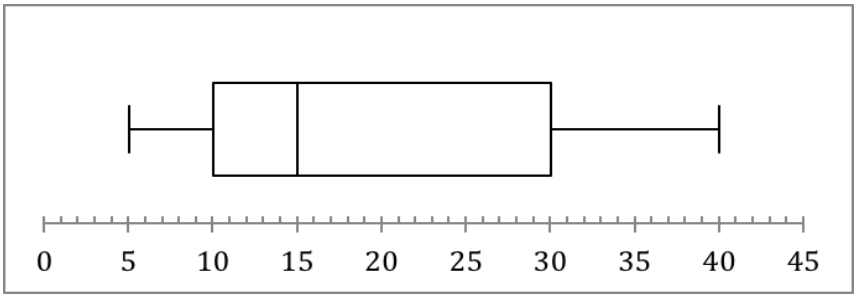
A. $w = \dfrac{6y - 3}{2}$

B. $w = \dfrac{6 - 2y}{2}$

C. $w = \dfrac{3 - 6y}{2}$

D. $w = 3 - 6y$

11 There were 140 students who completed an assessment task. The maximum mark was 40.



Which of the following statements is false?

A. 30 students scored a mark less than 10.

B. The distribution of the scores is positively skewed.

C. The median score is 15.

D. 105 students achieved a score greater than the lower quartile.

12 Which statement is correct?

A. A minimum spanning tree must contain a loop.

B. A minimum spanning tree must contain a cycle.

C. Every network has only one minimum spanning tree.

D. A minimum spanning tree has one more vertex than the number of edges.

13 The graph of $y = \frac{2}{x}$ is:

A. an exponential

B. a hyperbola

C. a parabola

D. a circle

14 Shiv invests money for three years at 2% per half year, compounded every half year.

Compound values of $1

Period	*Interest rate per period*			
	1%	2%	3%	4%
1	1.010	1.020	1.030	1.040
2	1.020	1.040	1.061	1.082
3	1.030	1.061	1.093	1.125
4	1.041	1.082	1.126	1.170
5	1.051	1.104	1.159	1.217
6	1.062	1.126	1.194	1.265

Using the table, which figure should Shiv use to calculate his investment?

A. 1.020

B. 1.061

C. 1.126

D. 1.265

15 Tom and Jack decided to remove the fence between their individual properties and join the two properties. Tom has 160 cows and Jack has 120 cows. They plan to divide the profit for the year in the same ratios as the number of cows. If they make a profit of $2800 for the year and have spend $500 on maintenance, how much does Jack get?

A. $329

B. $1314

C. $164

D. $986

End of Section I

Question 16 (6 marks)

a) Jacob drives from Sydney to Nowra four days in a week. He travels $520\ km$ in total. The fuel consumption of the car is $5.5\ L\ /100\ km$. If fuel costs $\$1.89/L$, calculate the cost for that week? **2**

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b) The toll fee for a car to travel on motorway in 2023 is $8.20. It is projected that due to inflation the cost of the toll fee will increase by 3% each year. Calculate the cost of the toll fee in 5 years' time. **2**

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c) Jimmy bought a new car for $34000. The dealer told Jimmy that on the average the value of cars depreciates at 14% p.a. Based on the information, calculate the salvage value of the car after 5 years. **2**

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Question 17 (2 marks)

Eric is seven years old. He weighs $25.6\ kg$ and needs to have the correct dosage of cough syrup. The dosage d is calculated using the formula **2**

$$d = \frac{mA}{70}$$

where m is the mass of the child in kilograms

A is the adult dosage

If the adult dosage is $20ml$ twice a day, how many days will a $200ml$ bottle last for?

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Question 18 (4 marks)

Jonathan invests $38750 in an account earning 3% p.a. interest compounded annually for 4 years.

a) Calculate the total amount of interest earned. **2**

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b) Calculate the annual percentage rate of simple interest that would produce the same amount of interest. (Answer correct to 2 decimal places) **2**

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Question 19 (2 marks)

Solve the equation $\frac{5x-2}{4} = -2$ **2**

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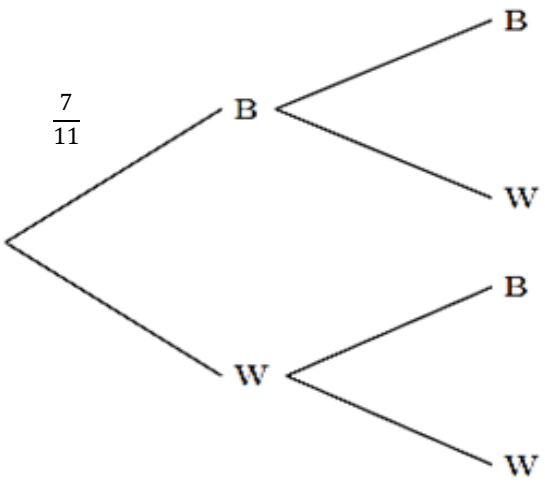
Question 20 (3 marks)

A box contains 11 chocolates. 7 chocolates contain fruits (B) and the rest of the chocolates contain nuts (W). Daniel randomly selects one of them and eats it. John then randomly chooses and eats one of the remaining chocolates. **3**
A partially completed tree diagram is shown below.



Complete the tree diagram and calculate the probability of selecting two different chocolates.

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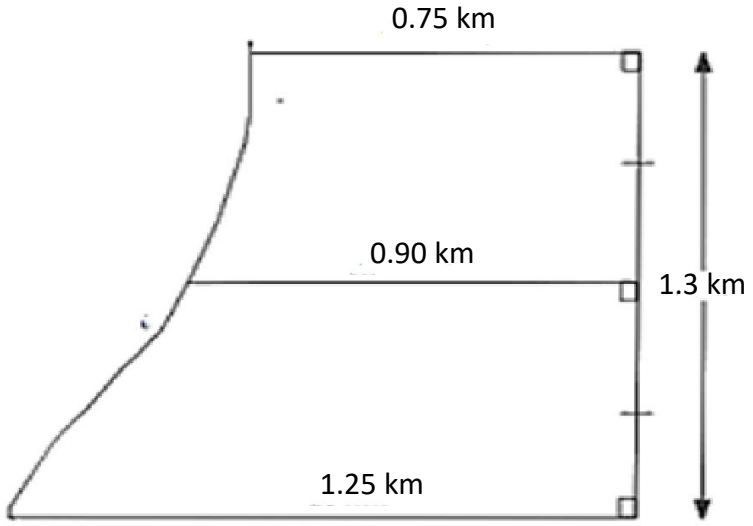
Question 21 (3 marks)

The diagram below represents a park, which runs along a creek in a suburb of Western Sydney and has an irregular boundary line. **3**



Use two applications of the Trapezoidal rule to estimate the area of the park correct to nearest square metre.

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Question 22 (2 marks)

The number of days, D, to complete a research project is inversely proportional to the number of researchers, R, who are working. The research project takes 123 days to complete when there are 7 people working on it. Find the equation relating D and R. **2**

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Question 23 (6 marks)

The internet provides a large platform which enables us to share data. On a specific app, the circulation of data grows exponentially, according to the function,

$$d = 20(1.3)^t$$

where d units is the amount of data circulated after t hours.

a) What is the initial amount of data? **1**

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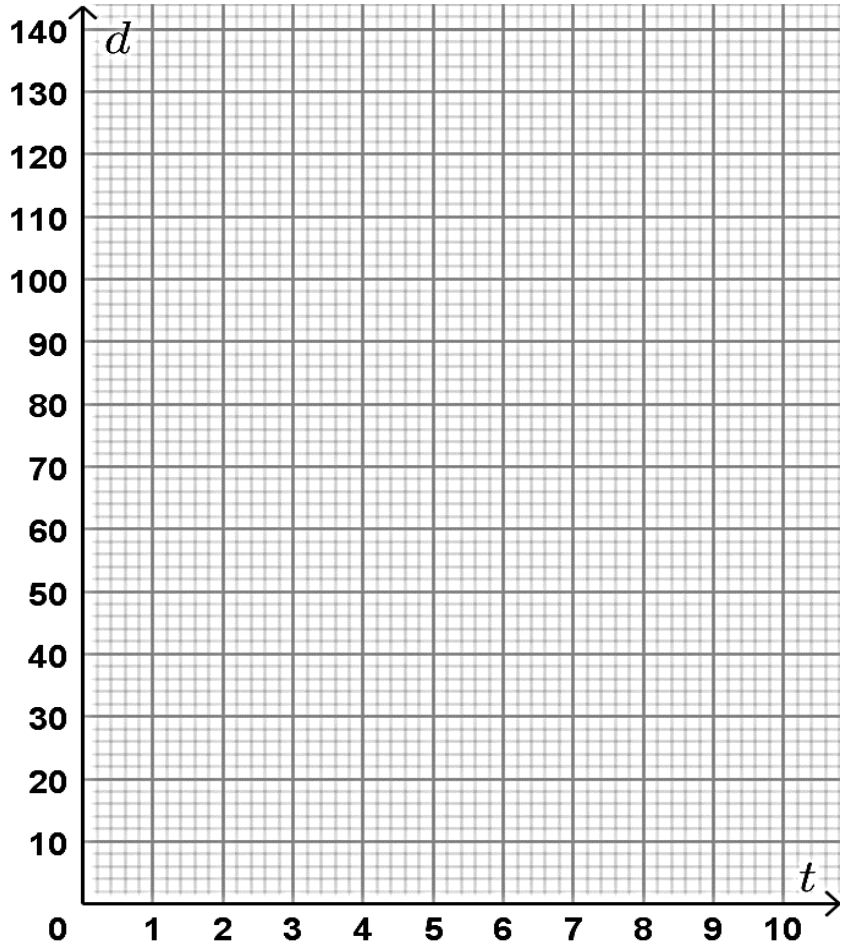
b) Complete the table of values, to the nearest whole number. **1**

t	0	2	4	6
d				

c) Sketch the graph on the grid provided below. **2**



d) Use the graph to estimate the amount of data after 7 hours. **1**

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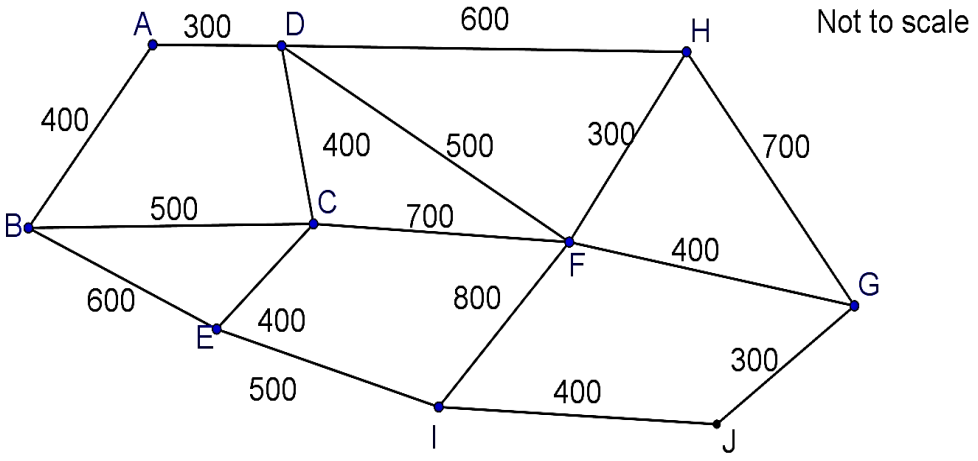
Question 24 (2 marks)

Tom wanted to take his dog for a walk. He wished to walk only on the footpath. Along which path should Tom take his dog to cover the shortest distance, if he starts at *A* and finishes at *J*. **2**



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Question 25 (7 marks)

One end of an elastic string was attached to a horizontal bar and a mass, m grams, was attached to the other end. The mass was suspended freely and allowed to settle.

The length of the elastic string, l mm, was recorded, for various masses as follows.

m	100	200	300	400	500	600
l	228	236	256	278	285	301

a) Calculate the Pearson's correlation coefficient, correct to two significant figures. **2**

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b) Describe the association between the mass and the length in terms of strength and direction. **2**

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c) Determine the equation of the least-squares regression line of l in terms of m. **2**

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d) Calculate the mass attached to the string if the string length is 275 mm, correct to the nearest gram. **1**

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Question 26 (5 marks)

The table below shows the present value interest factors for some monthly interest rates and loan periods in months.

Present value of $1				
Period	0.0060	0.0065	0.0070	0.0075
46	40.09350	39.64965	39.21263	38.78231
47	40.84841	40.38714	39.93310	39.48617
48	41.59882	41.11986	40.64856	40.18478
49	42.34475	41.84785	41.35905	40.87820

Gurnoor borrows $22 000 for a car. He arranges to repay the loan with monthly repayments over 4 years. He is charged 7.8% per annum interest.

a) What value will Gurnoor use from the table to calculate his monthly repayment? **1**

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b) Find Gurnoor's monthly repayment, correct to the nearest cent. **2**

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c) Calculate the amount of interest Gurnoor will pay over the term of the loan, correct to the nearest cent. **2**

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Question 27 (4 marks)

Jim is an engineer and earns a salary of $145000. He has allowable deductions of $22000. Jim must also pay a Medicare levy of 2% of his taxable income.

a) Calculate the total tax payable by Jim including the Medicare levy. Use the tax table given below. **3**

Taxable income	*Tax on this income*
0 – $18 200	Nil
$18 201 – $37 000	19c for each $1 over $18 200
$37 001 – $90 000	$3572 plus 32.5c for each $1 over $37 000
$90 001 – $180 000	$20 797 plus 37c for each $1 over $90 000
$180 001 and over	$54 097 plus 45c for each $1 over $180 000

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b) During the year, Jim paid $36000 in Pay as You Go (PAYG). Is he eligible for a refund? Justify your answer through calculations. **1**

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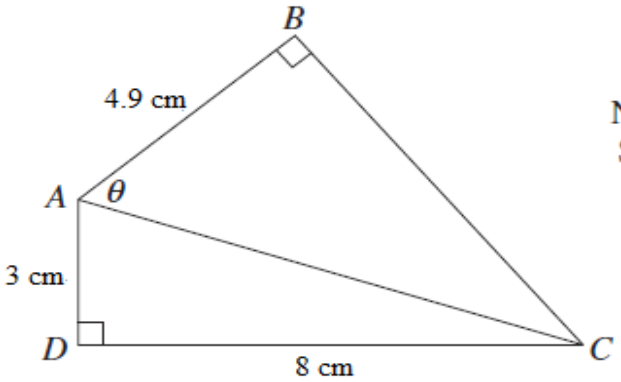
Question 28 (3 marks)

Two right-angled triangles ABC and ACD are drawn as shown.



NOT TO SCALE

a) Show that AC is approximately $8.5\ cm$, rounded to 1 decimal place. **1**

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b) Calculate the size of angle θ, correct to the nearest minute. **2**

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Question 29 (4 marks)

The prices of houses sold in Bellbird are recorded. The prices are in thousands of dollars.

210	135	147	165	190	149
198	164	184	182	178	

a) Calculate the mean of this data set, correct to one decimal place. **1**

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b) Justify using calculations, that the minimum house price is not an outlier. **3**

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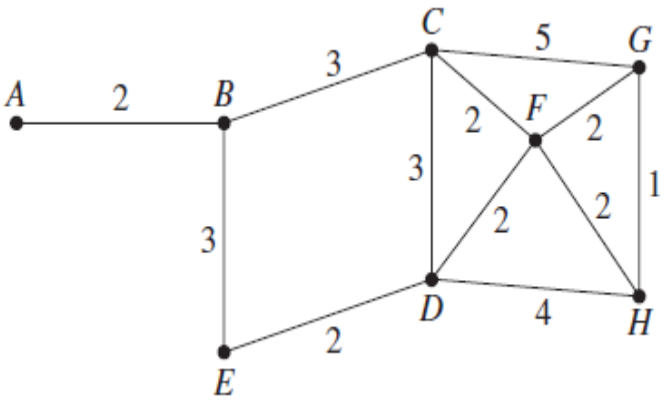
Questions 30 (4 marks)

The diagram represents a network of weighted edges.



a) List all the vertices that have a degree of 4. **1**

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b) Draw a minimum spanning tree for this network in the space below showing weighted edges. **2**

c) Calculate the length of the minimum spanning tree. **1**

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Question 31 (5 marks)

Brian lives in Auckland (UTC $+12$) and his mother lives in Peru (UTC -5).

a) What is the time difference between Auckland and Peru? **1**

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b) Brian's mother wishes to call him. It is 1 pm on Wednesday in Peru. What is the time and day that Brian will receive the call? **2**

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c) Brian's mother flies from Peru to Auckland leaving at 6 pm on Friday (Peru time). The flight takes 19 $hours$. Determine the day and time in Auckland when Brian's mother will arrive. **2**

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Question 32 (3 marks) **3**

Christian opens a new credit card account on 1st March. He uses it to buy tickets to Bali for $1050, on 5th March.
The credit card has following conditions:

- No interest free period.
- Interest is charged at 16.25% per annum, compounding daily, from the purchase date (included) to the last day of the month (included).

Christian makes no further purchases or repayments during the month of March.
Calculate the interest shown on the credit card statement issued on 31st March.

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Question 33 (3 marks)

A catering company charges \$35 per person for a buffet lunch. The cost to the company is \$120 plus \$5 per person. The equation to represent revenue is given below.

$$D = 35N$$

where D is the revenue and N is the number of people attending the lunch.

a) Write an equation to represent C, in terms of N, where C is the cost. **1**

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b) Solve the pair of simultaneous equations systematically to find the number of people required to break even. **2**

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Question 34 (2 marks)

A freestanding dishwasher has an energy consumption of 294 kWh, per year, and uses $10200\ L$ of water per year. **2**
Energy is charged at \$0.37/kWh and the cost of water supply is \$2.71/kL. What is the annual cost of using the dishwasher.

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Question 35 (5 marks)

A table of future value interest factors is shown:

Interest rate per period					
Period	1%	2%	3%	4%	5%
1	1.000	1.000	1.000	1.000	1.000
2	2.010	2.020	2.030	2.040	2.050
3	3.030	3.060	3.091	3.122	3.153
4	4.060	4.122	4.184	4.246	4.310
5	5.101	5.204	5.309	5.416	5.526
6	6.152	6.308	6.468	6.633	6.802
7	7.214	7.434	7.662	7.898	8.142
8	8.286	8.583	8.892	9.214	9.549
9	9.69	9.755	10.159	10.583	11.027
10	10.462	10.950	11.464	12.006	12.578

Samer starts an annuity that involves making equal contribution of $1250 per quarter for 2 years at an interest rate of 8% p.a.

a) Use the above table to find the future value of the annuity. **2**

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b) Calculate the total interest earned on the annuity. **1**

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c) What single amount would Samer have to invest now to achieve the same future value? **2**

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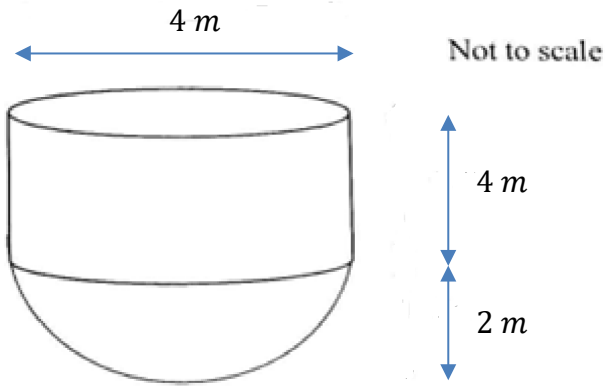
Question 36 (4 marks)

A closed container which is composed of a cylinder and hemisphere needs a coat of paint on the outside surface only.



a) If paint covers $5\ m^2\ per\ L$, determine the number of $5L$ cans of paint needed to paint the closed container with one coat. **3**

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b) Paint costs \$65 per $5L$ can. Find the cost of paint for the closed container. **1**

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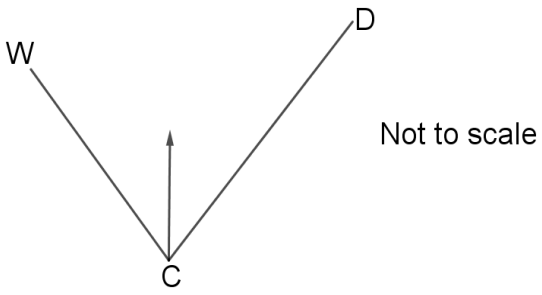
Question 37 (7 marks)

William and Darren are trying to set up a track in their school for the upcoming Athletics Carnival. They both start at the same point C.
William walks on a bearing of $320°$ for $9\ metres$ and marks the path using a marking machine. Darren walks on a bearing of $010°$ for $12\ metres$ and marks his path.



a) Calculate the size of $\angle WCD$. **1**

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b) Head Teacher Mr Brown suggests to the boys that they mark the track between them. Calculate the distance between the boys, to the nearest metre. **2**

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Question 37 continues next page

c) Use the Sine Rule to determine the angle CWD, to the nearest degree. **2**

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d) Calculate the area of the triangle WCD, correct to the nearest square metre. **2**

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End of paper

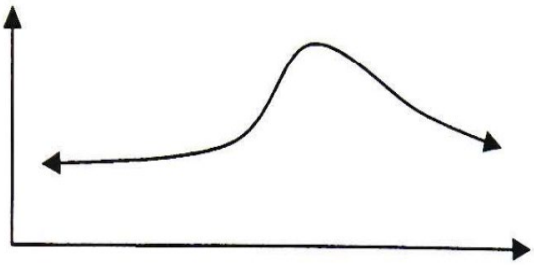
Section I

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

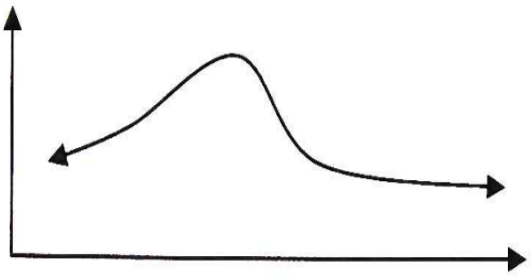
Use the multiple choice answer sheet for Questions 1–15.

1 Which of the following graphs would represent the negative skewed data?

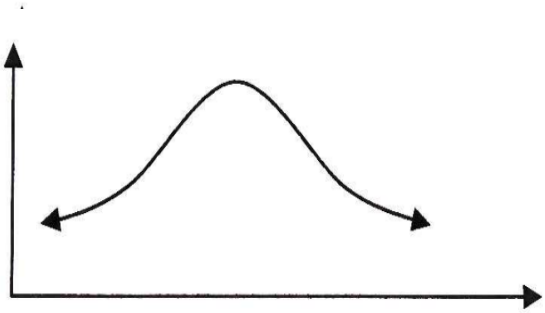
A.



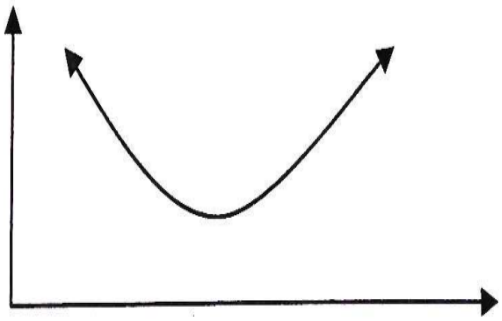
B.



C.



D.



2 Suliman and Ahmad work in Supermarket A and each earned \$800 last week. Suliman worked 4 hours more than Ahmad and was paid double-time for these hours. What is Ahmad's hourly wage if Suliman is paid an hourly wage rate of \$20 ?

A. \$15

B. \$20

C. \$25

D. \$30

3 The stem-and-leaf plot represents the daily sales of car parking tickets from a vending machine. One of the numbers, 65, was left out of data displays. Which statistical measure is most affected by the addition of this score to the data?

5	4 5 7
6	2 4 6 6
7	7 9 9
8	1

A. Mean

B. Median

C. Mode

D. Range

4 Marco invested \$40000 at a rate of 4.8% per annum compounded every 6 months. How much interest did Marco earn on his investment over 5 years?

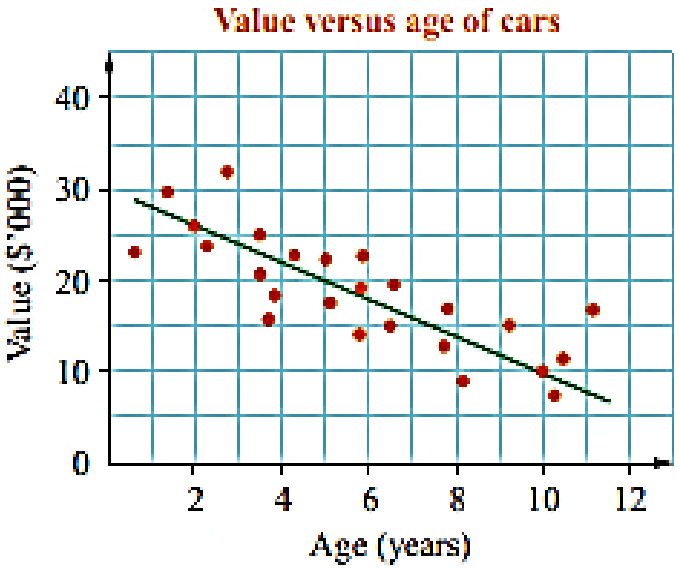
A. $\$40000(1.024)^5 - \$\,40000$

B. $\$40000(1.024)^{10} - \$\,40000$

C. $\$40000(1.048)^5 - \$\,40000$

D. $\$40000(1.048)^{10} - \$\,40000$

5 James collects data and draws a scatter plot showing the age and value for cars.
He also draws a line of best fit.
What is the likely correlation coefficient of the two variables?



A. $r = -0.95$

B. $r = -0.67$

C. $r = 0.95$

D. $r = 0.67$

6 It was found that "The greater number of hours a person spends revising his work, the higher the marks he obtains in the examination".

Which of the following types of correlations will best describe the relationship in the statement above?

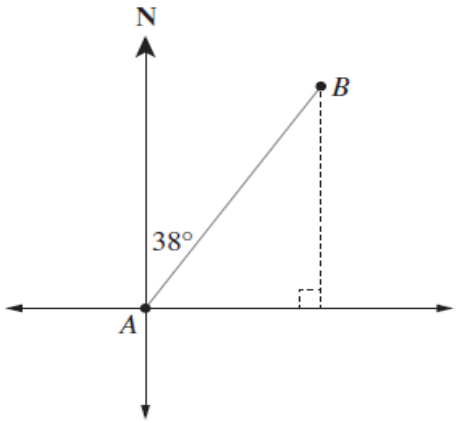
A. Zero correlation

B. Constant correlation

C. Negative correlation

D. Positive correlation

7 The compass bearing of B from A is $N38°E$.



NOT TO SCALE

What is the true bearing of A from B ?

A. 128° T

B. 218° T

C. 232° T

D 322° T

8 Marq invested \$1450 in an account which pays 12% $p.a.$ interest, compounded quarterly, on the 1st of February 2021. He added a further \$1280 to the account, on the 1st of February 2022. How much money does he have in the account on 1st February 2023?

A. \$3252.48

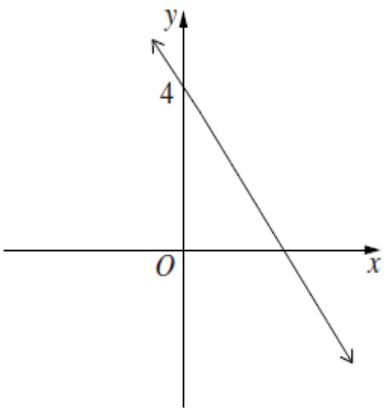
B. \$2911.99

C. \$3277.47

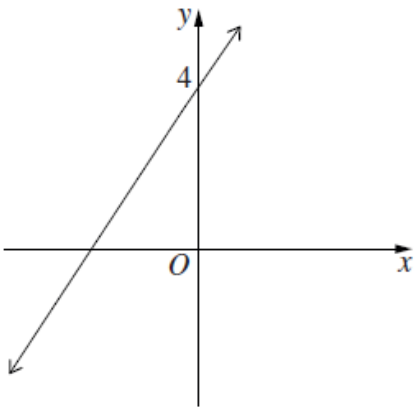
D. \$5604.25

9 Which one of the following best represents the graph of $y = -3x + 4$?

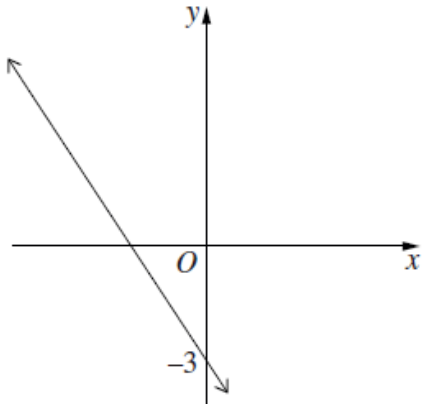
A.



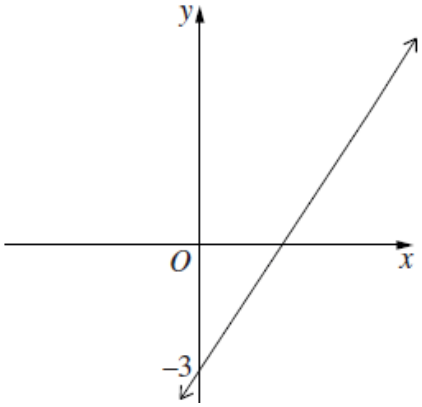
B.



C.



D.



.

10 When the equation $y = \dfrac{3 - 2w}{6}$ is transposed to make w the subject, the result is:

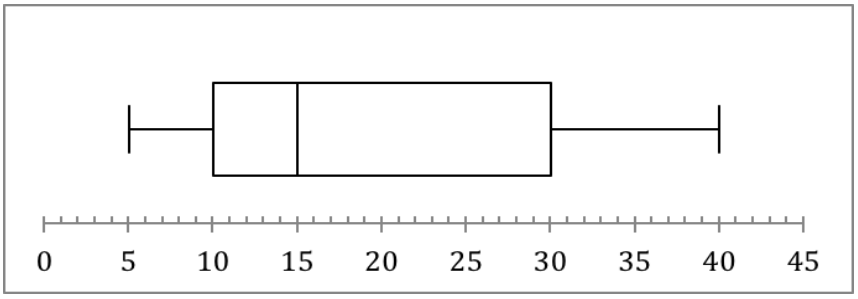
A. $w = \dfrac{6y - 3}{2}$

B. $w = \dfrac{6 - 2y}{2}$

C. $w = \dfrac{3 - 6y}{2}$

D. $w = 3 - 6y$

11 There were 140 students who completed an assessment task. The maximum mark was 40.



Which of the following statements is false?

A. 30 students scored a mark less than 10.

B. The distribution of the scores is positively skewed.

C. The median score is 15.

D. 105 students achieved a score greater than the lower quartile.

12 Which statement is correct?

A. A minimum spanning tree must contain a loop.

B. A minimum spanning tree must contain a cycle.

C. Every network has only one minimum spanning tree.

D. A minimum spanning tree has one more vertex than the number of edges.

13 The graph of $y = \frac{2}{x}$ is:

A. an exponential

B. a hyperbola

C. a parabola

D. a circle

14 Shiv invests money for three years at 2% per half year, compounded every half year.

Compound values of $1

Period	*Interest rate per period*			
	1%	2%	3%	4%
1	1.010	1.020	1.030	1.040
2	1.020	1.040	1.061	1.082
3	1.030	1.061	1.093	1.125
4	1.041	1.082	1.126	1.170
5	1.051	1.104	1.159	1.217
6	1.062	1.126	1.194	1.265

Using the table, which figure should Shiv use to calculate his investment?

A. 1.020

B. 1.061

C. 1.126

D. 1.265

15 Tom and Jack decided to remove the fence between their individual properties and join the two properties. Tom has 160 cows and Jack has 120 cows. They plan to divide the profit for the year in the same ratios as the number of cows. If they make a profit of $2800 for the year and have spend $500 on maintenance, how much does Jack get?

A. $329

B. $1314

C. $164

D. $986

End of Section I

Mathematics Standard 2

Section II Answer Booklet

85 marks
Attempt Questions 16 - 37
Allow about 2 hours and 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 (6 marks)

a) Jacob drives from Sydney to Nowra four days in a week. He travels 520 km in total. The fuel consumption of the car is 5.5 L /100 km. If fuel costs \$1.89/L , calculate the cost for that week? **2**

1 mark - some progress

$5.5 \times \frac{520}{100} = 28.6\,L$

2 mark - correct solution

$28.6 \times 1.89 = \$54.05$

b) The toll fee for a car to travel on motorway in 2023 is \$8.20. It is projected that due to inflation the cost of the toll fee will increase by 3% each year. Calculate the cost of the toll fee in 5 years' time. **2**

$A = 8.20(1+0.03)^5$ — (1)

$= \$9.5060$ — (1)

$= \$9.51$

c) Jimmy bought a new car for \$34000. The dealer told Jimmy that on the average the value of cars depreciates at 14% p.a. Based on the information, calculate the salvage value of the car after 5 years. **2**

$S = V_0(1-r)^n$

$= 34000(1-0.14)^5$ — (1)

$= \$15994.52$ — (1)

Question 17 (2 marks)

Eric is seven years old. He weighs 25.6 kg and needs to have the correct dosage of cough syrup. The dosage d is calculated using the formula **2**

$$d = \frac{mA}{70}$$

where m is the mass of the child in kilograms
A is the adult dosage
If the adult dosage is $20ml$ twice a day, how many days will a $200ml$ bottle last for?

$d = \frac{25.6 \times 20}{70} = 7.31ml$

$7.31 \times 2 = 14.628ml$ — (1)

No. of days $= \frac{200}{14.628} = 13.68$ days — (1)

Question 18 (4 marks)

Jonathan invests $38750 in an account earning 3% p.a. interest compounded annually for 4 years.

a) Calculate the total amount of interest earned. **2**

$A = 38750(1+3\%)^4 = 43613.47$ — (1)

$I = 43613.47 - 38750$

$= \$4863.47$ — (1)

b) Calculate the annual percentage rate of simple interest that would produce the same amount of interest. (Answer correct to 2 decimal places) **2**

$4863.47 = P \times r \times n$

$4863.47 = 38750 \times r \times 4$

$\frac{4863.47}{38750 \times 4} = r$ — (1)

$0.03137 = r$

$3.14\% = r$ — (1)

Question 19 (2 marks)

Solve the equation $\frac{5x-2}{4} = -2$ **2**

$5x - 2 = -8$ — (1)

$5x = -6$

$x = -\frac{6}{5}$ — (1)

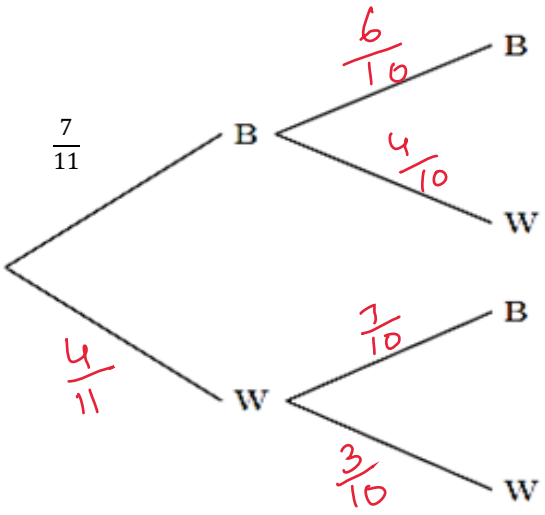
Question 20 (3 marks)

A box contains 11 chocolates. 7 chocolates contain fruits (B) and the rest of the chocolates contain nuts (W). Daniel randomly selects one of them and eats it. John then randomly chooses and eats one of the remaining chocolates. **3**

A partially completed tree diagram is shown below.

1 mark – 3 probabilities correct on the branch

2 mark – all probabilities correct

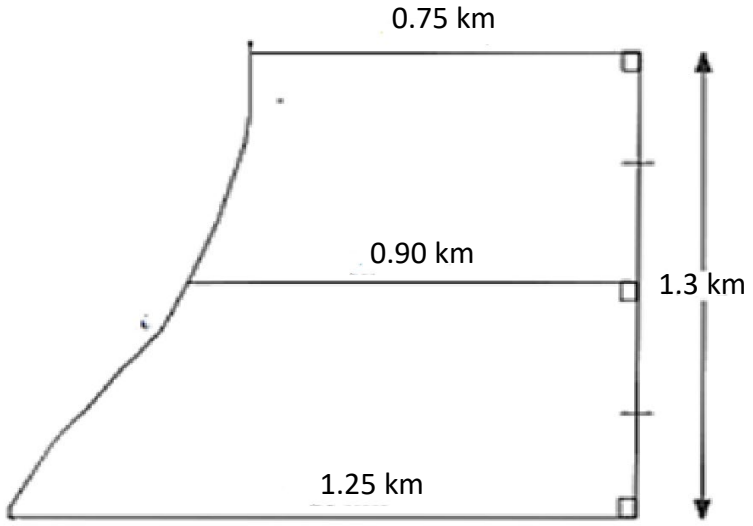


Complete the tree diagram and calculate the probability of selecting two different chocolates.

$\frac{4}{11} \times \frac{7}{10} + \frac{4}{11} \times \frac{7}{10} = \frac{56}{110} = \frac{28}{55}$ — (1)

Question 21 (3 marks)

The diagram below represents a park, which runs along a creek in a suburb of Western Sydney and has an irregular boundary line. **3**



1 mark
- correct one application of trapezoidal rule
2 mark - correct ans in km^2
3 mark - correct ans in m^2

Use two applications of the Trapezoidal rule to estimate the area of the park correct to nearest square metre.

$\frac{0.65}{2}(1.25+0.90)+\frac{0.65}{2}(0.90+0.75)$

Question 22 (2 marks)

The number of days, D, to complete a research project is inversely proportional to the number of researchers, R, who are working. The research project takes 123 days to complete when there are 7 people working on it. Find the equation relating D and R. **2**

$D \propto \frac{1}{R}$

$D = \frac{K}{R}$

$123 = \frac{K}{7}$ — (1)

$D = \frac{861}{R}$ — (1)

Question 23 (6 marks)

The internet provides a large platform which enables us to share data. On a specific app, the circulation of data grows exponentially, according to the function,

$$d = 20(1.3)^t$$

where d units is the amount of data circulated after t hours.

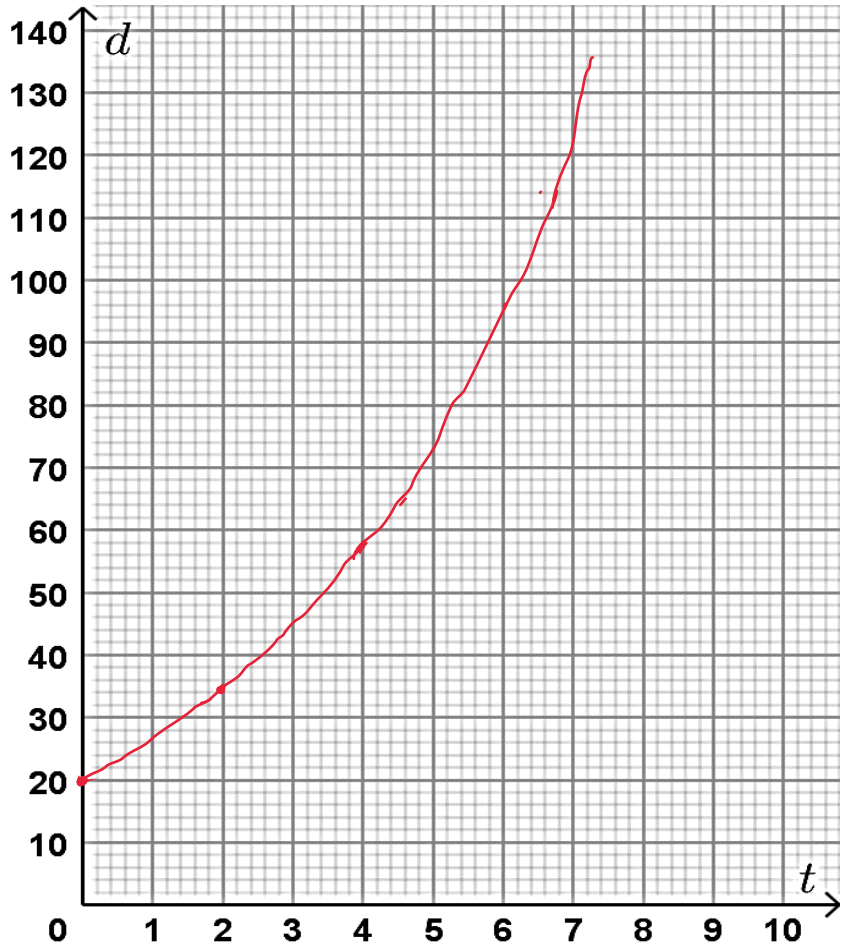
a) What is the initial amount of data? **1**

.....20.....

b) Complete the table of values, to the nearest whole number. **1**

t	0	2	4	6
d	20	34	57	97

c) Sketch the graph on the grid provided below. **2**



1 mark - 3 points plotted correctly

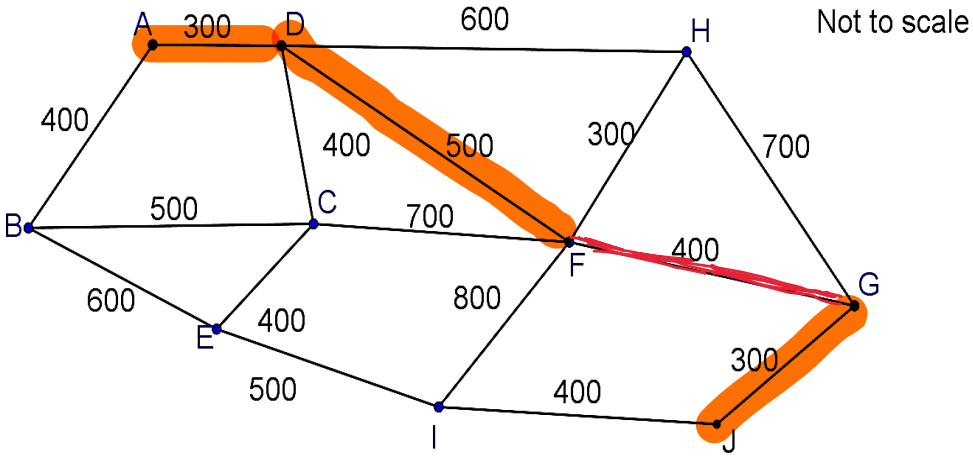
2 mark - correct graph

d) Use the graph to estimate the amount of data after 7 hours. **1**

125

Question 24 (2 marks)

Tom wanted to take his dog for a walk. He wished to walk only on the footpath. Along which path should Tom take his dog to cover the shortest distance, if he starts at *A* and finishes at *J*. **2**



300 + 500 + 400 + 300 = 1500 metres

Question 25 (7 marks)

One end of an elastic string was attached to a horizontal bar and a mass, m grams, was attached to the other end. The mass was suspended freely and allowed to settle.

The length of the elastic string, l mm, was recorded, for various masses as follows.

m	100	200	300	400	500	600
l	228	236	256	278	285	301

a) Calculate the Pearson's correlation coefficient, correct to two significant figures. **2**

0.9907593708 — (1)

0.99 — (1)

b) Describe the association between the mass and the length in terms of strength and direction. **2**

(1) strong, positive — (1)

c) Determine the equation of the least-squares regression line of l in terms of m. **2**

$y = Bx + A$ 1 mark = some progress

$y = 0.15x + 210.6$

$l = 0.15m + 210.6$ — (1)

d) Calculate the mass attached to the string if the string length is 275 mm, correct to the nearest gram. **1**

$275 = 0.15m + 210$

$m = \frac{275 - 210}{0.15} = 433.33 \text{ gm}$

Question 26 (5 marks)

The table below shows the present value interest factors for some monthly interest rates and loan periods in months.

Present value of $1				
Period	0.0060	0.0065	0.0070	0.0075
46	40.09350	39.64965	39.21263	38.78231
47	40.84841	40.38714	39.93310	39.48617
48	41.59882	41.11986	40.64856	40.18478
49	42.34475	41.84785	41.35905	40.87820

Gurnoor borrows $22 000 for a car. He arranges to repay the loan with monthly repayments over 4 years. He is charged 7.8% per annum interest.

a) What value will Gurnoor use from the table to calculate his monthly repayment? **1**

41·11986

b) Find Gurnoor's monthly repayment, correct to the nearest cent. **2**

PV = 41·11986 × PMT

22000 = PMT — (1)

41·11986

= $535·02 — (1)

c) Calculate the amount of interest Gurnoor will pay over the term of the loan, correct to the nearest cent. **2**

Total repaid = 535·02 × 48

= $25680·96 — (1)

Interest = 25680·96 − 22000

= $3680·96 — (1)

Question 27 (4 marks)

Jim is an engineer and earns a salary of $145000. He has allowable deductions of $22000. Jim must also pay a Medicare levy of 2% of his taxable income.

a) Calculate the total tax payable by Jim including the Medicare levy. Use the tax table given below. **3**

Taxable income	*Tax on this income*
0 – $18 200	Nil
$18 201 – $37 000	19c for each $1 over $18 200
$37 001 – $90 000	$3572 plus 32.5c for each $1 over $37 000
$90 001 – $180 000	$20 797 plus 37c for each $1 over $90 000
$180 001 and over	$54 097 plus 45c for each $1 over $180 000

Taxable Income = 145 000 − 22000

= $123 000 ——— (1)

20797 + 0.37(123000 − 90000) = $33007

— (1)

Medicare levy = 2% × 123000 = $2460

— (1)

Total tax payable = 33007 + 2460 = $35467

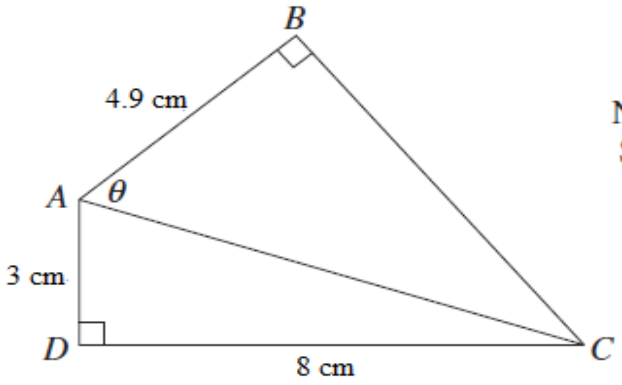
b) During the year, Jim paid $36000 in Pay as You Go (PAYG). Is he eligible for a refund? Justify your answer through calculations. **1**

36000 − 35467 = $533

Jim got a refund of $533

Question 28 (3 marks)

Two right-angled triangles ABC and ACD are drawn as shown.



NOT TO SCALE

a) Show that AC is approximately 8.5 cm, rounded to 1 decimal place. **1**

$\sqrt{64+9} = \sqrt{73} = 8.5m$

b) Calculate the size of angle θ, correct to the nearest minute. **2**

$\cos\theta = \frac{4.9}{8.5}$ — (1)

$\theta = \cos^{-1}\left(\frac{4.9}{8.5}\right) = 54^{\circ}47'50''$

$= 54^{\circ}48'$ — (1)

Question 29 (4 marks)

The prices of houses sold in Bellbird are recorded. The prices are in thousands of dollars.

210	135	147	165	190	149
198	164	184	182	178	

a) Calculate the mean of this data set, correct to one decimal place. **1**

$\frac{1902}{11} = 172.909 = 172.91$

b) Justify using calculations, that the minimum house price is not an outlier. **3**

$Q_1 = 149$

$Q_3 = 190$ $IQR = 190 - 149 = 41$ — (1)

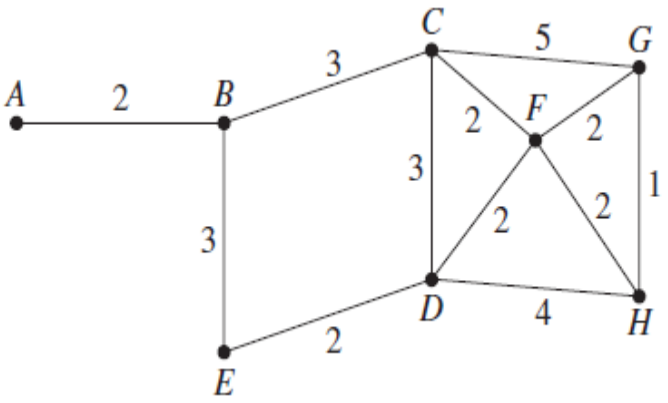
$Q_1 - 1.5 \times IQR = 149 - 1.5 \times 41$

$= 87.5$ — (1)

∴ Min. house price is not an outlier as 135 is greater than 87.5 — (1)

Questions 30 (4 marks)

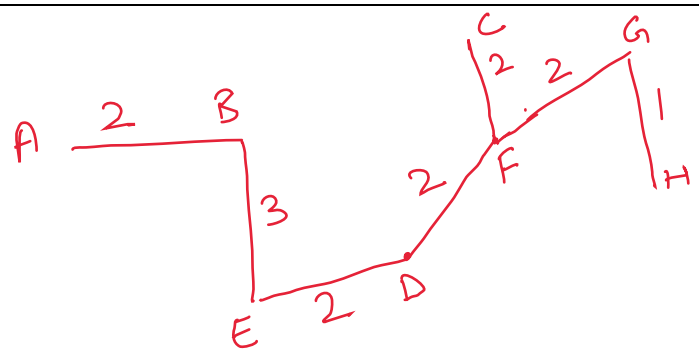
The diagram represents a network of weighted edges.



a) List all the vertices that have a degree of 4. **1**

C, F, D

b) Draw a minimum spanning tree for this network in the space below showing weighted edges. **2**



c) Calculate the length of the minimum spanning tree. **1**

14

Question 31 (5 marks)

Brian lives in Auckland (UTC +12) and his mother lives in Peru (UTC −5).

a) What is the time difference between Auckland and Peru? **1**

-5 | +12

17hrs

b) Brian's mother wishes to call him. It is 1 pm on Wednesday in Peru. What is the time and day that Brian will receive the call? **2**

1pm Wed +17hrs

6am Thursday

(1) (1)

c) Brian's mother flies from Peru to Auckland leaving at 6 pm on Friday (Peru time). The flight takes 19 *hours*. Determine the day and time in Auckland when Brian's mother will arrive. **2**

6pm Friday (Peru)

11am Saturday (Auckland)

Travel time 19hrs

11pm Saturday | +7hrs

6am Sunday Auckland

1 mark - some progress

2 mark - correct ans

Question 32 (3 marks) **3**

Christian opens a new credit card account on 1st March. He uses it to buy tickets to Bali for $1050, on 5th March.
The credit card has following conditions:

- No interest free period.
- Interest is charged at 16.25% per annum, compounding daily, from the purchase date (included) to the last day of the month (included).

Christian makes no further purchases or repayments during the month of March.
Calculate the interest shown on the credit card statement issued on 31st March.

Daily interest rate $= \frac{16.25\%}{365} = 0.000445$

1 mark either of these correct

Days = 27

$A = 1050(1 + 0.000445)^{27}$

$= 1062.689$ — (1)

$I = 1062.689 - 1050$

$= \$12.68$ — (1)

Question 33 (3 marks)

A catering company charges \$35 per person for a buffet lunch. The cost to the company is \$120 plus \$5 per person. The equation to represent revenue is given below.

$$D = 35N$$

where D is the revenue and N is the number of people attending the lunch.

a) Write an equation to represent C, in terms of N, where C is the cost. **1**

$C = 120 + 5N$

b) Solve the pair of simultaneous equations to find the number of people required to break even. **2**

$35N = 120 + 5N$ – (1)

$30N = 120$

$N = 4$ – (1)

Question 34 (2 marks)

A freestanding dishwasher has an energy consumption of 294 kWh, per year, and uses 10200 L of water per year. **2**
Energy is charged at \$ 0.37/kWh and the cost of water supply is \$2.71/kL. What is the annual cost of using the dishwasher.

– (1) mark either cost of energy or water correct

Annual cost = Energy + Water

$= 294 \times 0.37 + 2.71 \times \frac{10200}{1000}$

$= 136.422$ – (1)

Question 35 (5 marks)

A table of future value interest factors is shown:

Interest rate per period					
Period	1%	2%	3%	4%	5%
1	1.000	1.000	1.000	1.000	1.000
2	2.010	2.020	2.030	2.040	2.050
3	3.030	3.060	3.091	3.122	3.153
4	4.060	4.122	4.184	4.246	4.310
5	5.101	5.204	5.309	5.416	5.526
6	6.152	6.308	6.468	6.633	6.802
7	7.214	7.434	7.662	7.898	8.142
8	8.286	8.583	8.892	9.214	9.549
9	9.69	9.755	10.159	10.583	11.027
10	10.462	10.950	11.464	12.006	12.578

Samer starts an annuity that involves making equal contribution of $1250 per quarter for 2 years at an interest rate of 8% p.a.

a) Use the above table to find the future value of the annuity. **2**

$FV = 8.583 \times 1250$ (1)

$= 10728.75$ (1)

b) Calculate the total interest earned on the annuity. **1**

$I = F.V - \text{total contributions}$

$= 10728.75 - (1250 \times 3)$

$= \$728.75$

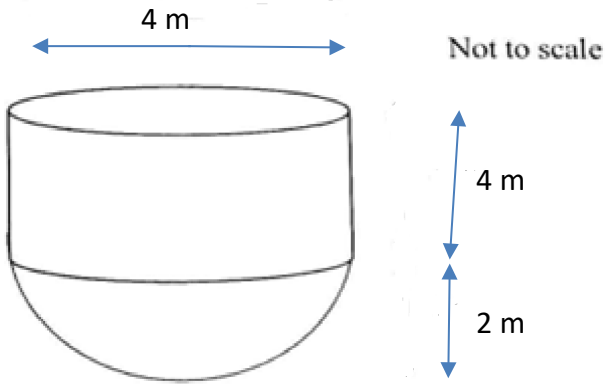
c) What single amount would Samer have to invest now to achieve the same future value? **2**

$PV = \frac{FV}{(1+r)^n}$ (1)

$= \frac{10728.75}{\left(1 + \frac{0.08}{4}\right)^8} = 9156.88$ (1)

Question 36 (4 marks)

A closed container which is composed of a cylinder and hemisphere needs a coat of paint on the outside surface only.



a) If paint covers 5 m^2 *per* L, determine the number of 5L cans of paint needed to paint the closed container with one coat. **3**

1 mark - some progress in calculating SA

S.A = $2\pi rh + \frac{1}{2} \times 4\pi r^2 + \pi r^2$

$= 2 \times \pi \times 2 \times 4 + \frac{1}{2} \times 4 \times \pi \times 2^2 + \pi \times 2^2$

$= 87.9645$

paint required $= \frac{87.9645}{5} = 17.59L$ — (1)

No. of cans $= \frac{17.59}{5} = 3.51$

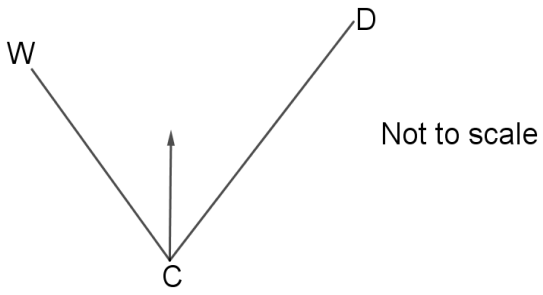
4 cans needed — (1)

b) Paint costs \$ 65 per 5 L can. Find the cost of paint for the closed container. **1**

$65 \times 4 = \$260$

Question 37 (7 marks)

William and Darren are trying to set up a track in their school for the upcoming Athletics Carnival. They both start at the same point C.
William walks on a bearing of 320° for 9 *metres* and marks the path using a marking machine. Darren walks on a bearing of 010° for 12 *metres* and marks his path.



a) Calculate the size of $\angle WCD$. **1**

$10^\circ + (360^\circ - 320^\circ)$

$= 50^\circ$

b) Head Teacher Mr Brown suggests to the boys that they mark the track between them. Calculate the distance between the boys, to the nearest metre. **2**

$WD^2 = WC^2 + CD^2 - 2 \times WC \times CD \times \cos 50^\circ$

$= 12^2 + 9^2 - 2 \times 9 \times 12 \cos 50^\circ$ → (1)

$WD = \sqrt{12^2 + 9^2 - 2 \times 9 \times 12 \cos 50^\circ}$

$= 9.282$ → (1)

$= 9\text{ m}$

Question 37 continues next page

c) Use Sine Rule to determine the angle CWD, to the nearest degree. **2**

$\frac{\sin\theta}{12} = \frac{\sin 50^\circ}{9}$

$\theta = \sin^{-1}\left(\frac{12\sin 50^\circ}{9.282}\right)$

$= 82.7$

$= 82^\circ 7'$

d) Calculate the area of the triangle WCD, correct to the nearest square metre. **2**

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

$= \frac{1}{2} \times 12 \times 9 \times \sin 50^\circ$ — (1)

$= 41.366$

$= 41\ m^2$ — (1)

End of paper