Student's Name: _____

Student Number: | | | | | | | | | |

Teacher's Name: _____

ABBOTSLEIGH

2024

HIGHER SCHOOL CERTIFICATE

Assessment 4

Trial Examination

Mathematics Standard 2

General Instructions

- Reading time – 10 minutes.
- Working time – 2 hours and 30 minutes
- Write using black pen.
- **NESA approved** calculators may be used.
- **NESA approved** reference sheet is provided.
- All necessary working should be shown in every question to gain full marks.
- Make sure your Student Number is on the front cover of each section.
- Answer the Multiple-Choice questions on the answer sheet provided.
- In Questions 16 - 39, show relevant mathematical reasoning and/or calculations.

Total marks – 100

- Attempt Sections I and II.

Section I — Pages 3 - 8

15 marks

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

Section II — Pages 9 - 36

85 marks

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

Outcomes to be assessed:

Standard 2 Mathematics:

Preliminary Outcomes:

MS11-1 uses algebraic and graphical techniques to compare alternative solutions to contextual problems

MS11-2 represents information in symbolic, graphical and tabular form

MS11-3 solves problems involving quantity measurement, including accuracy and the choice of relevant units

MS11-4 performs calculations in relation to two-dimensional and three-dimensional figures

MS11-5 models relevant financial situations using appropriate tools

MS11-6 makes predictions about everyday situations based on simple mathematical models

MS11-7 develops and carries out simple statistical processes to answer questions posed

MS11-8 solves probability problems involving multistage events

MS11-9 uses appropriate technology to investigate, organise and interpret information in a range of contexts

HSC Outcomes:

MS2-12-1 uses detailed algebraic and graphical techniques to critically evaluate and construct arguments in a range of familiar and unfamiliar contexts

MS2-12-2 analyses representations of data in order to make inferences, predictions and draw conclusions

MS2-12-3 interprets the results of measurements and calculations and makes judgements about their reasonableness, including the degree of accuracy and the conversion of units where appropriate

MS2-12-4 analyses two-dimensional and three-dimensional models to solve practical problems

MS2-12-5 makes informed decisions about financial situations, including annuities and loan repayments

MS2-12-6 solves problems by representing the relationships between changing quantities in algebraic and graphical forms

MS2-12-7 solves problems requiring statistical processes, including the use of the normal distribution and the correlation of bivariate data

MS2-12-8 solves problems using networks to model decision-making in practical problems

MS2-12-9 chooses and uses appropriate technology effectively in a range of contexts, and applies critical thinking to recognise appropriate times and methods for such use

SECTION I

15 marks

Attempt Questions 1 – 15

Use the multiple-choice answer sheet
Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.
Sample 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

(A) ○ (B) ● (C) ○ (D) ○

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

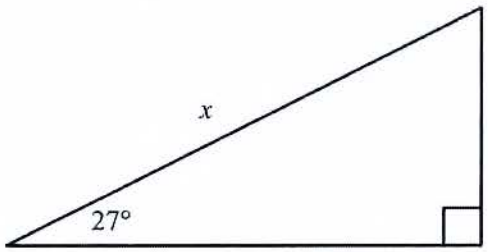
(A) ● (B) ⊗ (C) ○ (D) ○

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

correct ←

(A) ⊗ (B) ⊗ (C) ○ (D) ○

1.



NOT TO SCALE

Which expression can be used to find the length x?

A. $37\sin 27$

B. $\dfrac{37}{\sin 27}$

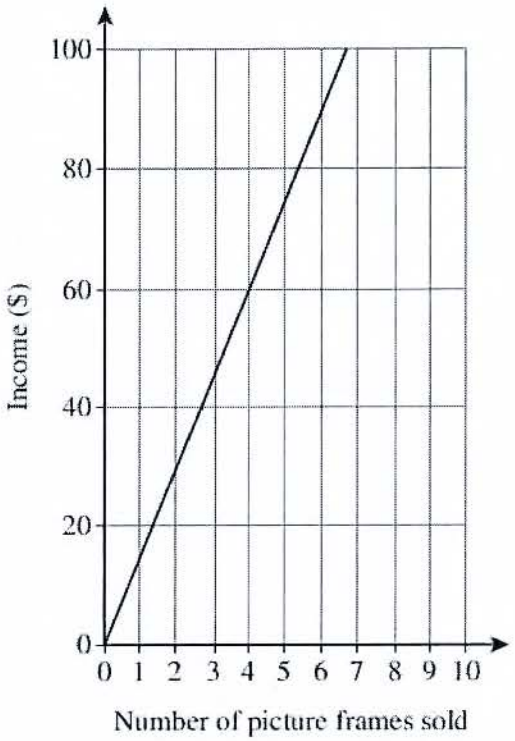
C. $37\cos 27$

D. $\dfrac{37}{\cos 27}$

2. A bank charges 0.05753% interest per day on the amount owing on a credit card.
What is the interest charged in four weeks on a balance of $1200?

A. $19.33 B. $27.61 C. $69.04 D. $276.14

3. The graph shows the income, in dollars, for a small business that makes and sells picture frames.



The cost to make the picture frames is given by the formula

$$C = 10n + 20,$$

where C is the cost and n is the number of picture frames sold.

If 6 picture frames are made and sold, which of the following statements is correct?

A. There is a profit of $10.

B. There is a loss of $10.

C. There is a profit of $90.

D. There is a loss of $80.

4. A box's weight is measured as 72.4 kg. What is the absolute error of this measurement?

A. 10 grams

B. 50 grams

C. 100 grams

D. 500 grams

5. There are four linear graphs shown on the set of axes below.

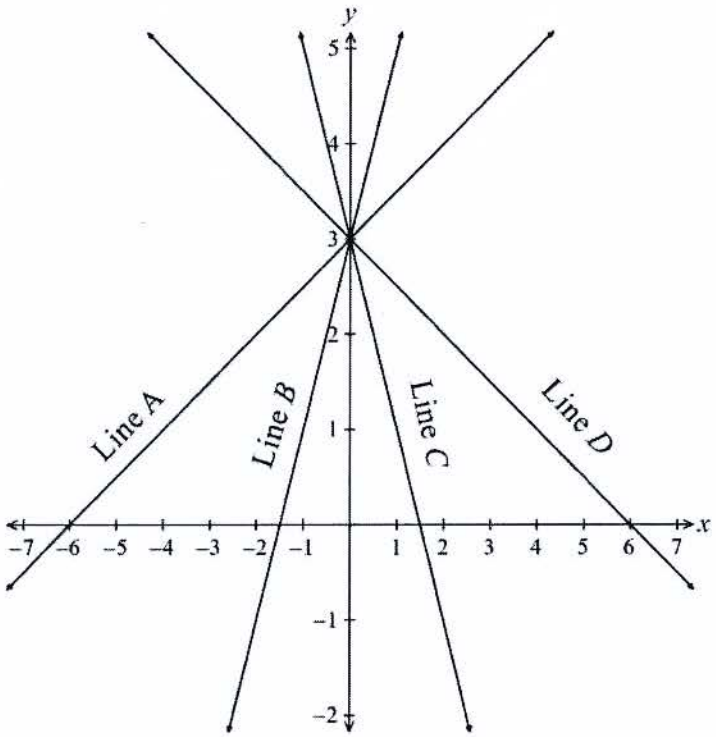
Which line has the equation $y = \frac{6-x}{2}$?

A. Line *A*

B. Line *B*

C. Line *C*

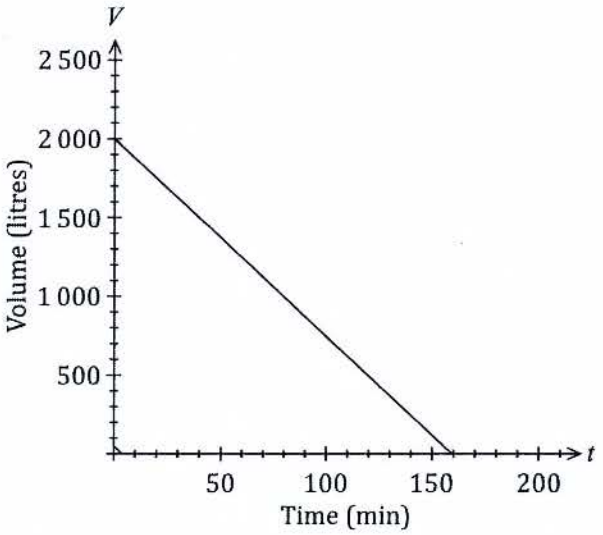
D. Line *D*



6. A full tank holds 2000 litres of water.

Water is pumped out of the tank at a constant rate.

The graph below shows how the volume of water in the tank, *V*, changes with time, *t*.



What is the constant rate at which the water is being pumped out of the tank?

A. 0.8 litres per minute

B. 2.0 litres per minute

C. 12.5 litres per minute

D. 80.0 litres per minute

7. A test had the following five number summary: {20, 55, 61, 65, 73}.

Declan, Ross, and Mia scored the results below on the test.

	Mark
Declan	69
Mia	73
Ross	30

Which of these results would be considered as outliers on the test?

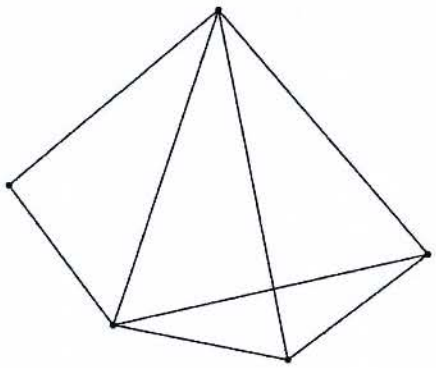
A. Only Mia's result is an outlier.

B. Only Ross's result is an outlier.

C. Mia's and Ross's results are both outliers.

D. All three results are outliers.

8.



How many edges are in the network diagram shown above ?

A. 5

B. 7

C. 8

D. 10

9. A used car was purchased for $6200. At the end of each year the declining balance method of depreciation is used to estimate the value of the car. The annual rate of depreciation is 18%. What is the approximate value of the car after 4 years ?

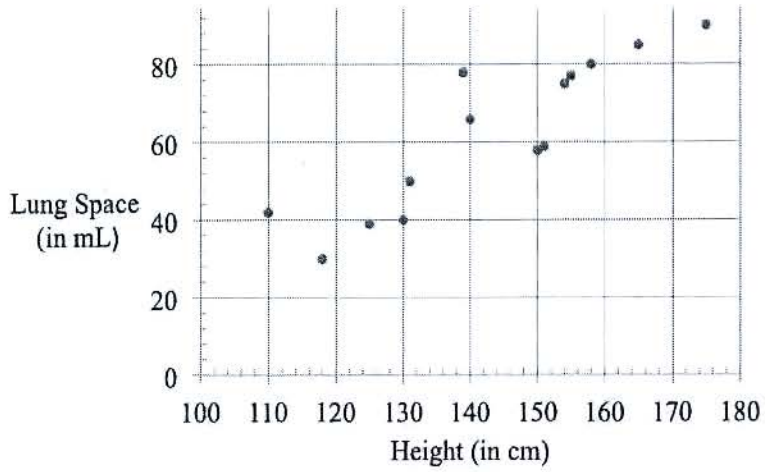
A. $1116

B. $2803

C. $3397

D. $5084

10. The data in the scatterplot below compares the heights of some children with the amount of space in their lungs.



What relationship is suggested by the data between the heights of the children and their lung space ?

A. Strong positive correlation

B. Perfect positive correlation

C. Weak negative correlation

D. No correlation

11. In a normally distributed set of scores, the mean is 72 and the standard deviation is 6. Approximately what percentage of the scores will lie between 60 and 84 ?

A. 34%

B. 68%

C. 95%

D. 99.7%

12. When Samuel stops drinking alcohol at 9:00 pm, he has a blood alcohol content (BAC) of 0.07625. The number of hours required for a person to reach zero BAC after they stop consuming alcohol is given by the formula:

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

At what time should Samuel expect his BAC to be 0.05 ?

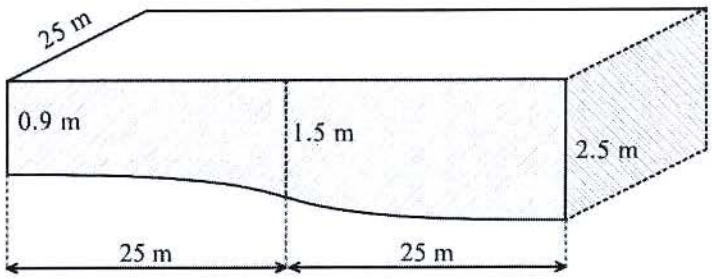
A. 2:05 am

B. 2:08 am

C. 10:35 pm

D. 10:45 pm

13. An Olympic swimming pool is 50 m long and 25 m wide and gradually increases in depth as shown in the cross section below.



NOT TO SCALE

By first using two applications of the trapezoidal rule to find the area of the cross-section, find the volume of the pool in cubic metres.

A. 2 000 m^3

B. 2 125 m^3

C. 4 000 m^3

D. 4 250 m^3

14. After the opening of a new housing estate, the population of a town increases from 12 500 to 15 500.

What is this as a percentage increase?

A. 20%

B. 22%

C. 24%

D. 25%

15. Consider the network.

The capacity of the cut shown in the network is 40.

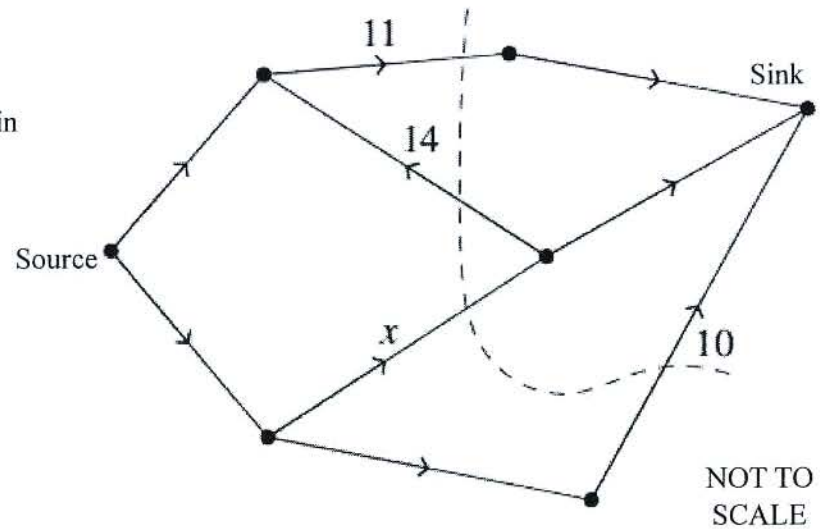
What is the value of x?

A. 5

B. 15

C. 16

D. 19



NOT TO SCALE

End of Section I

Student Number: | | | | | | | | | |

2024 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 2

Section II Answer Booklet 1

Section II

85 marks

Attempt Questions 16-39

Allow about 2 hours and 5 minutes for this section

Booklet 1: Attempt Questions 16 – 23 (28 marks)

Booklet 2: Attempt Questions 24 – 32 (29 marks)

Booklet 3: Attempt Questions 33 – 39 (28 marks)

Answer the questions in the spaces provided.

These spaces provide guidance for the expected length of response.

Your responses should include relevant mathematical reasoning and/or calculations.

Extra writing space is provided on pages 16, 24 and 34 - 36. If you use this space, clearly indicate which question you are answering.

Please Turn Over

Question 16 (2 marks)

The nutrition information for a box of cupcakes is shown.

Nutrition information	
12 servings per container	
Serving size: 58 g	
Calories per serve: 80	
Nutrients	**Daily value**
Total fat: 1g	1%
Saturated fat: 0 g	
Trans fat: 0 g	
Cholesterol: 15 mg	5%
Sodium: 150 mg	7%
Total carbohydrate: 16 g	6%
Dietary fibre: 1 g	4%
Total sugars: 6 g	
Protein: 3 g	
Calcium: 33 mg	2%
Iron: 2 mg	10%
Potassium: 31 mg	0%

If 1 calorie is equal to 4.184 joules, what is the total number of kilojoules in the box of **2**

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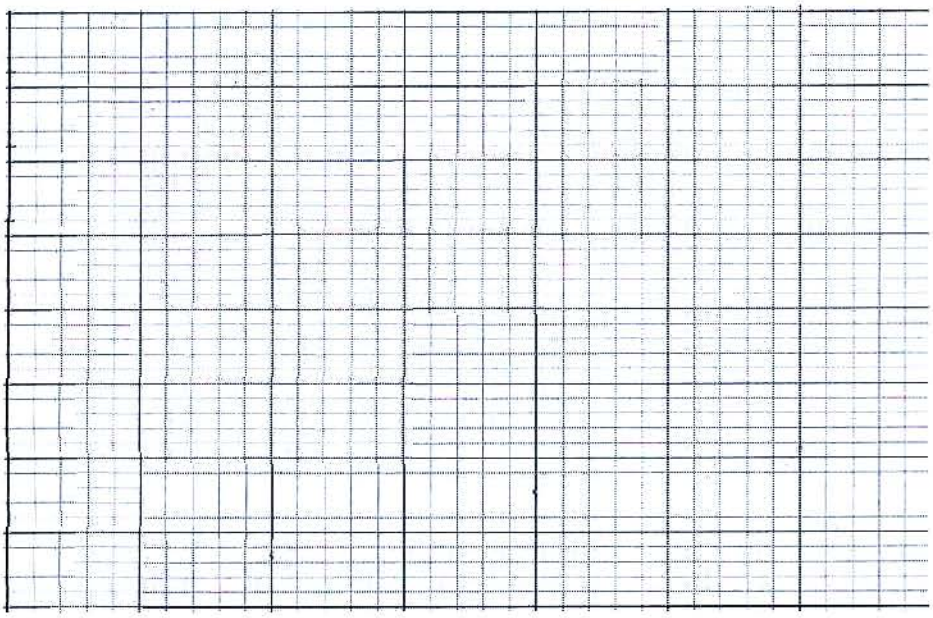
Question 17 (6 marks)

The income of a travel kit manufacturer is given by $I = 7x$ (dollars) and their costs is given by $C = 5x + 1000$ (dollars), where x represents the number of travel kits.

(a) Draw a sketch to represent the costs **and** the income for producing a travel kit. **3**



(b) How many travel kits are needed to break-even? **1**

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(c) Determine the level of production at the break-even point if the total cost increases by 5%. **2**

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Question 18 (2 marks)

A 4 kL water tank is being emptied at the rate of 5 litres per minute.
How long will it take to empty the water tank? Answer in hours and minutes. **2**

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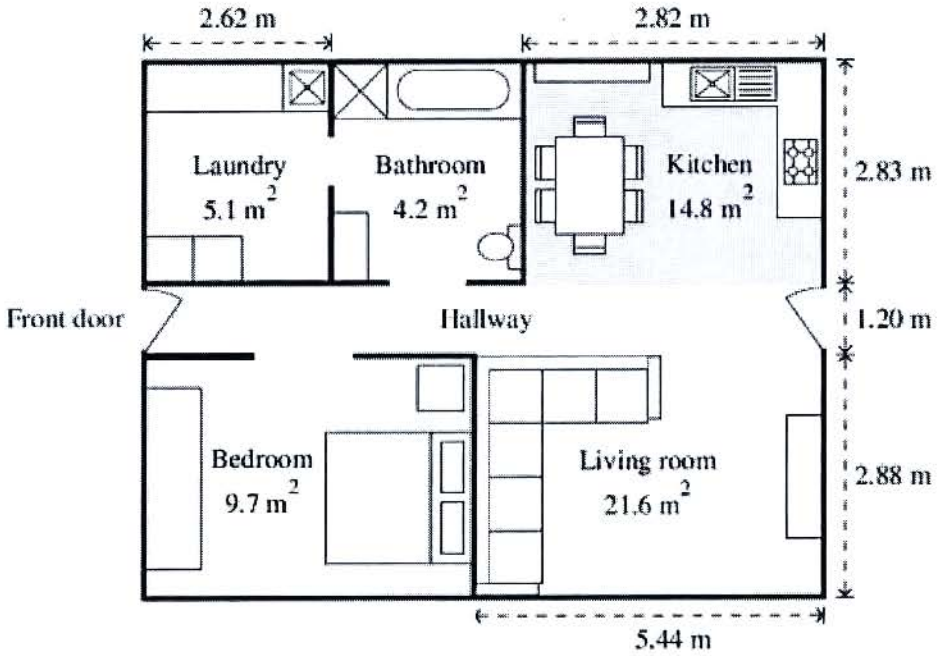
Question 19 (2 marks)

The floor plan for a house is shown.



NOT TO SCALE

(a) Lara enters the house through the front door and stands in the hallway.
Which room can she NOT see inside? **1**

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(b) Find the width of the bathroom, in metres, correct to two decimal places. **1**

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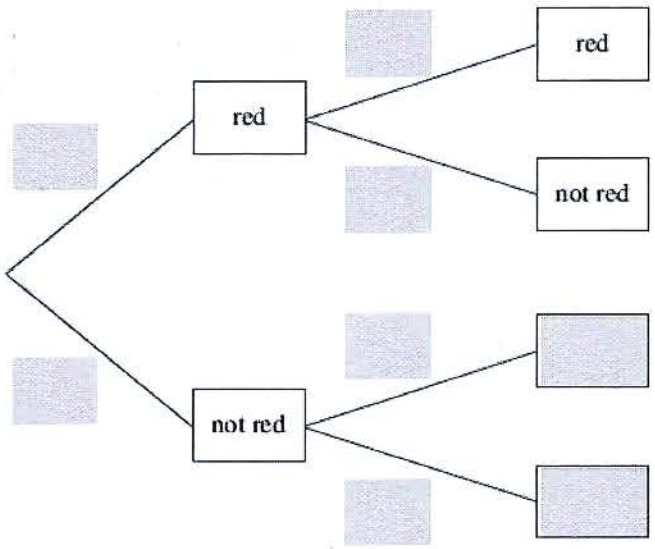
Question 20 (4 marks)

A bag contains 5 white, 8 red and 4 purple marbles. Sarah intends to take two marbles from the bag (without replacement). She firstly records the theoretical outcomes in the tree diagram, shown.



(a) Complete the missing information on the tree diagram. Include all appropriate outcomes and branch probabilities in the green spaces provided. **2**

(b) Find the probability that at least ONE of the marbles is RED. **2**

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Question 21 (2 marks)

The driving distance from Rebecca's home to her work is 18 km. She drives to and from work five times each week. Her car uses fuel at the rate of 8 L /100 km. **2**
How much fuel does she use driving to and from work each week?

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Question 22 (5 marks)

Businesses often collect data on the total amount of money spent on advertising and total revenue. The table shows information about six consecutive sales quarters for a particular business.

Sales quarter	*Money spent on advertising ($)*	*Total revenue ($)*
1	15 500	61 000
2	18 000	62 000
3	23 400	81 000
4	32 000	94 000
5	32 000	102 000
6	40 000	150 000

(a) Find the equation of the least-squares regression line by calculating the gradient and y-intercept. Give these values correct to two decimal places. **3**

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(b) The advertising manager of the business believes that the data shows a strong and positive correlation. Are they correct? **2**

Justify your answer using appropriate statistical measure(s) and mathematical reasoning.

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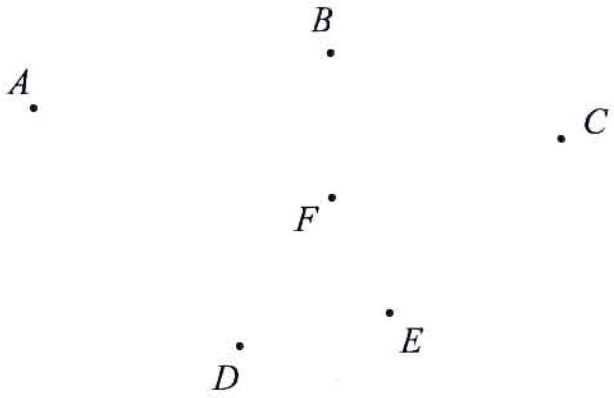
Question 23 (5 marks)

There are six accommodation buildings on a university campus, which are connected by paths. The table below shows the length of each path in metres.

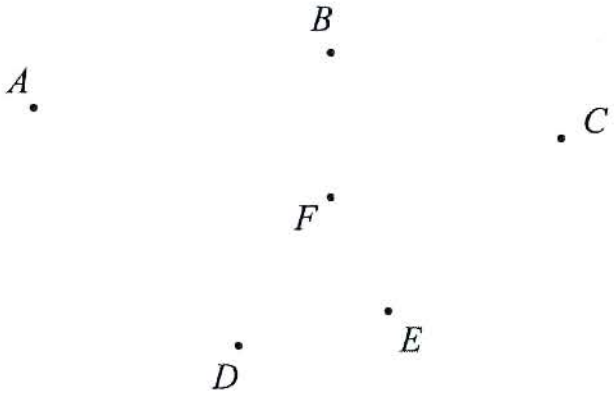
Building	Archer	Bowen	Clarke	Dyson	Everly	Field
Archer		350	-	400	-	380
Bowen	350		300	-	-	120
Clarke	-	300		-	200	220
Dyson	400	-	-		110	-
Everly	-	-	200	110		180
Field	380	120	220	-	180	

(a) Use the vertices below to draw a weighted network diagram to represent the information in the table. **2**



(b) The university wants to shelter some of the paths so that it is possible to move between all the buildings on sheltered paths, but at a minimum cost.

Draw the minimum spanning tree that accomplishes this. **2**



(c) Minimum length of sheltering required **1**

End of Booklet 1

Section II Extra writing space

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

Student Number:

2024 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 2

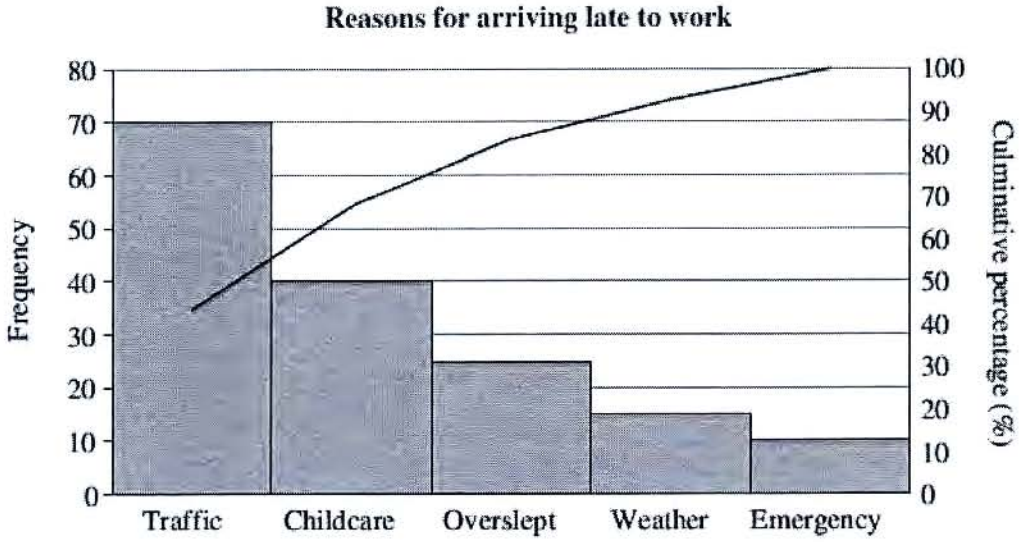
Section II Answer Booklet 2

Booklet 2: Attempt Questions 24 – 32 (29 marks)

Please Turn Over

Question 24 (1 mark)

The managers of a company are investigating the reported reasons that their employees arrive late to work. The results are shown in the Pareto chart.



Find the percentage of employees who reported arriving late to work due to weather or emergency. **1**

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Question 25 (3 marks)

A live-streamed conference is being held in Santa Barbara, California (34° N, 119° W) and the keynote address starts at 9:00 on Monday morning. **3**

Angelique is in Sydney, NSW (34° S, 151° E) and wants to watch the address live. Every 15° difference in longitude corresponds to a 1-hour difference in local time.

At what local time in Sydney should Angelique join in to watch the address?

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Question 26 (3 marks)

Andrew is driving at 80 km/h when he notices a branch on the road ahead and decides to apply the brakes. His reaction time is 1.7 seconds, and the braking distance (D metres) is given by

$$D = 0.01s^2$$

where s is speed in km/h.

Stopping distance can be calculated using the following formula:

stopping distance = {reaction time distance} + {braking distance}

What is Andrew's stopping distance, to the nearest metre? **3**

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Question 27 (3 marks)

The share price of a company is $16.25.

(a) The predicted dividend yield is 2.2%. What would be the dividend? Answer correct to the nearest cent. **1**

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(b) The company decides to pay a dividend of $0.52. What is the dividend yield? **2**

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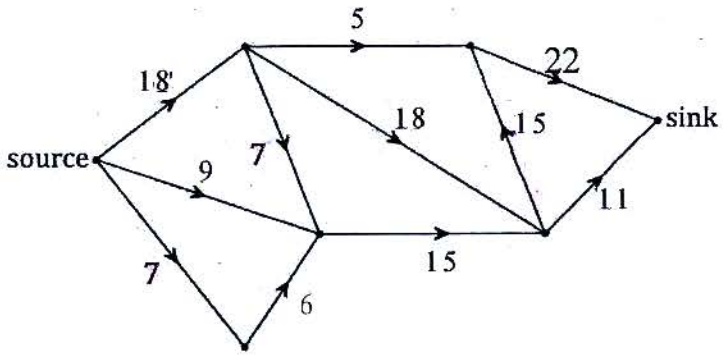
Question 28 (2 marks)

Draw the minimum cut on the network diagram below. **2**

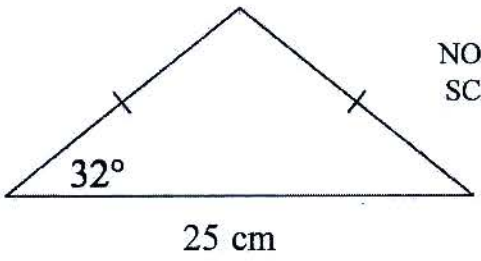
If you draw multiple cuts, indicate which one is the minimum cut and its value.



NOT TO SCALE

Question 29 (3 marks)

An isosceles triangle has a base angle of 32° and base length of 25 cm.



NOT TO SCALE

Find the length of the equal sides in the triangle. Answer correct to 1 decimal place. **3**

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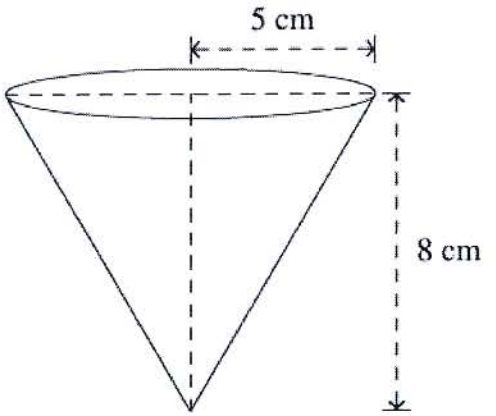
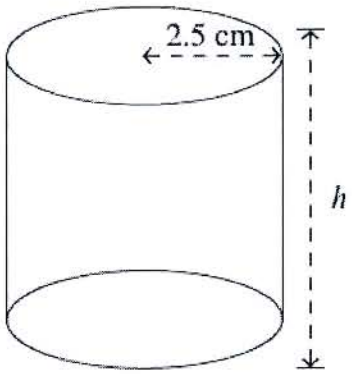
Question 30 (3 marks)

Jenny wanted to investigate the capacities of different three-dimensional objects.

She used two containers: one in the shape of a cone and one in the shape of a cylinder.

The containers and their dimensions are shown.





NOT TO SCALE

When Jenny completely filled the conical container with water and then poured the water into the cylindrical container, she found that the containers had equal volumes.

What is the height (h) of the cylindrical container, correct to two decimal places? **3**

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Question 31 (7 marks)

The time taken for train trips from Sydney to Town A is normally distributed with a mean of 54 minutes and a standard deviation of 5 minutes.

The time taken for train trips from Sydney to Town B is normally distributed with a mean of 56 minutes and a standard deviation of 8 minutes.

(a) Lucy travelled by train from Sydney to Town A in 64 minutes.

What percentage of the train trips from Sydney to Town A took longer than Lucy's trip? **2**

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(b) There were 1000 train trips from Sydney to Town B last year.

Calculate the number of train trips from Sydney to Town B that would be expected to have a time taken less than Lucy's 64 minute trip to Town A. **2**

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(c) Isaac travelled by train from Sydney to Town A and Sydney to Town B.
The time taken and the z-score was exactly the same for both trips.

By first forming an equation, calculate the time taken by train for Isaac's trip. **3**

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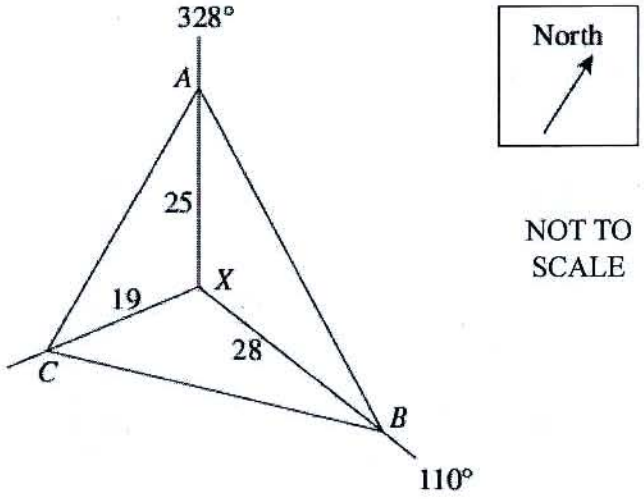
Question 32 (4 marks)

The compass radial survey shows the position of four towns: A, B, C and X.

Towns A and B lie at a true bearing of 328° and 110° degrees from town X, respectively.

All distances between the towns are given in kilometres.



(a) Find the distance between towns A and B, correct to the nearest kilometre. **2**

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(b) If the area of triangle XCB is 265 km^2, find the true bearing of town C from town X.
Give your answer correct to the nearest degree. **2**

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End of Booklet 2

Section II Extra writing space

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

Student Number:

2024 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 2

Section II Answer Booklet 3

Booklet 3: Attempt Questions 33 – 39 (28 marks)

Please Turn Over

Question 33 (2 marks)

The following table shows the fortnightly repayments required to repay a personal loan at 11.5% p.a. for terms from 2 to 5 years.

Amount borrowed	*2 years*	*3 years*	*4 years*	*5 years*
$12 000	$269	$190	$151	$127
$16 000	$358	$253	$201	$170
$20 000	$447	$316	$251	$212
$24 000	$536	$379	$301	$254
$28 000	$581	$411	$326	$275
$32 000	$670	$474	$376	$317

Audrey borrows $24 000 over 4 years. How much interest does she pay? **2**

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Question 34 (4 marks)

The table shows the seven tasks required to complete a project; the immediate predecessor(s) to each task; the earliest start time of each task in days; and the duration of some of the tasks in days.

Task	*Immediate predecessor*	*Earliest start time (days)*	*Duration (days)*
A	–	0	?
B	*A*	7	10
C	–	0	14
D	–	0	?
E	*D*	6	9
F	*B, C, E*	17	5
G	*A*	7	12

(a) Draw a network to represent the information shown in the table. **2**

(b) Identify which activities can be delayed without affecting the duration of the entire project **AND** state the maximum number of days that these activities can be delayed. **2**

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Question 35 (4 marks)

The table shows the future values of an annuity of $1.

Future values of an annuity of $1

Period (months)	*Interest rate per period*				
	1%	2%	3%	4%	5%
10	10.462	10.950	11.464	12.006	12.578
11	11.567	12.169	12.808	13.486	14.207
12	12.683	13.412	14.192	15.026	15.917
13	13.809	14.680	15.618	16.627	17.713
14	14.947	15.974	17.086	18.292	19.599
15	16.097	17.293	18.599	20.024	21.579

Luke wants to save $35 026 for a deposit to buy his first home.
He is able to save $2050 each month and plans to invest his savings in an annuity for a fixed period.

(a) Using the future value table, find the most appropriate interest rate and time period for Luke's investment. **2**

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(b) Using the interest rate and time period found in part (a), calculate the single investment Luke would need to invest now to ensure he has the necessary deposit. **2**

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Question 36 (4 marks)

The following table shows probabilities associated with normally distributed data.
The values represent the area under the normal curve to the left of the z-score.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55966	.56360	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91308	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327

The duration of human pregnancies approximates a normal distribution with a mean of 266 days and a standard deviation of 16 days. Use the table to help calculate the proportion of all pregnancies which require between 242 and 270 days (that is, roughly between 8 and 9 months). **4**

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Question 37 (3 marks)

Grace owns a credit card that has no annual fees and it charges 18.4% p.a. interest on all purchases. The interest is charged from the day of purchase, **including the day of purchase.**

(a) Show that the daily interest rate is 0.0504%. **1**

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(b) On the 29th of June, Grace bought a TV for $899 using her credit card. Grace paid her credit card account on the 10th of July. **2**

What was the total amount she paid for the TV, including interest?
Answer correct to the nearest cent.

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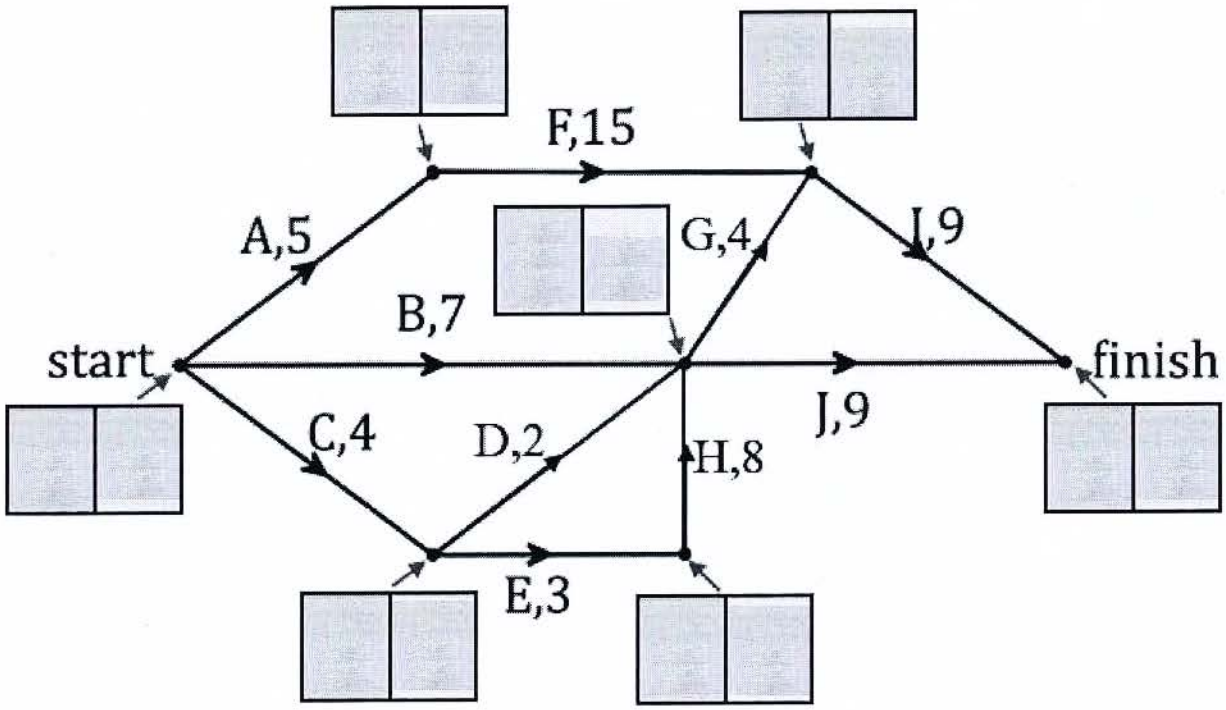
Question 38 (4 marks)

A project requires a series of ten activities to be completed and the weighted network diagram is shown below. Each number represents the number of days.



(a) Important junctions of the project are indicated by the seven red arrows in the diagram. Show their earliest- and latest-starting times in the respective yellow and blue boxes. **2**

(b) What is the critical path for this network? **1**

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(c) What is the minimum time for this project to be completed? **1**

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Question 39 (7 marks)

Elena takes out a loan of \$150 000, which has an interest rate of 6.14% per annum.
She makes regular monthly repayments of \$1000.
The table shows the details to determine her monthly balance.

n	Amount owing at start of month	interest	Monthly repayment	Balance owing
1	\$150 000	\$767.5	\$1000	\$149 767.50
2				A_2

(a) Complete the table to find the value of A_2, answering to the nearest cent. **2**

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(b) Let A_n be the value of Elena's loan after n months.
Complete the recurrence relation to model the value of this loan over time. **2**
That is, indicate both A_0 and A_{n+1} in the space below.
Where necessary, give your answers correct to three decimal places.

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$A_0 =$ _____, $A_{n+1} =$ _____ $\times A_n - 1000$

Question 39 continues over the page

Question 39 continued

(c) After the second month, Elena realises that the interest she pays is very high.
She decides to switch to a different bank, which offers an interest rate of 6% per annum.
The table shows the present value for an annuity of $1.

Period	*Interest rate per period*						
	0.5%	1%	2%	3%	4%	5%	6%
90	72.331	59.161	41.587	31.002	24.267	19.752	16.579
100	78.543	63.029	43.098	31.599	24.505	19.848	16.618
120	90.073	69.701	45.355	32.373	24.774	19.943	16.651
132	96.460	73.111	46.338	32.660	24.859	19.968	16.659
142	101.497	75.658	46.996	32.832	24.905	19.98	16.665
144	102.475	76.137	47.112	32.861	24.912	19.982	16.663
165	112.173	80.637	48.095	33.079	24.961	19.994	16.666
168	113.477	81.206	48.205	33.101	24.966	19.994	16.666
180	118.504	83.322	48.584	33.170	24.979	19.997	16.666

Using the table, calculate the total interest that Elena will pay if she repays the loan in full after 12 years. **3**

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End of Paper

Student's Name: Solutions 3

Student Number:

Teacher's Name:

ABBOTSLEIGH

2024

HIGHER SCHOOL CERTIFICATE

Assessment 4

Trial Examination

Mathematics Standard 2

General Instructions

- Reading time – 10 minutes.
- Working time – 2 hours and 30 minutes
- Write using black pen.
- **NESA approved** calculators may be used.
- **NESA approved** reference sheet is provided.
- All necessary working should be shown in every question to gain full marks.
- Make sure your Student Number is on the front cover of each section.
- Answer the Multiple-Choice questions on the answer sheet provided.
- In Questions 16 - 39, show relevant mathematical reasoning and/or calculations.

Total marks – 100

- Attempt Sections I and II.

Section I — Pages 3 - 8

15 marks

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

Section II — Pages 9 - 36

85 marks

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

Outcomes to be assessed:

Standard 2 Mathematics:

Preliminary Outcomes:

MS11-1 uses algebraic and graphical techniques to compare alternative solutions to contextual problems

MS11-2 represents information in symbolic, graphical and tabular form

MS11-3 solves problems involving quantity measurement, including accuracy and the choice of relevant units

MS11-4 performs calculations in relation to two-dimensional and three-dimensional figures

MS11-5 models relevant financial situations using appropriate tools

MS11-6 makes predictions about everyday situations based on simple mathematical models

MS11-7 develops and carries out simple statistical processes to answer questions posed

MS11-8 solves probability problems involving multistage events

MS11-9 uses appropriate technology to investigate, organise and interpret information in a range of contexts

HSC Outcomes:

MS2-12-1 uses detailed algebraic and graphical techniques to critically evaluate and construct arguments in a range of familiar and unfamiliar contexts

MS2-12-2 analyses representations of data in order to make inferences, predictions and draw conclusions

MS2-12-3 interprets the results of measurements and calculations and makes judgements about their reasonableness, including the degree of accuracy and the conversion of units where appropriate

MS2-12-4 analyses two-dimensional and three-dimensional models to solve practical problems

MS2-12-5 makes informed decisions about financial situations, including annuities and loan repayments

MS2-12-6 solves problems by representing the relationships between changing quantities in algebraic and graphical forms

MS2-12-7 solves problems requiring statistical processes, including the use of the normal distribution and the correlation of bivariate data

MS2-12-8 solves problems using networks to model decision-making in practical problems

MS2-12-9 chooses and uses appropriate technology effectively in a range of contexts, and applies critical thinking to recognise appropriate times and methods for such use

SECTION I

15 marks

Attempt Questions 1 – 15

Use the multiple-choice answer sheet
Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.
Sample 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

(A) ○ (B) ● (C) ○ (D) ○

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

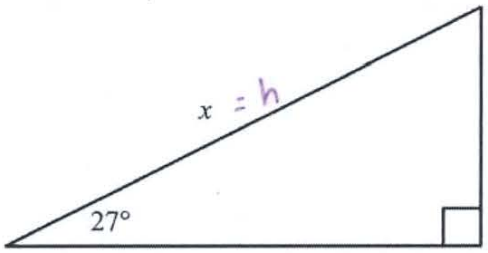
(A) ● (B) ⊗ (C) ○ (D) ○

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

correct ←

(A) ⊗ (B) ⊗ (C) ○ (D) ○

1.



NOT TO SCALE

Which expression can be used to find the length x?

$\sin 27° = \frac{37}{x}$

A. $37 \sin 27$

B. $\frac{37}{\sin 27}$

C. $37 \cos 27$

$\therefore x = \frac{37}{\sin 27°}$

D. $\frac{37}{\cos 27}$

2. A bank charges 0.05753% interest per day on the amount owing on a credit card. What is the interest charged in four weeks on a balance of \$1200?

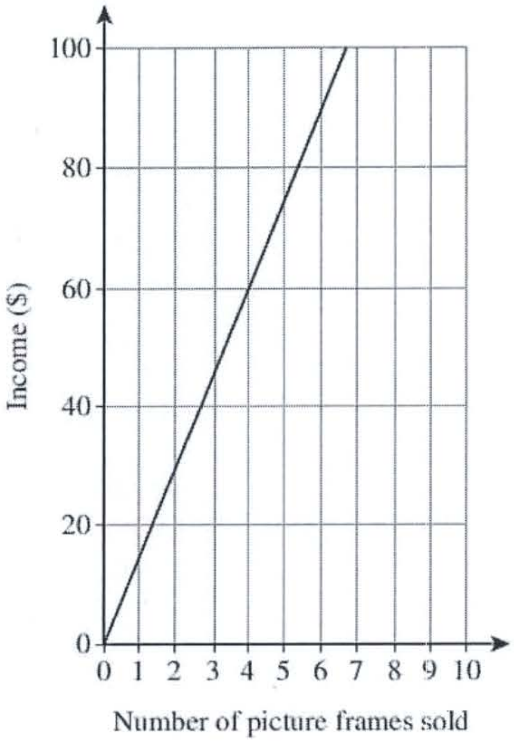
$I = Prn$

$I = 1200 \times 0.0005753 \times 28$

$= \$19.33$

A. \$19.33 B. \$27.61 C. \$69.04 D. \$276.14

3. The graph shows the income, in dollars, for a small business that makes and sells picture frames.



The cost to make the picture frames is given by the formula

$$C = 10n + 20,$$

where C is the cost and n is the number of picture frames sold.

If 6 picture frames are made and sold, which of the following statements is correct?

(A.) There is a profit of $10.

B. There is a loss of $10.

C. There is a profit of $90.

D. There is a loss of $80.

$C = 10(6) + 20 = \$80$

$R = 15n$

$= 15(6)$

$= \$90$

$\therefore$ Profit $= \$10$

4. A box's weight is measured as 72.4 kg. What is the absolute error of this measurement?

A. 10 grams

(B.) 50 grams

C. 100 grams

D. 500 grams

Precision $= \frac{1}{2} \times 0.1$ kg

$= 0.05$ kg

0.05 kg $\times 1000 = 50$ g

5. There are four linear graphs shown on the set of axes below.

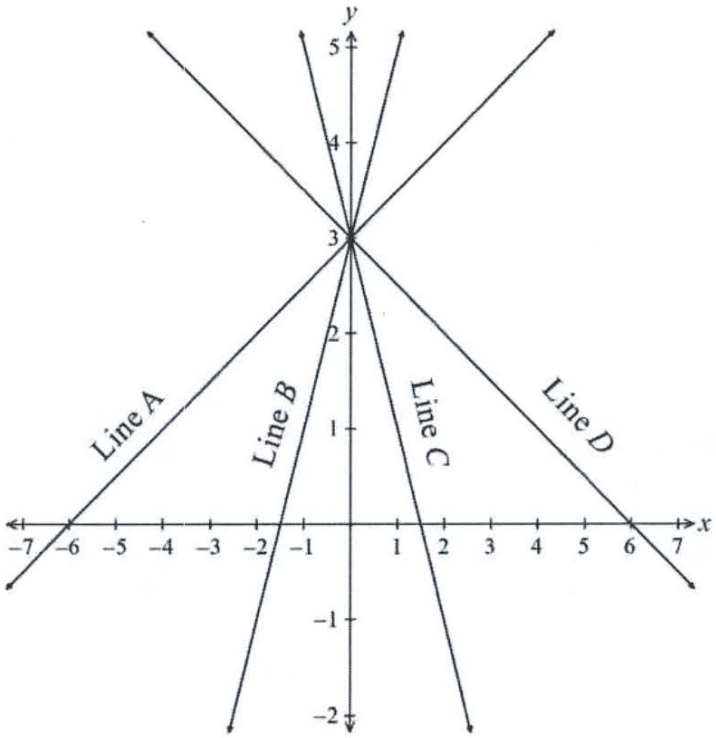
Which line has the equation $y = \frac{6-x}{2}$?

A. Line *A*

B. Line *B*

C. Line *C*

(D.) Line *D*



$y = \frac{-1}{2}x + 3$

$y = -\frac{1}{2}(6) + 3$

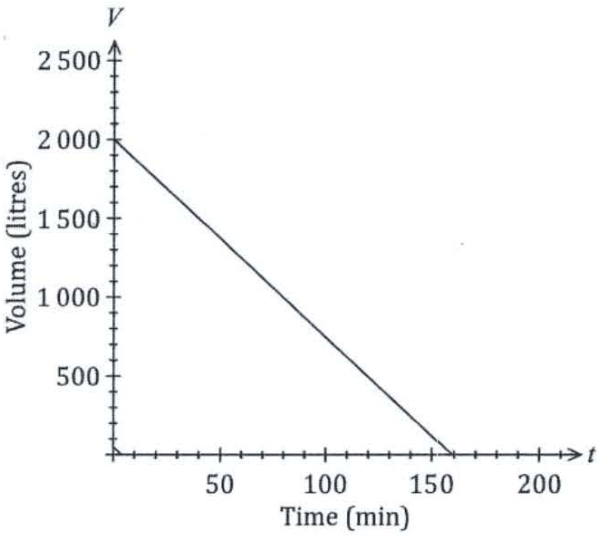
$y = 0$

$\therefore$ Line D

6. A full tank holds 2000 litres of water.

Water is pumped out of the tank at a constant rate.

The graph below shows how the volume of water in the tank, *V*, changes with time, *t*.



$\frac{2000}{160} = 12.5L$

What is the constant rate at which the water is being pumped out of the tank?

A. 0.8 litres per minute

B. 2.0 litres per minute

(C.) 12.5 litres per minute

D. 80.0 litres per minute

7. A test had the following five number summary: {20, 55, 61, 65, 73}.

Declan, Ross, and Mia scored the results below on the test.

	Mark
Declan	69
Mia	73
Ross	30

Which of these results would be considered as outliers on the test?

A. Only Mia's result is an outlier.

B. Only Ross's result is an outlier.

C. Mia's and Ross's results are both outliers.

D. All three results are outliers.

$Q_1 = 55$
$Q_3 = 65$
$IQR = 10$

Outliers

$Q_3 + 1.5 \times IQR$

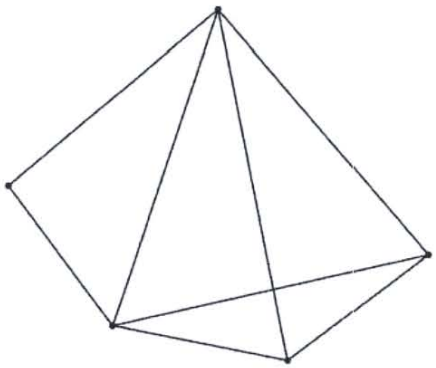
$Q_1 - 1.5 \times IQR$

$\therefore 65 + 1.5 \times 10 = 80$

$\therefore 55 - 1.5 \times 10 = 40$

$30 < 40$ so is an outlier

8.



How many edges are in the network diagram shown above ?

A. 5

B. 7

C. 8

D. 10

9. A used car was purchased for \$6200. At the end of each year the declining balance method of depreciation is used to estimate the value of the car. The annual rate of depreciation is 18%. What is the approximate value of the car after 4 years ?

A. \$1116

B. \$2803

C. \$3397

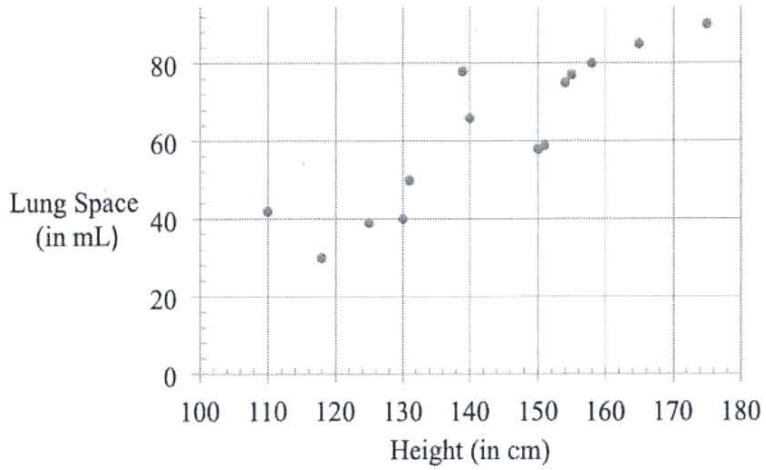
D. \$5084

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

$S = 6200 (1 - 0.18)^4$

$S = \$2803.15$

10. The data in the scatterplot below compares the heights of some children with the amount of space in their lungs.



What relationship is suggested by the data between the heights of the children and their lung space ?

A. Strong positive correlation

B. Perfect positive correlation

C. Weak negative correlation

D. No correlation

11. In a normally distributed set of scores, the mean is 72 and the standard deviation is 6. Approximately what percentage of the scores will lie between 60 and 84 ?

A. 34%

B. 68%

C. 95%

D. 99.7%

1	1	1	1	1
-2	-1	0	1	2
60	66	72	78	84

12. When Samuel stops drinking alcohol at 9:00 pm, he has a blood alcohol content (BAC) of 0.07625. The number of hours required for a person to reach zero BAC after they stop consuming alcohol is given by the formula:

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

$\frac{0.05}{0.015} : 3\frac{1}{3}$ h

At what time should Samuel expect his BAC to be 0.05 ?

A. 2:05 am

B. 2:08 am

C. 10:35 pm

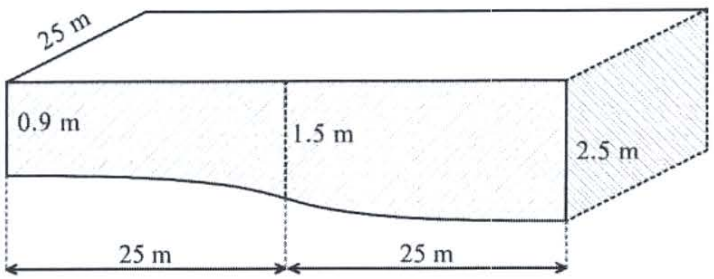
D. 10:45 pm

$\frac{0.07625}{0.015} : 5\frac{1}{12}$ h

Difference : 1 h 45

∴ 10 · 45 pm

13. An Olympic swimming pool is 50 m long and 25 m wide and gradually increases in depth as shown in the cross section below.



NOT TO SCALE

By first using two applications of the trapezoidal rule to find the area of the cross-section, find the volume of the pool in cubic metres.

$A = \frac{25}{2}(0.9 + 1.5) + \frac{25}{2}(1.5 + 2.5)$

$= 80$

$V = A \times h$

$= 80 \times 25 = 2000\ m^3$

(A.) 2 000 m^3

B. 2 125 m^3

C. 4 000 m^3

D. 4 250 m^3

14. After the opening of a new housing estate, the population of a town increases from 12 500 to 15 500.

What is this as a percentage increase?

$\%\ \text{Increase} = \frac{3000}{12500} \times 100$

$= 24\ \%$

A. 20%

B. 22%

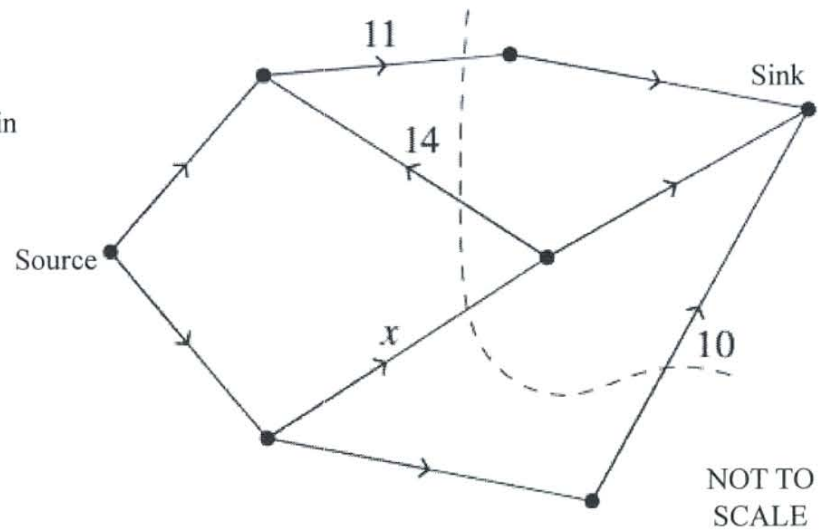
(C.) 24%

D. 25%

15. Consider the network.

The capacity of the cut shown in the network is 40.

What is the value of x?



NOT TO SCALE

A. 5

B. 15

C. 16

(D.) 19

$11 + x + 10 = 40$

$21 + x = 40$

$x = 19$

End of Section I

Student Number:

2024 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 2

Section II Answer Booklet 1

Section II

85 marks

Attempt Questions 16-39

Allow about 2 hours and 5 minutes for this section

Booklet 1: Attempt Questions 16 – 23 (28 marks)

Booklet 2: Attempt Questions 24 – 32 (29 marks)

Booklet 3: Attempt Questions 33 – 39 (28 marks)

Answer the questions in the spaces provided.

These spaces provide guidance for the expected length of response.

Your responses should include relevant mathematical reasoning and/or calculations.

Extra writing space is provided on pages 16, 24 and 34 - 36. If you use this space, clearly indicate which question you are answering.

Please Turn Over

Question 16 (2 marks)

The nutrition information for a box of cupcakes is shown.

Nutrition information	
12 servings per container	
Serving size: 58 g	
Calories per serve: 80	
Nutrients	**Daily value**
Total fat: 1g	1%
Saturated fat: 0 g	
Trans fat: 0 g	
Cholesterol: 15 mg	5%
Sodium: 150 mg	7%
Total carbohydrate: 16 g	6%
Dietary fibre: 1 g	4%
Total sugars: 6 g	
Protein: 3 g	
Calcium: 33 mg	2%
Iron: 2 mg	10%
Potassium: 31 mg	0%

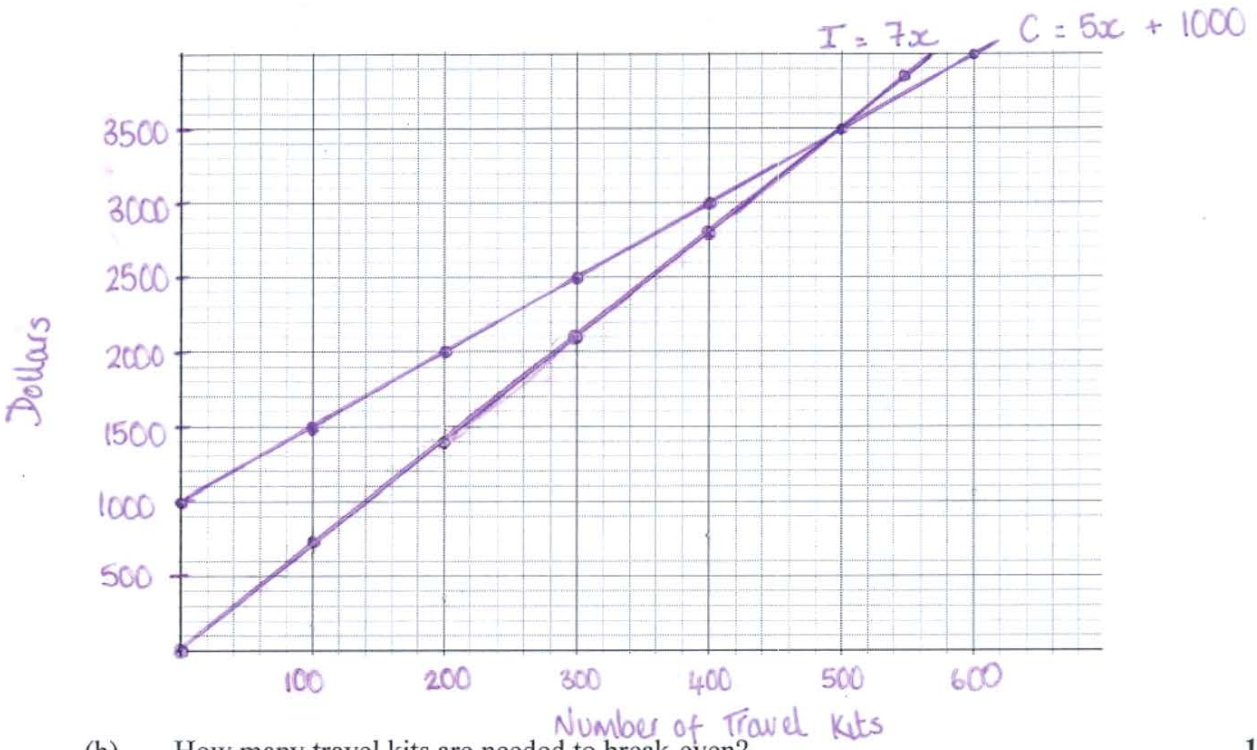
If 1 calorie is equal to 4.184 joules, what is the total number of kilojoules in the box of cupcakes? **2**

80 x 12 x 4.184 = 4016.64 kJ

Question 17 (6 marks)

The income of a travel kit manufacturer is given by $I = 7x$ (dollars) and their costs is given by $C = 5x + 1000$ (dollars), where x represents the number of travel kits.

(a) Draw a sketch to represent the costs **and** the income for producing a travel kit. **3**



(b) How many travel kits are needed to break-even? **1**

$7x = 5x + 1000$

$2x = 1000$

$x = 500$ ∴ 500 to breakeven

(c) Determine the level of production at the break-even point if the total cost increases by 5%. **2**

$C = 5.25x + 1050$

Breakeven $\Rightarrow I = C$

$\therefore 7x = 5.25x + 1050$

$1.75x = 1050$

$x = 600$ ∴ 600 travel kits would need to be sold to breakeven

Question 18 (2 marks)

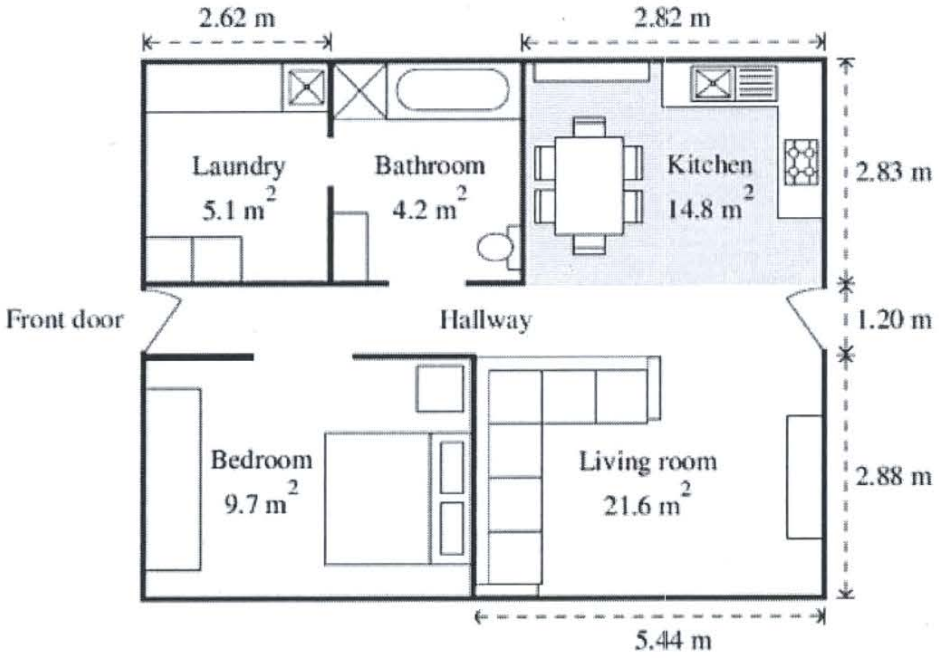
A 4 kL water tank is being emptied at the rate of 5 litres per minute.
How long will it take to empty the water tank? Answer in hours and minutes. **2**

4000L ÷ 5 = 800 minutes

800 minutes = 13 h 20 mins

Question 19 (2 marks)

The floor plan for a house is shown.



NOT TO SCALE

(a) Lara enters the house through the front door and stands in the hallway.
Which room can she NOT see inside? **1**

Laundry

(b) Find the width of the bathroom, in metres, correct to two decimal places. **1**

A = L x W

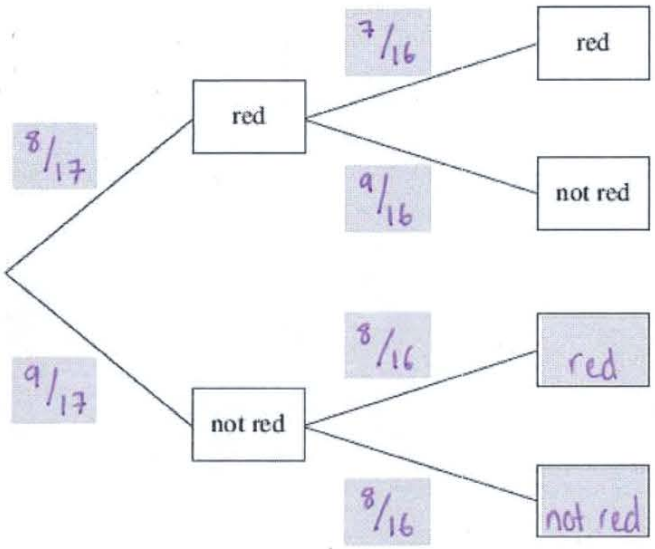
4.2 = 2.83 x W

W = 1.5 m

Question 20 (4 marks)

A bag contains 5 white, 8 red and 4 purple marbles. Sarah intends to take two marbles from the bag (without replacement). She firstly records the theoretical outcomes in the tree diagram, shown.

Total = 17



(a) Complete the missing information on the tree diagram. Include all appropriate outcomes and branch probabilities in the green spaces provided. **2**

(b) Find the probability that at least ONE of the marbles is RED. **2**

P(R & not red) + P(R & R) + P(not red & R)

$(\frac{8}{17} \times \frac{9}{16}) + (\frac{8}{17} \times \frac{7}{16}) + (\frac{9}{17} + \frac{8}{16})$

$\frac{9}{34} + \frac{7}{34} + \frac{9}{34}$

P(at least one red) = $\frac{25}{34}$

Question 21 (2 marks)

The driving distance from Rebecca's home to her work is 18 km. She drives to and from work five times each week. Her car uses fuel at the rate of 8 L /100 km. **2**
How much fuel does she use driving to and from work each week?

18 km x 2 x 5 = 180 km per week

∴ 8L x 1·8 = 14·4 L of fuel used each week

Question 22 (5 marks)

Businesses often collect data on the total amount of money spent on advertising and total revenue. The table shows information about six consecutive sales quarters for a particular business.

Sales quarter	*Money spent on advertising ($)*	*Total revenue ($)*
1	15 500	61 000
2	18 000	62 000
3	23 400	81 000
4	32 000	94 000
5	32 000	102 000
6	40 000	150 000

(a) Find the equation of the least-squares regression line by calculating the gradient and y-intercept. Give these values correct to two decimal places. **3**

$y = Bx + A$ $A = 2496.39$

$y = 3.33x + 2496.39$ $B = 3.33$

(b) The advertising manager of the business believes that the data shows a strong and positive correlation. Are they correct? **2**

Justify your answer using appropriate statistical measure(s) and mathematical reasoning.

$r = 0.9502277256$

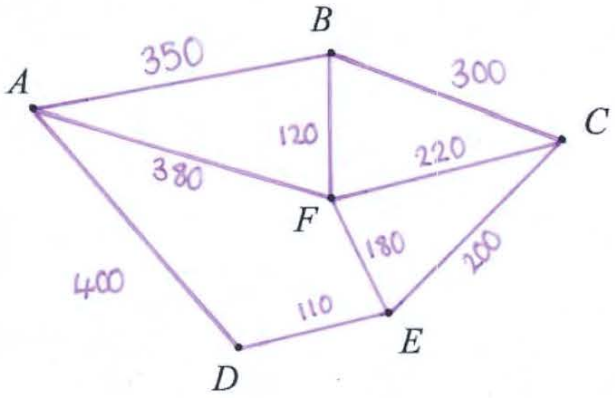
$\therefore$ The manager would be correct as the value for Pearson's correlation coefficient denotes strong, positive correlation

Question 23 (5 marks)

There are six accommodation buildings on a university campus, which are connected by paths. The table below shows the length of each path in metres.

Building	Archer	Bowen	Clarke	Dyson	Everly	Field
Archer		350	-	400	-	380
Bowen	350		300	-	-	120
Clarke	-	300		-	200	220
Dyson	400	-	-		110	-
Everly	-	-	200	110		180
Field	380	120	220	-	180	

(a) Use the vertices below to draw a weighted network diagram to represent the information in the table. **2**

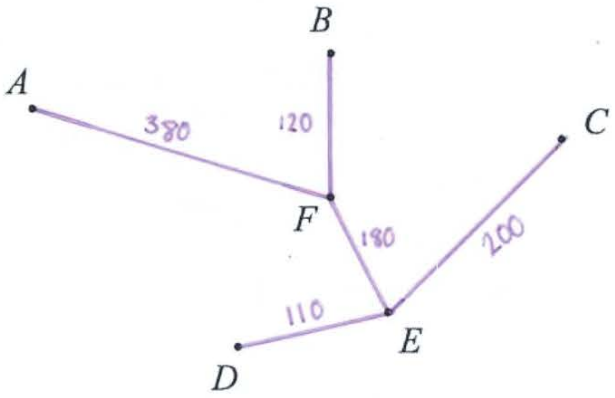


(b) The university wants to shelter some of the paths so that it is possible to move between all the buildings on sheltered paths, but at a minimum cost.

Draw the minimum spanning tree that accomplishes this. **2**

6 vertices

5 edges



(c) Minimum length of sheltering required ....110 + 120 + 180 + 200 + 380.... **1**

990 m

End of Booklet 1

Section II Extra writing space

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

Student Number:

2024 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 2

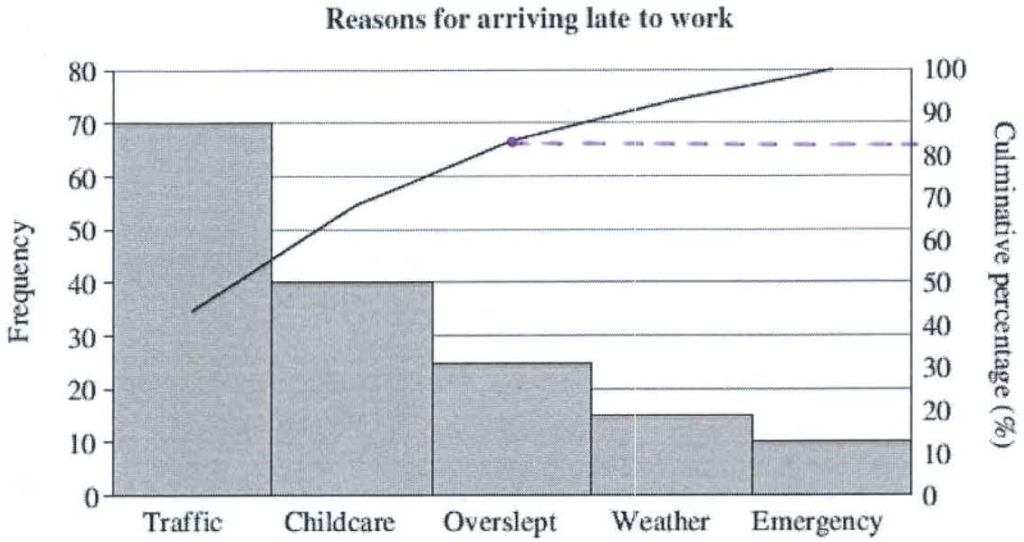
Section II Answer Booklet 2

Booklet 2: Attempt Questions 24 – 32 (29 marks)

Please Turn Over

Question 24 (1 mark)

The managers of a company are investigating the reported reasons that their employees arrive late to work. The results are shown in the Pareto chart.



Find the percentage of employees who reported arriving late to work due to weather or emergency. **1**

Approximately 15 % (accept 13 - 15 %)

Question 25 (3 marks)

A live-streamed conference is being held in Santa Barbara, California (34° N, 119° W) and the keynote address starts at 9:00 on Monday morning. **3**

Angelique is in Sydney, NSW (34° S, 151° E) and wants to watch the address live. Every 15° difference in longitude corresponds to a 1-hour difference in local time.

At what local time in Sydney should Angelique join in to watch the address?

119° W → 151° E = 270° difference

270° ÷ 15° = 18 hours

9am Monday + 18 hours = 2am Tuesday in Sydney

Question 26 (3 marks)

Andrew is driving at 80 km/h when he notices a branch on the road ahead and decides to apply the brakes. His reaction time is 1.7 seconds, and the braking distance (D metres) is given by

$$D = 0.01s^2$$

where s is speed in km/h.

Stopping distance can be calculated using the following formula:

stopping distance = {reaction time distance} + {braking distance}

What is Andrew's stopping distance, to the nearest metre? **3**

Braking distance $= 0.01(80)^2$

$= 64$ m

Reaction time → 80 km = 3600 seconds

22.22 m = 1 second

38 m = 1.7 seconds

Stopping distance = 64 + 38 = 102 m

Question 27 (3 marks)

The share price of a company is \$16.25.

(a) The predicted dividend yield is 2.2%. What would be the dividend? Answer correct to the nearest cent. **1**

\$16.25 × 2.2% = \$0.3575

≈ \$0.36

(b) The company decides to pay a dividend of \$0.52. What is the dividend yield? **2**

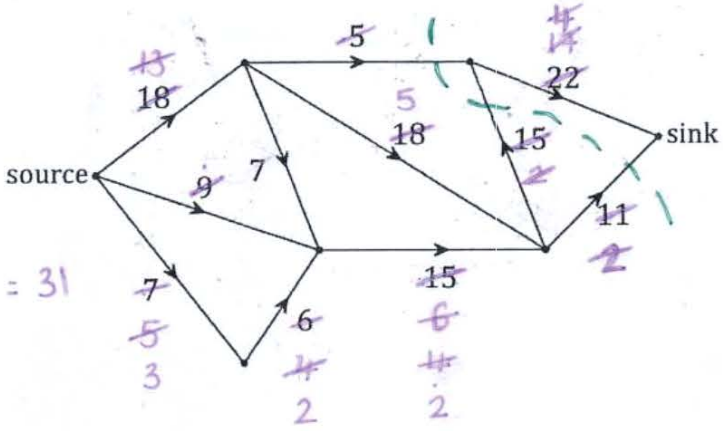
$\frac{0.52}{16.25} \times 100 = 3.2\%$

Question 28 (2 marks)

Draw the minimum cut on the network diagram below. **2**

If you draw multiple cuts, indicate which one is the minimum cut and its value.

Max flow = Min cut

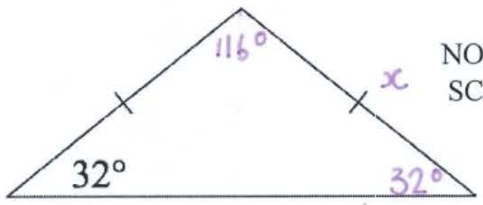


NOT TO SCALE

5 + 9 + 13 + 2 + 2 = 31

Question 29 (3 marks)

An isosceles triangle has a base angle of 32° and base length of 25 cm.



NOT TO SCALE

25 cm

Find the length of the equal sides in the triangle. Answer correct to 1 decimal place. **3**

$\frac{x}{\sin 32^\circ} = \frac{25}{\sin 116^\circ}$

$x = \frac{25 \times \sin 32^\circ}{\sin 116^\circ}$

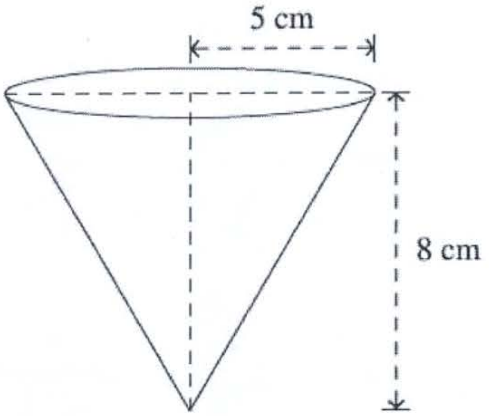
$x = 14.7$ cm (to 1 dp)

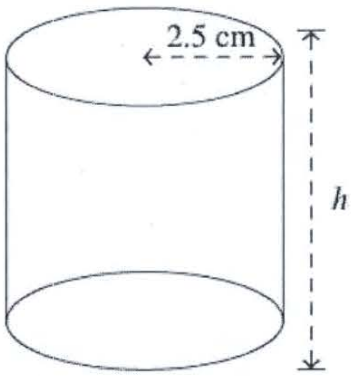
Question 30 (3 marks)

Jenny wanted to investigate the capacities of different three-dimensional objects.

She used two containers: one in the shape of a cone and one in the shape of a cylinder.

The containers and their dimensions are shown.





NOT TO SCALE

When Jenny completely filled the conical container with water and then poured the water into the cylindrical container, she found that the containers had equal volumes.

What is the height (h) of the cylindrical container, correct to two decimal places? **3**

V of cone = $\frac{1}{3}\pi r^2 h$

V of cylinder = $\pi r^2 h$

$\therefore \frac{1}{3}\pi r^2 h = \pi r^2 h$

$\frac{1}{3}\pi(5)^2(8) = \pi(2.5)^2 h$

$\frac{200\pi}{3} = 6.25\pi h$

$200\pi = 18.75\pi h$

$\therefore h = 10.66\dot{6}$

$h = 10.67$ cm

Town A | Town B

39	44	49	54	59	64	69	32	40	48	56	64	72	80
-3	-2	-1	0	1	2	3	-3	-2	-1	0	1	2	3

Question 31 (7 marks)

The time taken for train trips from Sydney to Town A is normally distributed with a mean of 54 minutes and a standard deviation of 5 minutes.

The time taken for train trips from Sydney to Town B is normally distributed with a mean of 56 minutes and a standard deviation of 8 minutes.

(a) Lucy travelled by train from Sydney to Town A in 64 minutes.

What percentage of the train trips from Sydney to Town A took longer than Lucy's trip? **2**

100 % - 50 % - 34 % = 16 %

(b) There were 1000 train trips from Sydney to Town B last year.

Calculate the number of train trips from Sydney to Town B that would be expected to have a time taken less than Lucy's 64 minute trip to Town A. **2**

Less than 64 minutes → Less than 1 SD

∴ 66 % less than 64 minutes

1000 x 66 % = 660 trips

(c) Isaac travelled by train from Sydney to Town A and Sydney to Town B.
The time taken and the z-score was exactly the same for both trips.

By first forming an equation, calculate the time taken by train for Isaac's trip. **3**

$$\frac{x - 54}{5} = \frac{x - 56}{8}$$

$$8x - 432 = 5x - 280$$

$$3x = 152$$

$$x = 50 \cdot 66$$

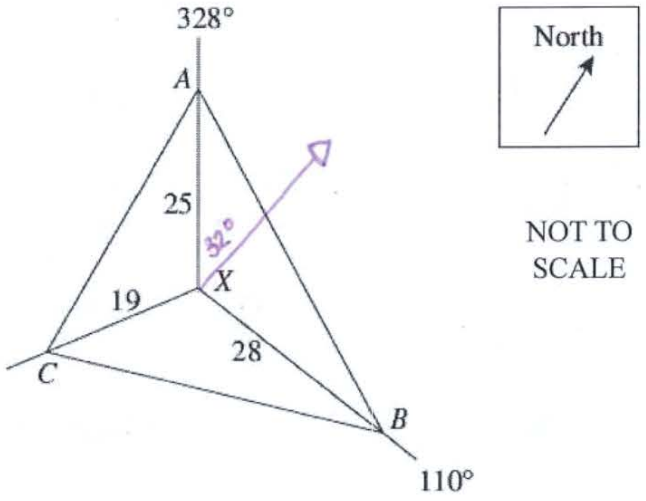
≈ 50 minutes (or 51 minutes)

Question 32 (4 marks)

The compass radial survey shows the position of four towns: A, B, C and X.

Towns A and B lie at a true bearing of 328° and 110° degrees from town X, respectively.

All distances between the towns are given in kilometres.



(a) Find the distance between towns A and B, correct to the nearest kilometre. **2**

$AB^2 = 25^2 + 28^2 - 2(25)(28)\cos(142^\circ)$

$AB^2 = 2512.215055$

$AB = 50.12200171$

≈ 50 km

(b) If the area of triangle XCB is 265 km^2, find the true bearing of town C from town X. Give your answer correct to the nearest degree. **2**

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

$265 = \frac{1}{2} \times 19 \times 28 \times \sin C$

$C = 85^\circ$

$\therefore$ True bearing $= 85^\circ + 110^\circ = 195^\circ$

End of Booklet 2

Section II Extra writing space

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

Student Number: | | | | | | | | | |

2024 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 2

Section II Answer Booklet 3

Booklet 3: Attempt Questions 33 – 39 (28 marks)

Please Turn Over

Question 33 (2 marks)

The following table shows the fortnightly repayments required to repay a personal loan at 11.5% p.a. for terms from 2 to 5 years.

Amount borrowed	*2 years*	*3 years*	*4 years*	*5 years*
$12 000	$269	$190	$151	$127
$16 000	$358	$253	$201	$170
$20 000	$447	$316	$251	$212
$24 000	$536	$379	$301	$254
$28 000	$581	$411	$326	$275
$32 000	$670	$474	$376	$317

Audrey borrows $24 000 over 4 years. How much interest does she pay? **2**

Repaid = $301 × 26 × 4

= $31304

Interest = $31304 − $24000

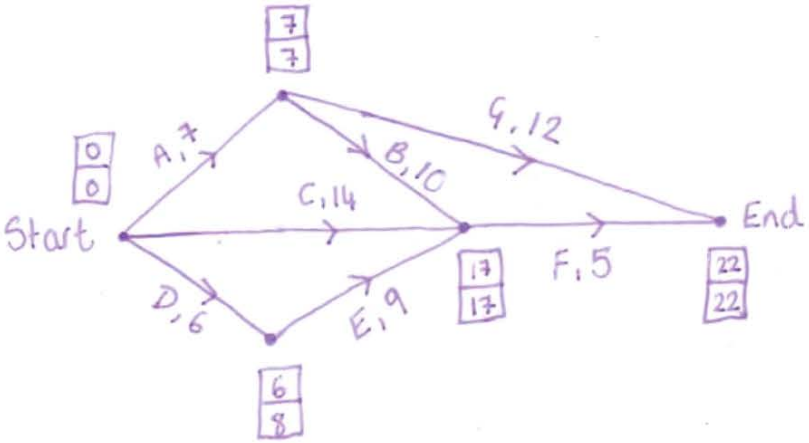
= $7304

Question 34 (4 marks)

The table shows the seven tasks required to complete a project; the immediate predecessor(s) to each task; the earliest start time of each task in days; and the duration of some of the tasks in days.

Task	*Immediate predecessor*	*Earliest start time (days)*	*Duration (days)*
A	–	0	?
B	*A*	7	10
C	–	0	14
D	–	0	?
E	*D*	6	9
F	*B, C, E*	17	5
G	*A*	7	12

(a) Draw a network to represent the information shown in the table. **2**



Float time:

LST (end) - EST (start) - activity time

(b) Identify which activities can be delayed without affecting the duration of the entire project **AND** state the maximum number of days that these activities can be delayed. **2**

Critical Path = ABF

∴ Activity C can be delayed by 3 days

Activity D can be delayed by 2 days

Activity E can be delayed by 2 days

Activity G can be delayed by 3 days

Question 35 (4 marks)

The table shows the future values of an annuity of $1.

Future values of an annuity of $1

Period (months)	*Interest rate per period*				
	1%	2%	3%	4%	5%
10	10.462	10.950	11.464	12.006	12.578
11	11.567	12.169	12.808	13.486	14.207
12	12.683	13.412	14.192	15.026	15.917
13	13.809	14.680	15.618	16.627	17.713
14	14.947	15.974	17.086	18.292	19.599
15	16.097	17.293	18.599	20.024	21.579

Luke wants to save $35 026 for a deposit to buy his first home.
He is able to save $2050 each month and plans to invest his savings in an annuity for a fixed period.

(a) Using the future value table, find the most appropriate interest rate and time period for Luke's investment. **2**

$35026 = $2050 x

$\therefore x = 17.085\,85366$

$\therefore$ Interest rate = 3%

Time period = 14 (months)

(b) Using the interest rate and time period found in part (a), calculate the single investment Luke would need to invest now to ensure he has the necessary deposit. **2**

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

$35026 = PV\left(1+\frac{0.03}{12}\right)^{14}$

$PV = \frac{35026}{\left(1+\frac{0.03}{12}\right)^{14}}$

$PV = \$33822.77$

0·216595 | 0·09871

Question 36 (4 marks)

−1·5 (242) | 0 (266) | 0·25 (270)

The following table shows probabilities associated with normally distributed data.
The values represent the area under the normal curve to the left of the *z*-score.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55966	.56360	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91308	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327

The duration of human pregnancies approximates a normal distribution with a mean of 266 days and a standard deviation of 16 days. Use the table to help calculate the proportion of all pregnancies which require between 242 and 270 days (that is, roughly between 8 and 9 months). **4**

$z = \frac{242 - 266}{16} = -1.5 \rightarrow 0.93319$

$z = \frac{270 - 266}{16} = 0.25 \rightarrow 0.59871$

$P = 0.216595 + 0.09871 = 0.315305$

$0 \rightarrow 1.5 = 0.93319 - 0.5 = 0.43319$

$\therefore -1.5 = 0.216595$

$0 \rightarrow 0.25 = 0.59871 - 0.5 = 0.09871$

Question 37 (3 marks)

Grace owns a credit card that has no annual fees and it charges 18.4% p.a. interest on all purchases. The interest is charged from the day of purchase, **including the day of purchase.**

(a) Show that the daily interest rate is 0.0504%. **1**

$18.4\% \div 365 = 0.0504109589$

$\approx 0.0504\%$ (to 4 dp)

(b) On the 29th of June, Grace bought a TV for \$899 using her credit card. Grace paid her credit card account on the 10th of July. **2**

What was the total amount she paid for the TV, including interest?
Answer correct to the nearest cent.

Days = 12 days

$I = Prn$

$= 899 \times 0.000504 \times 12$

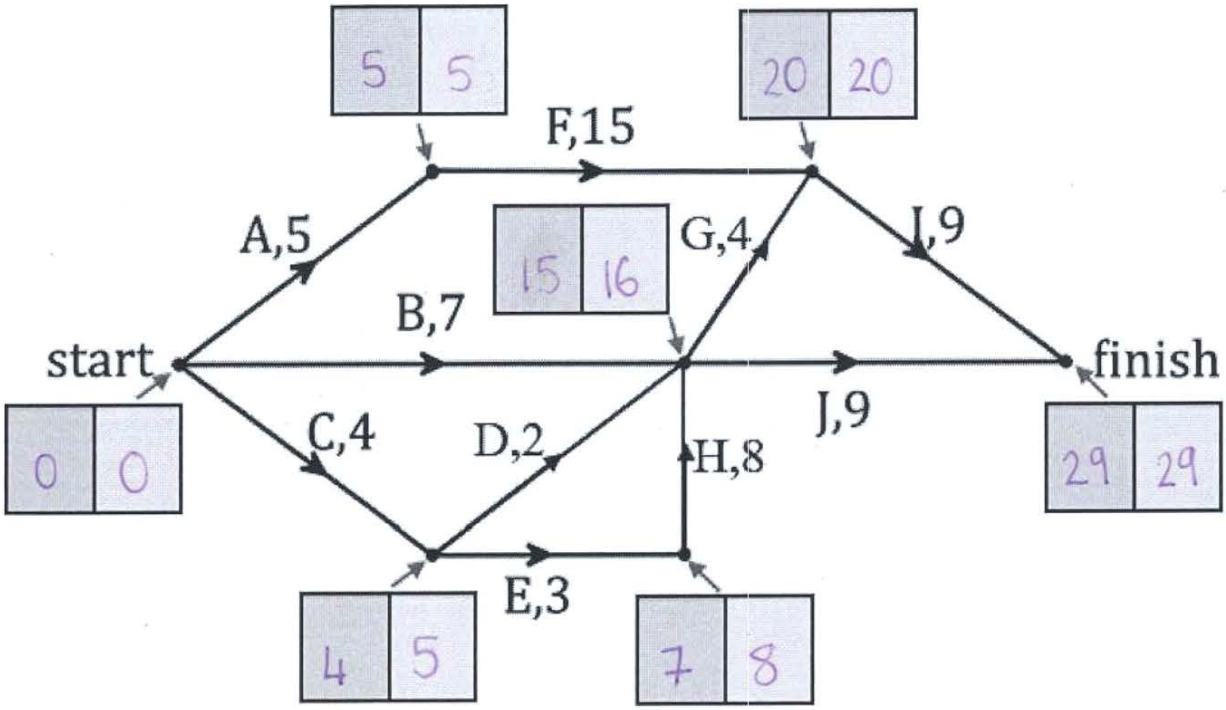
$= 5.437152$

∴ Total amount = \$899 + \$5.44

= \$904.44

Question 38 (4 marks)

A project requires a series of ten activities to be completed and the weighted network diagram is shown below. Each number represents the number of days.



(a) Important junctions of the project are indicated by the seven red arrows in the diagram. Show their earliest- and latest-starting times in the respective yellow and blue boxes. **2**

(b) What is the critical path for this network? **1**

AFJ

(c) What is the minimum time for this project to be completed? **1**

29 days

$r = \frac{6.14\%}{12}$

Question 39 (7 marks)

Elena takes out a loan of \$150 000, which has an interest rate of 6.14% per annum.
She makes regular monthly repayments of \$1000.
The table shows the details to determine her monthly balance.

n	Amount owing at start of month	interest	Monthly repayment	Balance owing
1	\$150 000	\$767.5	\$1000	\$149 767.50
2	149767.50	\$766.31	1000	A_2

(a) Complete the table to find the value of A_2, answering to the nearest cent. **2**

$A_2 = \$149533.81$

(b) Let A_n be the value of Elena's loan after n months.
Complete the recurrence relation to model the value of this loan over time. **2**
That is, indicate both A_0 and A_{n+1} in the space below.
Where necessary, give your answers correct to three decimal places.

$r = 1.005$ (to 3 d.p.)

$A_{n+1} = 149767.50$

$A_0 = 150,000$

$A_0 = 150,000$, $A_{n+1} = \underbrace{\left(1 + \frac{0.0614}{12}\right)}_{= 1.005} \times A_n - 1000$

Question 39 continues over the page

Question 39 continued

(c) After the second month, Elena realises that the interest she pays is very high.
She decides to switch to a different bank, which offers an interest rate of 6% per annum.
The table shows the present value for an annuity of $1.

Period	*Interest rate per period*						
	0.5%	1%	2%	3%	4%	5%	6%
90	72.331	59.161	41.587	31.002	24.267	19.752	16.579
100	78.543	63.029	43.098	31.599	24.505	19.848	16.618
120	90.073	69.701	45.355	32.373	24.774	19.943	16.651
132	96.460	73.111	46.338	32.660	24.859	19.968	16.659
142	101.497	75.658	46.996	32.832	24.905	19.98	16.665
144	102.475	76.137	47.112	32.861	24.912	19.982	16.663
165	112.173	80.637	48.095	33.079	24.961	19.994	16.666
168	113.477	81.206	48.205	33.101	24.966	19.994	16.666
180	118.504	83.322	48.584	33.170	24.979	19.997	16.666

$r = \frac{6\%}{12} = 0.5\%$

$n = 12 \times 12$
$= 144$

Using the table, calculate the total interest that Elena will pay if she repays the loan in full after 12 years. **3**

$x = 150,000$

102.475

$x = \$1463.77$ (to nearest cent) OR $x = 1463.771652$

Total $= \$1463.77 \times 12 \times 12$
$= \$210,782.88$

Total $= x \times 144$
$= \$210783.12$

$I = \$210,782.88 - \$150,000$
$= \$60,782.88$

$\therefore$ Interest $= \$60,783.12$

End of Paper