Killara HIGH SCHOOL
MATHEMATICS DEPARTMENT

Student Number

2022 **Year 12 Trial Examination**

Mathematics Standard 2

08/08/2022

General Instructions

- Reading time – 10 minutes
- Working time – 2 hours and 30 minutes
- Write using blue or black pen
- Calculators approved by NESA may be used
- A reference sheet is provided
- For questions in Section II, show relevant mathematical reasoning and/or calculations
- No white-out may be used

Total Marks: 100

Section I - 15 marks (pages 3–10)

- Allow about 25 minutes for this section

Section II - 85 marks (pages 11–44)

- Allow about 2 hours and 5 minutes for this section

This question paper must not be removed from the examination room.

This assessment task constitutes 30% of the course.

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Section I

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

Use the multiple-choice sheet for Question 1–15.

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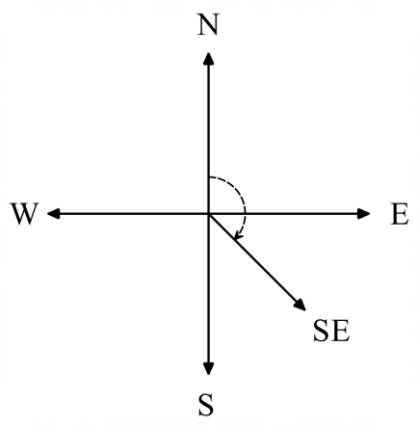
1 What true bearing is equivalent to the compass bearing SE?



(A) 045°T

(B) 075°T

(C) 135°T

(D) 150°T

2 What is 7 400 000 000 written in standard form?

(A) 74×10^8

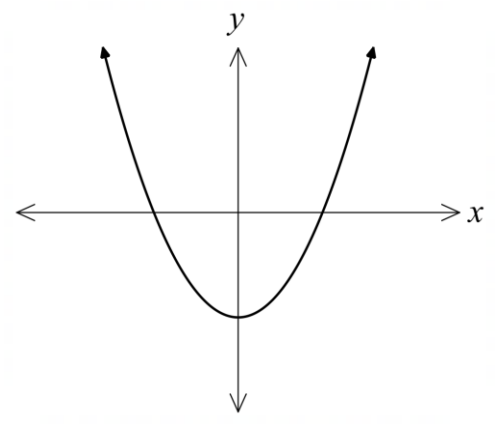
(B) 7.4×10^8

(C) 74×10^9

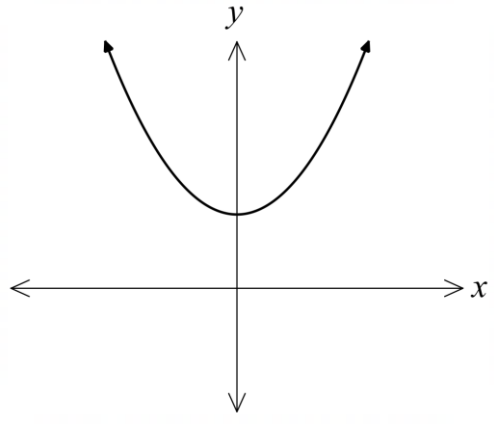
(D) 7.4×10^9

3 Which of the following graph best represents the equation $y = x^2 + 3$?

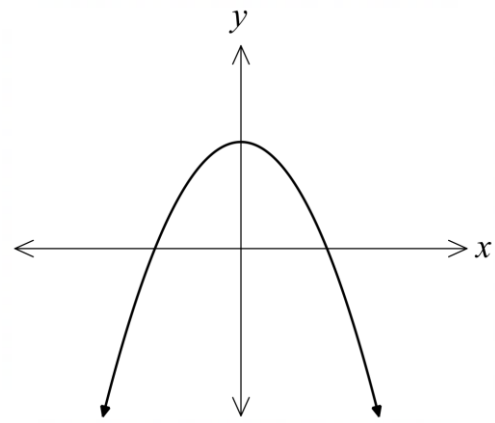
(A)



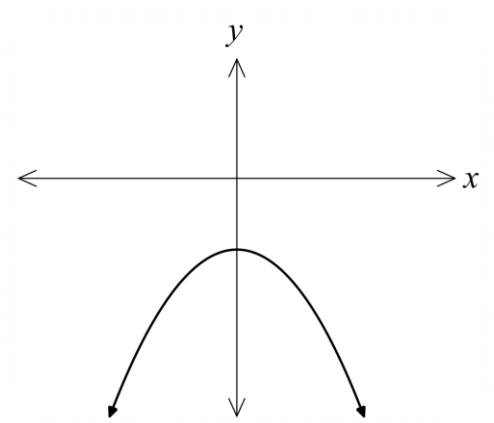
(B)



(C)



(D)



4 A straight road has an actual length of 1.35 kilometres. On the map, its length is 3cm.

If another straight road has an actual length of 0.93 kilometres, which measurement best represents the length of the road on the map?

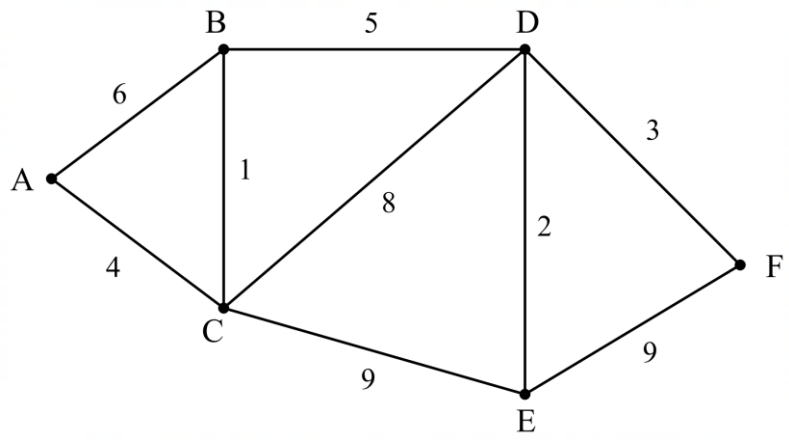
(A) 0.48 cm

(B) 1.26 cm

(C) 2.07 cm

(D) 2.39 cm

5 The following graph shows the times, in minutes, it takes to travel between 6 buildings.



What is the shortest time between A and F?

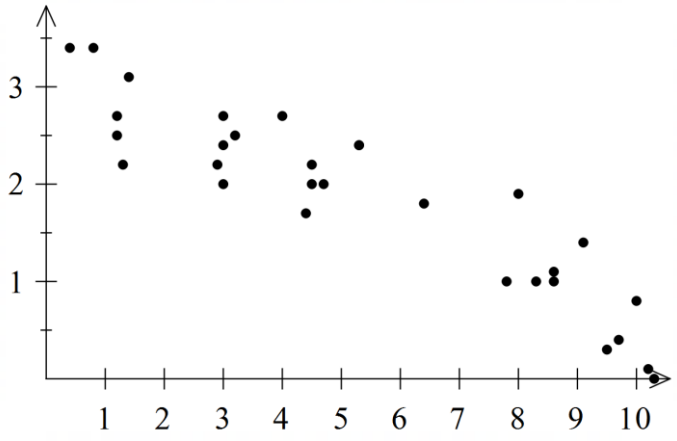
(A) 12 minutes

(B) 13 minutes

(C) 14 minutes

(D) 15 minutes

6 Consider the scatter plot shown below.



Which is the best approximation for Pearson's correlation coefficient (r)?

(A) $r = -0.8$

(B) $r = -0.1$

(C) $r = 0.7$

(D) $r = 3$

7 Chris owns 10 shares of a company and earned \$9.40 in dividends.

If the current price of each share is \$36.83, what is the dividend yield, correct to 2 decimal places?

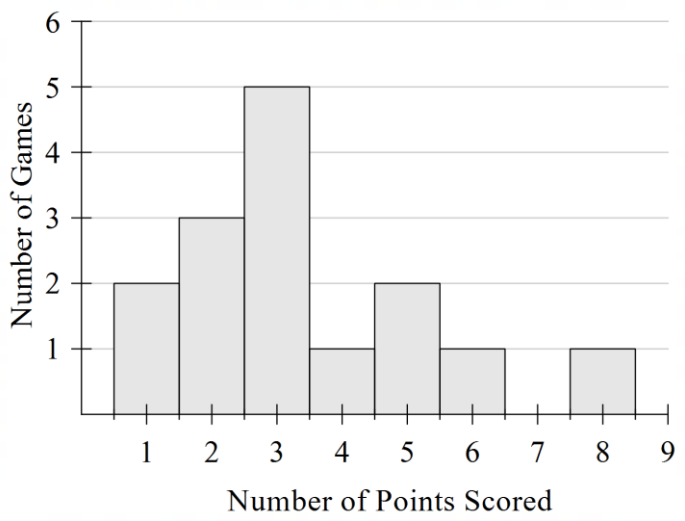
(A) 0.03%

(B) 0.26%

(C) 0.94%

(D) 2.55%

8 A sports team recorded the number of points scored each game. The frequency histogram shows the number of points scored each game across 15 games.



What is the mean number of points scored per game for this team?

(A) 1.9

(B) 3

(C) 3.4

(D) 4

9 A new bike costs $239 including 10% of GST. How much GST is included in the bike?

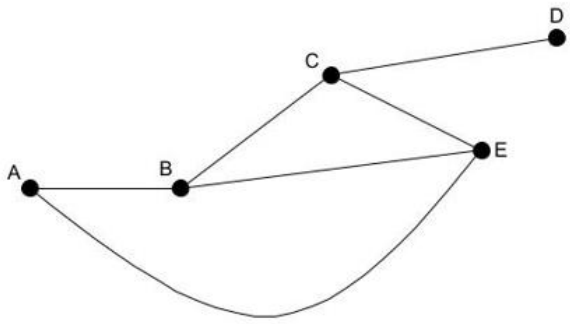
(A) $21.73

(B) $23.90

(C) $215.10

(D) $217.27

10 For the network shown below, how many vertices have an even degree?



(A) 1

(B) 2

(C) 3

(D) 4

11 The average mass of oranges is normally distributed with a mean of 140 g and a standard deviation of 25 g.

In a sample of 5000 oranges, how many would you expect to have a weight between 90 g and 165 g?

(A) 3400

(B) 4075

(C) 4200

(D) 4750

12 When two dice are rolled, the sum of the two upper most faces can be found. The following array shows the possible sums.

+	**1**	**2**	**3**	**4**	**5**	**6**
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

If two, fair six-sided dice are rolled 500 times, what is the expected frequency of rolling a sum of 10 or more?

(A) 6

(B) 83

(C) 125

(D) 136

13 The coordinates of Tokyo are $(36°\text{N}, 140°\text{E})$ and the coordinates of Oslo are $(60°\text{N}, 11°\text{E})$.

If the sun rises at 7 am in Oslo, what time will it be in Tokyo when the sun rises in Oslo? You may assume $15° = 1$ hour.

(A) 8:36 am

(B) 1:24 pm

(C) 3:36 pm

(D) 10:24 pm

14 Which of the following is a solution to the following equation?

$$\frac{4x}{5} = 2x - 1$$

(A) $x = \frac{1}{2}$

(B) $x = \frac{1}{6}$

(C) $x = \frac{5}{6}$

(D) $x = -\frac{2}{5}$

15 \$40 000 is invested in an account which earns interest of 2% per month. At the end of each month, immediately after the interest has been paid, \$1200 is withdrawn from the account.

Which of the following recurrence relations models this situation, where $n = 1, 2, 3, \ldots$

(A) $A_0 = 40\,000$

$A_n = A_{n-1}(1.02) - 1200$

(B) $A_0 = 40\,000$

$A_n = (A_{n-1} - 1200)(1.02)$

(C) $A_0 = 40\,000$

$A_n = 1200 - A_{n-1}(1.02)$

(D) $A_0 = 40\,000$

$A_n = (1200 - A_{n-1})(1.02)$

End of Section I

Killara HIGH SCHOOL
MATHEMATICS DEPARTMENT

Student Number

2022 **Year 12 Trial Examination**

Mathematics Standard 2

Section II Answer Booklet 1

08/08/2022

Section II

90 Marks
Attempt Questions 16–41
Allow about 2 hours and 5 minutes for this section

Booklet 1 – Attempt Questions 16–32 (52 marks)
Booklet 2 – Attempt Questions 33–41 (33 marks)

Instructions

- 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 page 28. If you use this space, clearly indicate which question you are answering.

Q	Marks
16	/2
17	/3
18	/3
19	/3
20	/3
21	/2
22	/2
23	/3
24	/4
25	/3
26	/3
27	/4
28	/3
29	/4
30	/4
31	/3
32	/3
Total	**/52**

Please turn over

Section II

In Questions 16 - 41, your response should include relevant mathematical reasoning and/or calculations.

Question 16 (2 marks)

Filip drives a car with a petrol consumption of 8.3 L/100 km. The gas tank of the car has a capacity of 40 L. **2**

If Filip is driving 870 km, how many full tanks of petrol will he need to reach his destination?

Question 17 (2 marks)

In 2019, Jasmine bought a home for $875 000. Over the next 3 years, the house appreciated by 6.5% p.a. **3**

Determine how much the value of the house had increased by over the 3 years, correct to the nearest $1000.

Question 18 (3 marks)

A business manufactures and sells beach towels. The graphs representing the costs (C) and revenue (R) are displayed on the same axes below.

The cost equation is $y = 14x + 180$
The revenue equation is $y = 26x$

(a) How many beach towels need to be sold to break even? **1**

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(b) Using the equations, determine the profit/loss amount when 8 beach towels are sold. **2**

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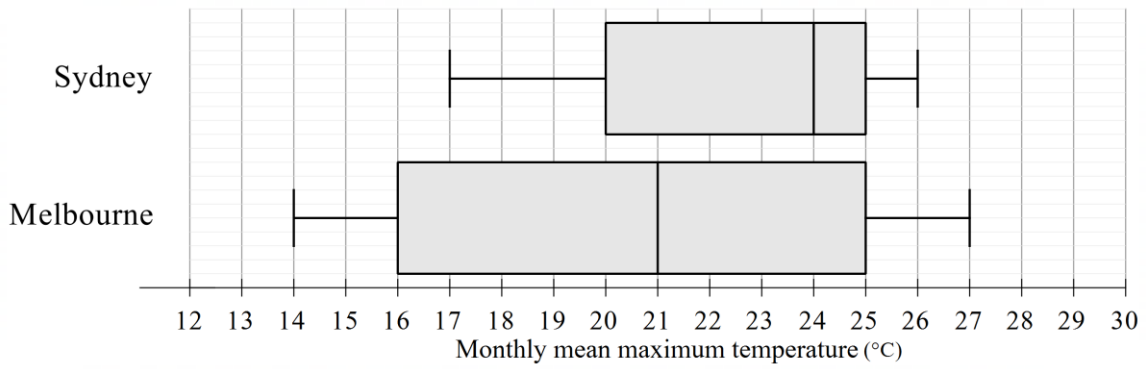
Question 19 (3 marks)

The monthly maximum temperature for Sydney and Melbourne are drawn in the boxplots below.



(a) What is the median maximum temperature for Sydney? **1**

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(b) Calculate the interquartile range for Melbourne. **1**

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(c) Which city has more consistent maximum temperatures? Justify your answer by comparing one measure of spread. **1**

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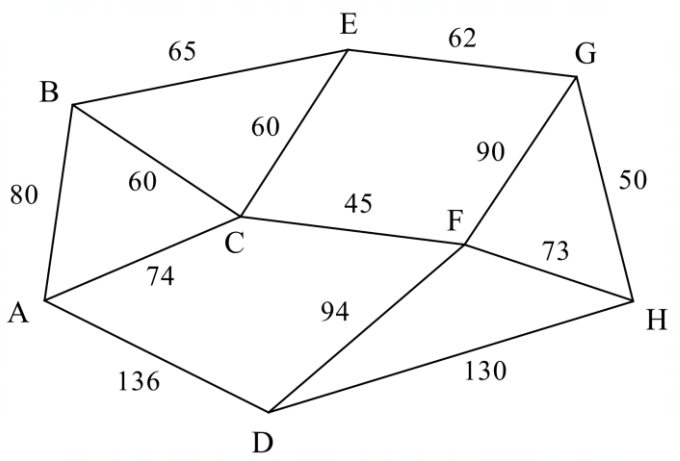
Question 20 (3 marks)

The weighted network below models bird-watching platforms (vertices) within a national park that are connected together by footpaths (edges). The weightings on the edges of the graph indicate the distance in metres between the bird watching platforms. **3**



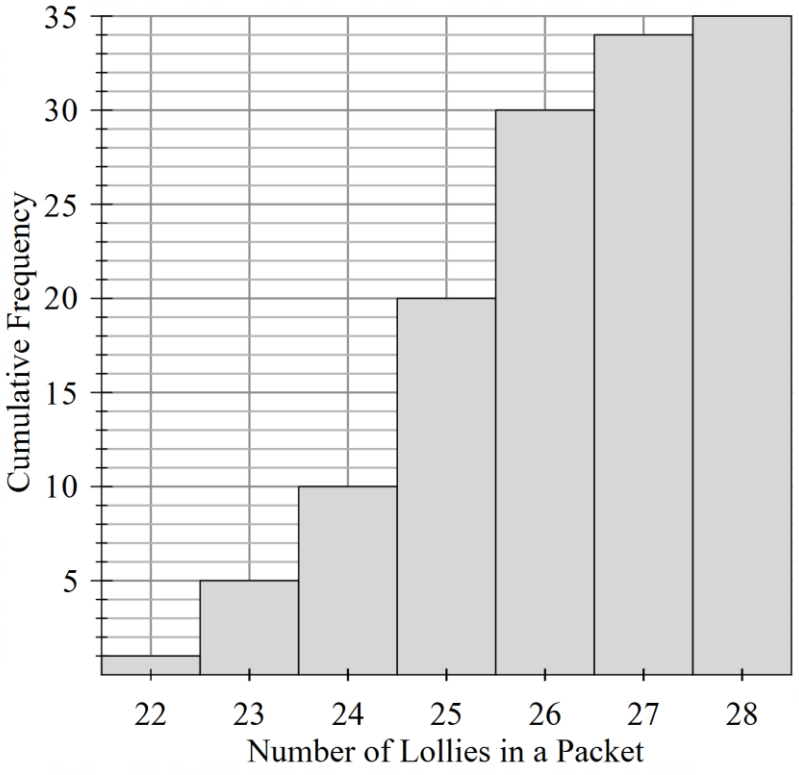
Draw a minimum spanning tree for this network and determine its length.

Length of minimum spanning tree = ……

Question 21 (2 marks)

A company manufacturing packets of lollies advertises them as '25 lollies per packet'. **2**

A sample of packets was collected and the number of lollies in each packet were counted. The results are displayed in the cumulative frequency histogram below.



If a packet is chosen at random, what is the probability that it contains at least 25 lollies?

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Question 22 (2 marks)

The following table shows the monthly repayments for each $1000 borrowed. Davy is planning to borrow $1 220 000 for a house and to repay the loan over a period of 30 years. The bank has offered him an interest rate of 4% per annum. **2**

	Interest Rate per Year		
Time Period (Years)	**4**%	**5**%	**6**%
20	$6.06	$6.60	$7.16
25	$5.28	$5.85	$6.44
30	$4.77	$5.37	$6.00

How much interest will he end up paying over the term of the loan?

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Question 23 (3 marks)

The formula to calculate an estimate for blood alcohol content (BAC) for males is given by **3**

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

The number of hours it takes for a person's BAC to reach zero after they stop drinking is given by

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

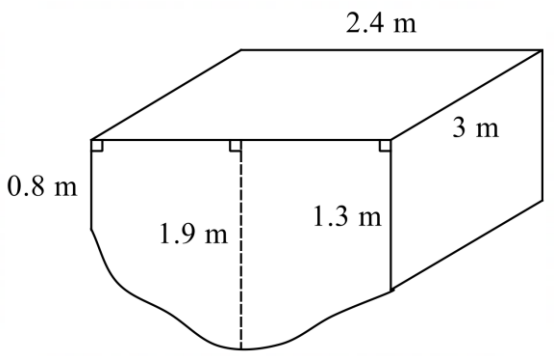
Michael weighs 70kg and holds a provisional licence with a zero alcohol limit.

He started drinking at 7:00 pm and consumes 9 standard drinks over 5 hours. He stopped drinking at midnight.

At what time can he legally drive his car, correct to the nearest minute?

Question 24 (4 marks)

A pond has constant cross-sections as shown in the diagram.



(a) Use two applications of the Trapezoidal Rule to estimate the area of the cross-section. **2**

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(b) Hence estimate the capacity of the pond in litres. **2**

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Question 25 (3 marks)

Sebastian has created a spreadsheet to help him budget for his fixed expenses each month.

	A	B
1	**Sebastian's Fixed Monthly Expenses**	
2		
3	Electricity	***X***
4	Rent	$1,560
5	Entertainment	$250
6	Water	$85
7	Fuel	$185
8		
9	Total	$2,230

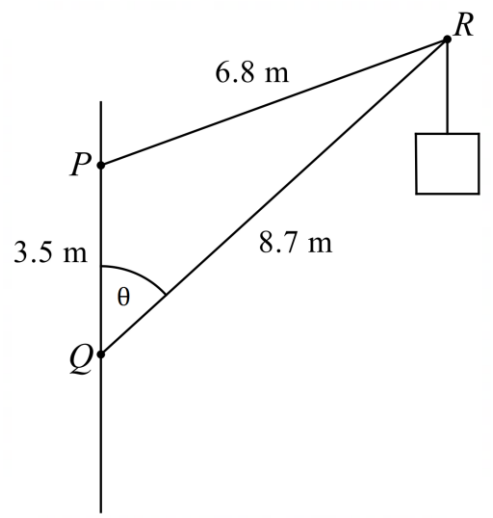
(a) Calculate the monthly cost of electricity (X). **1**

(b) The average cost of electricity throughout the year is 32c/kWh. Using this average, determine how many kWh Sebastian uses per year. **2**

Question 26 (3 marks)

A jib crane is shown in the diagram below. **3**

In the diagram, $RQ = 8.7$ m, $PQ = 3.5$ m and $PR = 6.8$ m.



Determine the angle PQR, correct to the nearest minute.

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Question 27 (4 marks)

This table is used to calculate income tax for the 2021 – 2022 financial year. **4**

Taxable income	*Tax on this income*
0 – $18,200	Nil
$18,201 – $45,000	19 cents for each $1 over $18,200
$45,001 – $120,000	$5092 plus 32.5 cents for each $1 over $45,000
$120,001 – $180,000	$29,467 plus 37 cents for each $1 over $120,000
$180,000 and over	$51,667 plus 45 cents for each $1 over $180,000

Max is a lawyer and has an annual gross salary of $116,487. He has allowable tax deductions of $980 for renewing his practising certificate and $650 of travel expenses between clients annually. Max must also pay a Medicare Levy of 2% of his taxable income. During the year, he paid $3000 per month in Pay As You Go (PAYG) tax.

Will Max receive a tax refund or have to pay additional tax?

Justify your answer with calculations to determine the amount of tax refund or tax payable.

Question 28 (3 marks)

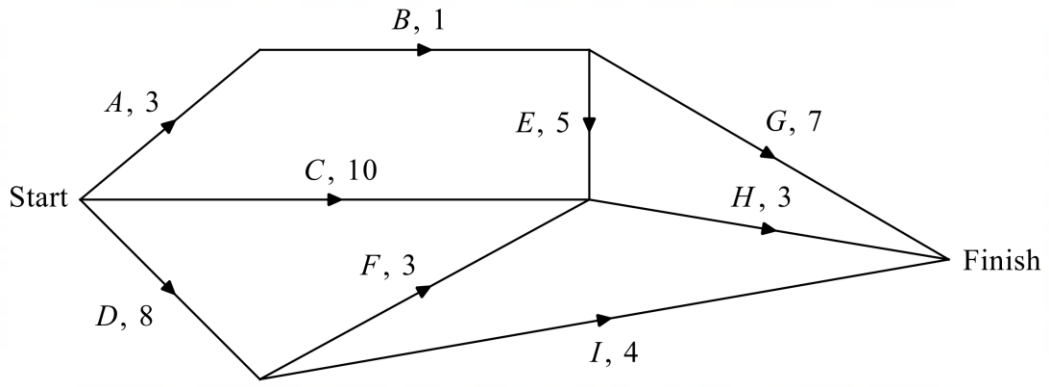
The assessment marks for a Biology assessment and a History assessment are both normally distributed. The Biology assessment has a mean of 74 and a standard deviation of 3. The History assessment has a mean of 82 and a standard deviation of 1.5.

(a) Kathryn knows that her *z*-score for both her Biology assessment and History assessment are the same. She received a mark of 80 in Biology. Calculate her assessment mark for her history assessment. **2**

(b) What percentage of students received a lower score than Kathryn in her Biology assessment? **1**

Question 29 (4 marks)

The directed network below shows the sequence of activities A to I that is required to complete a manufacturing process. The time taken to complete each activity, in hours, is also shown.



(a) Determine the minimum completion time for the direct network and state the critical path. **2**

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(b) What is the float time of activity G? **1**

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(c) What is the latest starting time for activity A? **1**

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Question 30 (4 marks)

The table of interest factors below shows the future value of a $1 annuity for different interest rates over different numbers of time periods.

Future value of an annuity of $1

Time periods	*Interest rate per period*					
	1%	2%	3%	4%	5%	6%
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	2.0400	2.0500	2.0600
3	3.0301	3.0604	3.0909	3.1216	3.1525	3.1836
4	4.0604	4.1216	4.1836	4.2465	4.3101	4.3746

(a) Colleen makes equal contributions of $5500 into an account every 6 months for 2 years, at an interest rate of 4% per annum compounding biannually. What is the future value of Colleen's annuity? **2**

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(b) Claire wants to make 4 equal contributions throughout the year into an account with an interest rate of 4% per annum, compounding quarterly. These contributions will be whole dollar amounts. She aims to have $12 000 in the account by the end of the year. **2**

Calculate the least amount her contributions need to be.

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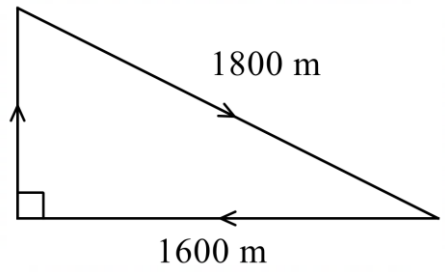
Question 31 (3 marks)

Kenzo is planning to go for a morning jog. He is going to run a circuit in the shape of the right-angled triangle shown below. **3**



Kenzo wants to finish the circuit in 30 minutes or less. If he runs at an average speed of 9 km/h, will he finish it in this time? Justify your answer with appropriate calculations.

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Question 32 (3 marks)

Shaw received this credit card statement from CBA for the month of May. Interest was charged at rate of 18.98% per annum, compounding daily. **3**

There is no interest-free period. The period for which interest was charged included the date of purchase and the date of payment.

What amount was paid when the account was paid in full on 31 May?

Purchase Date	Transaction Details	Purchase Amount
08 May	Booktopia Pty Ltd Lidcombe	$33.90
21 May	NRMA Insurance	$1906.84

Do NOT write in this area.

Section II extra writing space

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

Killara HIGH SCHOOL
MATHEMATICS DEPARTMENT

Student Number

2022 **Year 12 Trial Examination**

Mathematics Standard 2

Section II Answer Booklet 2

08/08/2022

Booklet 2 – Attempt Questions 33–41 (33 marks)

Q	Marks
33	/2
34	/3
35	/3
36	/4
37	/6
38	/5
39	/3
40	/3
41	/4
Total	**/33**

Instructions

- 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 page 44. If you use this space, clearly indicate which question you are answering.

Please turn over

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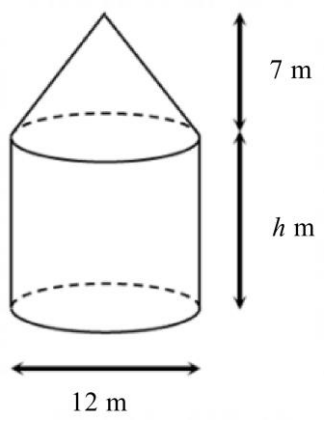
Question 33 (2 marks)

A rectangle has a perimeter of 56 cm. If the ratio of its length to its width is 4:3, find the area of the rectangle. **2**

Question 34 (3 marks)

The diagram below shows a silo made up of a cone with a perpendicular height of 7 m on top of a cylinder with a height of h m. The diameter of the cone and cylinder is 12 m. **3**

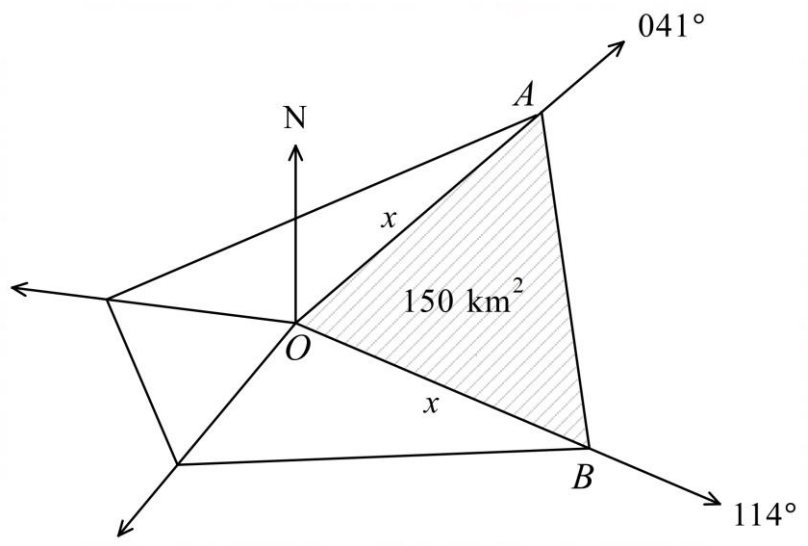


The volume of the silo is 1500 m^3. Determine the height of the cylinder h, correct to 3 significant figures.

Question 35 (3 marks)

A radial survey is taken on a plot of land. Point A and B are equal distance (x) in kilometres from O. Point A is on a bearing of $041°$ and point B is on a bearing of $114°$. The area of triangle AOB is 150 km^2. **3**

What is the distance x, in kilometres, correct to one decimal place?



Question 36 (4 marks)

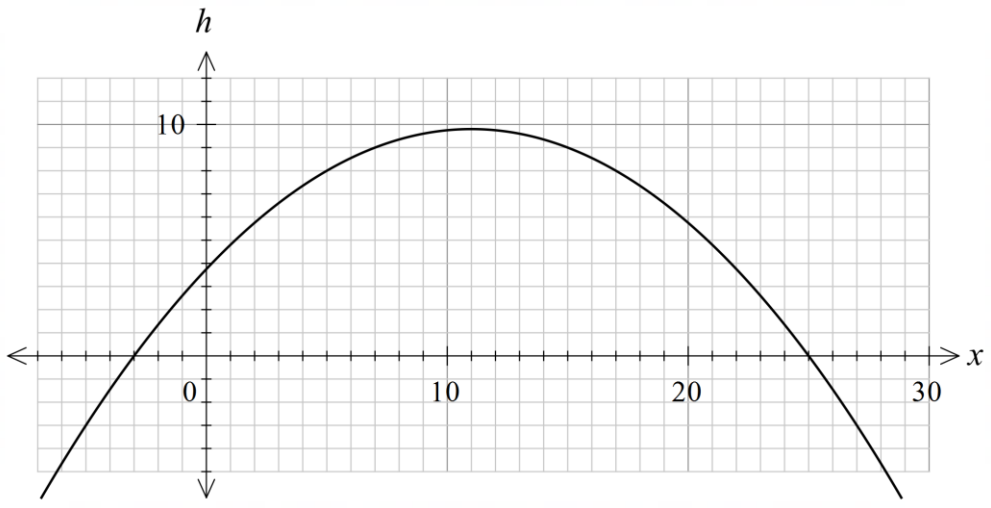
A ball is thrown off the top of a building, and lands on the ground. The path of the ball can be modelled by the equation

$$h = 3.75 + 1.1x - 0.05x^2$$

where

- h is the height above ground level in metres.
- x is the horizontal distance from the starting position in metres.

This equation is graphed below.



(a) What is the initial height of the ball when it is thrown? **1**

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(b) Find the exact height of the ball when its height is at a maximum. **2**

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Question 36 continues on page 35

Question 36 (continued)

(c) Give, with reasons, one range of x values for which this model will not be practical. **1**

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End of Question 36

Question 37 (6 marks)

A company is investigating its weight loss diet. They find 10 people who use their diet and recorded the time they've been on the diet and their weight loss.

Weeks on the diet	8	4	4	2	7	8	5	3	9	6
Weight loss (kg)	5	4	3	1	4	4	3	3	6	5

(a) Pearson's coefficient for this data is $r = 0.846$. What does this value say about the strength and direction of the correlation between the number of weeks on the diet and the weight loss? **1**

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(b) The least-squares regression line is $y = 1 + mx$, where: **1**

x is the number of weeks on the diet
y is the weight loss, in kilograms
m is the gradient of the line

Using technology, find the value of m.

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(c) Interpret the value of m found in part (b) in the context of the data provided. **1**

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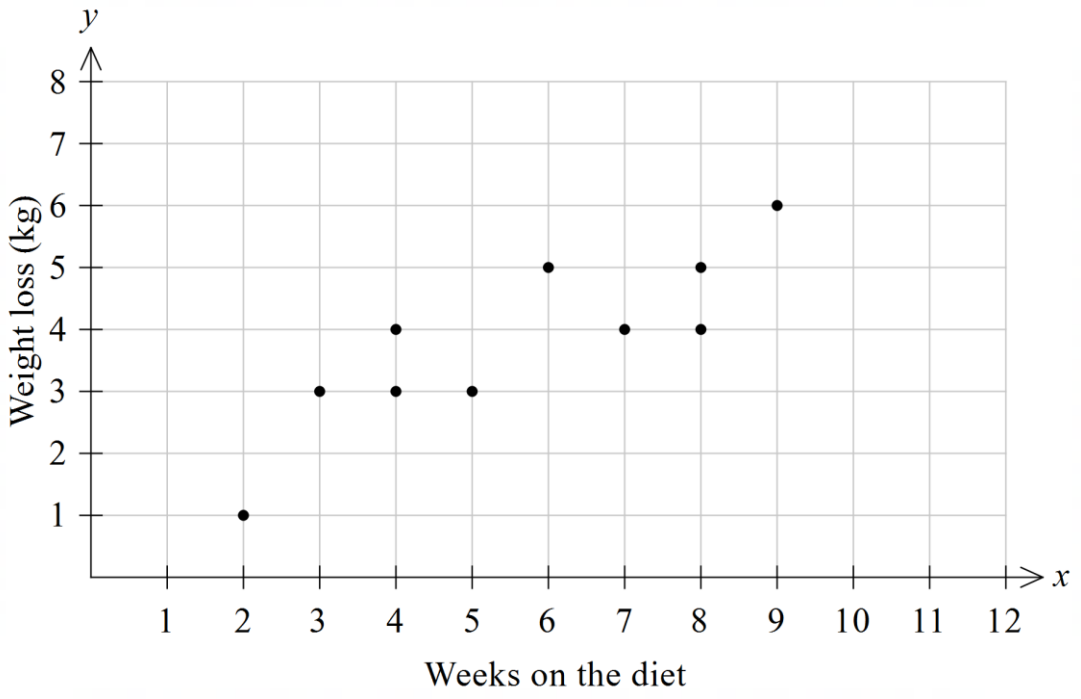
Question 37 continues on page 37

(d) The scatter plot shows the data collected from the 10 people on the diet. **2**

Draw the least-squares regression line found in part (b).



(e) Why does the y-intercept have no meaning in the context provided? **1**

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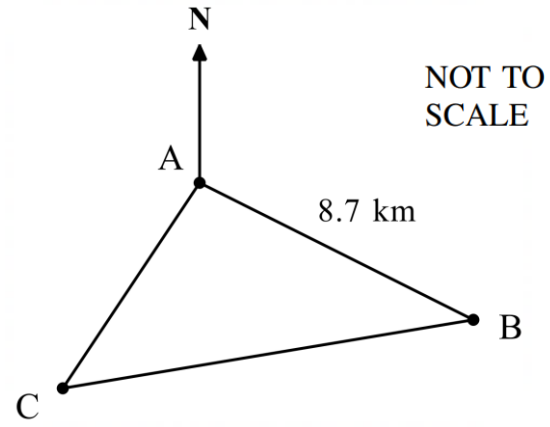
End of Question 37

Question 38 (5 marks)

There are 3 campsites, A, B and C, each connected by roads. The length of the road between A and B is 8.7 km.



The following information is known:

- The bearing of B from A is 125°
- The bearing of C from A is 209°
- The bearing of B from C is 085°

(a) Calculate the length of the road between B and C, correct to 4 significant figures. **3**

Question 38 continues on page 39

Question 38 (continued)

(b) Hence, or otherwise, find the area of the triangle enclosed by the 3 roads, correct to the nearest square metre. **2**

End of Question 38

Question 39 (3 marks)

Present value interest factors for an annuity of $1 for various interest rates and time periods are given in the table below. **3**

Table of present value interest factors

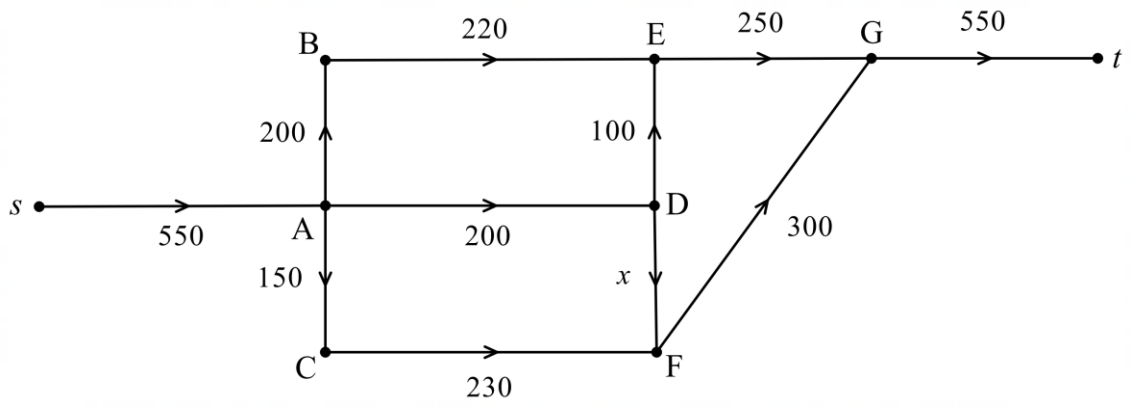
Time periods	*Interest rate per period*			
	0.4%	0.5%	0.6%	0.7%
12	11.6937	11.6189	11.5448	11.4714
24	22.8405	22.5629	22.2899	22.0216
36	33.4659	32.8710	32.2907	31.7247
48	43.5942	42.5803	41.5988	40.6486

Isaac uses this table to calculate his car loan repayments. His loan is $24 500 and will be paid in equal monthly payments. The monthly interest rate for his loan is 0.7%.

Calculate the how much Isaac will save paying back the loan in 2 years instead of 3.

Question 40 (3 marks)

The network diagram shows the maximum flow of traffic, in vehicles per hour, between along several streets in a congested town.



(a) It is known that the minimum cut of this network cuts through edge DF. The maximum flow of the network is 530 vehicle per hour. Determine the value of x. **2**

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(b) A new road from D to G is being built. The flow capacity of this road is 30 vehicles per hour. Will this road increase the maximum flow of the entire network to 560 vehicles per hour? Justify your answer. **1**

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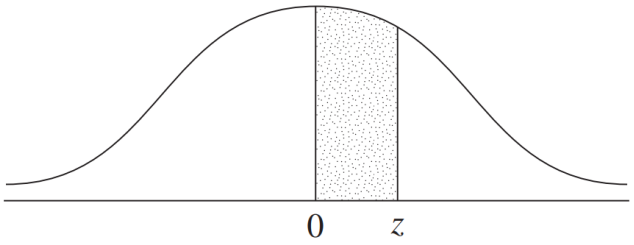
Question 41 (4 marks)

A random variable is normally distributed with mean 0 and standard deviation 1. The table gives the probability that this random variable lies between 0 and z for different values of z. **4**

z	0	0.25	0.5	0.75	1	1.25	1.5	1.75	2
Probability	0	0.0987	0.1915	0.2734	0.3413	0.3944	0.4332	0.4599	0.4773

The probability values given in the table for different values of z are represented by the shaded area in the following diagram.



Tennis balls are manufactured, and their weights are normally distributed with the following specifications:

- Mean $(\mu) = 57.4$ g
- Standard deviation $(\sigma) = 0.4$ g

Tennis balls that weight less than 56.7 g do not meet the rules of tennis and are rejected.

Question 41 continues on page 43

Question 41 (continued)

Two recently manufactured tennis balls are chosen at random and weighed.

By drawing a tree diagram, or otherwise, find the probability that neither tennis ball is rejected, correct to the nearest percentage.

End of Question 41

End of paper

Section II extra writing space

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

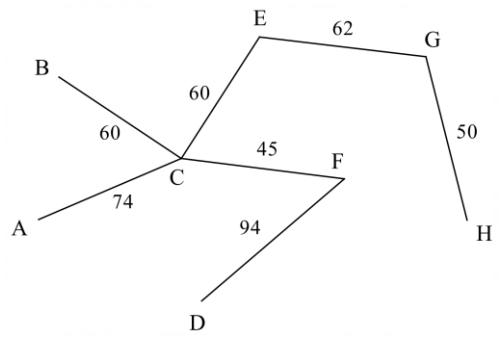
Multiple Choice		Feedback for certain questions
1.	**C**	
2.	**D**	This question was poorly done. Please make sure you review standard form (scientific notation).
3.	**B**	
4.	**C**	
5.	**B**	
6.	**A**	
7.	**D**	Dividend yield is a concept with regularly throws students off. Practise a lot of questions about this to help understand what it means.
8.	**C**	Working out the mean, median, mode and range from various graphs is important. Doing these with histograms, dot plots, cumulative histograms, stem-and-leaf plots etc. is difficult and worth practising.
9.	**A**	Review GST. These kinds of questions should not be difficult. Learning the concept of GST and how it works with pricing is important.
10.	**A**	
11.	**B**	
12.	**B**	
13.	**C**	
14.	**C**	Please make sure you practise you equation solving skills. These skills help with many topics throughout the course.
15.	**A**	

Short Answers -- Solutions		Marking Guidelines
16.	Petrol used $= \frac{870}{100} \times 8.3$ $= 72.21\ \text{L}$ So Filip will need to use 2 full tanks of petrol	1 Mark ▪ Calculating the amount of fuel used ▪ Stating the number of tanks used is 1.80525 without rounding 2 Marks ▪ Correctly determining that he will need 2 tanks
Feedback This was well done. Most students were able to find the number of litres needed. Some lost a mark for not answering the question, noting that Filip needs 2 full tanks.		
17.	$FV = 875000(1 + 0.065)^3$ $= \$1056955.922\ \ldots$ Increase amount $= 1056955.922 - 875000$ $= \$181\,955.9219\ \ldots$ $= \$182\,000$ (to the nearest \$1000)	1 Mark ▪ Using the future value formula 2 Marks ▪ Finding the amount it has appreciated by 3 Marks ▪ Finding the amount it has appreciated by correct to the nearest \$1000 (No marks for using the simple interest formula)
Feedback While most students correctly used the future value formula for this, many still lost 1 or 2 marks. Students needed to find the increase amount, and to round it to the nearest \$1000. Please read the question carefully.		
18.	a) 15 beach towels	Only the number 15 needed
	b) Loss amount $= 14(8) + 180 - 26(8)$ $= \$84$	1 Mark ▪ Indicting a loss amount (estimate from graph) ▪ Substituting 8 into both equations 2 Marks ▪ Calculating and indicating the loss amount (no marks for using the graph to guess when they don't indicate that it is a loss)
Feedback Part a) was answered correctly by most students. Part b) was also generally done well. Some just need to make sure they interpreted the value as a loss.		

19.	a) $24°\text{C}$	1 Mark for answer
	b) $25 - 16 = 9°\text{C}$	1 Mark for solution (with working)
	c) Sydney IQR $5°\text{C}$ < Melbourne $(9°\text{C})$ Or Sydney range $(9°\text{C})$ < Melbourne range $(13°\text{C})$ So Sydney has more consistent temperatures	1 Mark for a comparison and conclusion

Feedback
While most students correctly answered part a) and b) correctly, there were still about 25% of the cohort that lost marks here. These first two parts should have been gimmes. Make sure you are comfortable interpreting box plots.

Part c) was mixed, and highlighted that students need to answer reasoning questions a bit better. Make sure you understand measures of spread and can use correct terminology (range or interquartile range), and have numbers to justify you reason. Please make sure you have answered the question too, not just given numbers.

20.	 Min spanning tree $= 445$ m	1 Mark ▪ drawing a spanning tree 2 Marks ▪ finding minimum spanning tree ▪ a spanning tree with calculated length 3 Marks ▪ Drawing a correct minimum spanning tree with a correct total length (no working needed for the calculation)

Feedback
This was generally done well. The most common mistake was students not finding the minimum spanning tree, by missing 1 edge or getting 1 wrong. Please make sure you practise checking your spanning tree once you've found it.

21.	$P(\geq 25) = 1 - P(< 24)$ $= 1 - \frac{10}{35}$ $= \frac{25}{35} \approx 71.4\%$	1 Mark ▪ Indicating total packets is 35 ▪ Finding that there are 25 packets with at least 25 lollies 2 Marks ▪ Determining the correct probability
Feedback This was generally not well done by the cohort. Please make sure you are comfortable reading cumulative graphs. You did not need to add the totals for the columns here. Reviewing these graphs is necessary for most students.		
22.	Total Loan $= 1220 \times 4.77 \times 30 \times 12$ $= \$2094984$ Interest $= 2094984 - 1220000$ $= \$874\ 984$	1 Mark ▪ Finding the correct total repayments 2 Marks ▪ Correctly calculating the interest paid
Feedback This question was very poorly done by the cohort. Many students did not multiply 12 (for months) or 30 (for years). The question asked to find the interest, not the repayment amount, and \$1 220 000 needed to be subtracted as well. Most students got 0 for this question.		
23.	$BAC = \frac{10(9) - 7.5(5)}{6.8(70)}$ $= 0.11029\ldots$ $\text{Time} = \frac{0.11029\ldots}{0.015}$ $= 7.35\ldots$ $= 7\text{h}\ 21\text{min}$ So Michael can legally drive his car at $7{:}22\ \text{am}$*	1 Mark ▪ Using the BAC formula correctly 2 Marks ▪ Finding how long it takes for the BAC to reach 0 3 Marks ▪ Correctly calculating the time he can drive (rounding error not penalised here)
Feedback This question was generally well done and it was clear it had been well practised. Some students couldn't connect the answer of 7.35… to 7 h and 21 min, so this should be reviewed. *Technically, Michael cannot drive at 7:21 am, and must wait until 7:22.		

24.	a) $A = \frac{1.2}{2}(0.8 + 1.9) + \frac{1.2}{2}(1.9 + 1.3)$ $= 3.54\ \text{m}^2$	1 Mark ▪ Using the trapezoidal rule/area of a trapezium formula 2 Marks ▪ Calculating the correct total area
	b) $V = 3.54 \times 3$ $= 10.62\ \text{m}^3$ Capacity $= 10.62 \times 1000$ $= 10620\ \text{L}$	1 Mark ▪ Find the volume of the pond in m^3 ▪ Incorrect volume but a correct conversion to capacity 2 Marks ▪ Correctly calculating the capacity
Feedback Part a) was done well overall. If a mistake was made here, you should be reviewing the trapezoidal rule. Part b) was done okay, and students should make sure they have practised basic conversions and can do this comfortably.		
25.	a) $X = 2230 - (1560 + 250 + 85 + 185)$ $= \$150$	1 Mark ▪ Shows calculations to find X
	b) Monthly cost $= 150 \div 0.32$ $= 468.75\ \text{kWh}$ Yearly usage $= 468.75 \times 12$ $= 5625\ \text{kWh}$	1 Mark ▪ Finds the monthly energy usage ▪ Finds the yearly cost of electricity 2 Marks ▪ Correctly calculates the total energy use for the year
Feedback For part a), working was needed to receive the mark. The word 'calculate' should be an indication that calculation must be shown. Part b) was done well, and many students were able to use appropriate calculations to find the yearly usage.		

26.	$\cos \angle PQR = \dfrac{8.7^2 + 3.5^2 - 6.8^2}{2(3.5)(8.7)}$ $= 0.6847 \ldots$ $\angle PQR = \cos^{-1}(0.6847 \ldots)$ $= 46°47'$	1 Mark ▪ Attempts to use the cosine rule 2 Marks ▪ Finds the angle correctly, with incorrect rounding. 3 Marks ▪ Correctly calculating the angle and using the correct units for minutes
Feedback This question was generally done well, with most students recognising to use the cosine rule. A number of students did not read to leave the answer to the nearest minute, and were penalised for this.		
27.	Taxable income $= 116487 - 980 - 650$ $= \$114{,}857$ Income tax $= (114857 - 45000) \times 0.325 + 5092$ $= \$27{,}795.53$ Medicare $= 114857 \times 0.02$ $= \$2297.14$ Total Tax $= 2297.14 + 27795.53$ $= \$30{,}092.67$ So Max's refund $= 3000 \times 12 - 30092.67$ $= \$5907.33$	1 Mark ▪ Finds the taxable income ▪ Correctly uses the tax table from an incorrect taxable income 2 Marks ▪ Finds the taxable income and correctly uses the tax table ▪ Finds the taxable income and finds the Medicare levy amount 3 Marks ▪ Calculates the correct total tax ▪ Incorrect tax calculation, but correctly compares to total PAYG paid 4 Marks ▪ Correct calculations to determine the tax income
Feedback Many students did this question well. Most were able to start the questions by choosing the correct tax bracket. Please make sure that you continually practise these kinds of questions, and are comfortable with the terms and calculations for taxable deductions, Medicare levy, and PAYG.		

28.	a) z-score (Biology) $= \frac{80-74}{3}$ $= 2$ z-score (History) $= 2 = \frac{x-82}{1.5}$ So $x - 82 = 3$ $x = 85$ So Kathryn's History score is 85	1 Mark ▪ Finding the correct z-score for Biology ▪ Finding and incorrect z-score, but using it correctly to find the History score 2 Marks ▪ Finds the History z-score through correct calcuations
	b) 97.5%	1 Mark ▪ Stating the correct percentage
Feedback Part a) was generally well done, but it was clear that some student did not know where to start. Setting up an equation with the z-score formula should be well practised and solving these should be quick and easy. Part b) was also well done. It was good to see diagrams being drawn to help show your working.		
29.	a) Critical path: DFH Minimum completion time: 14 hours.	1 Mark ▪ For a correct critical path or minimum completion time 2 Marks ▪ Stating both the correct critical path and minimum completion time
	b) Float time $= 14 - 4 - 7$ $= 3$ hours	1 Mark ▪ Stating the correct float time (No working needed)
	c) LST(A) is after 2 hours	1 Mark ▪ Stating the correct latest starting time for the activity (No working needed)
Feedback Overall, this question was poorly done. Critical paths, forward and backward scans, and float times need a lot of review and practise. Part a) was mixed. Some students found the shortest path, which is not the same as the critical path. The **critical path is the longest path** with activity networks. Doing a forward and backward scan of the network helps with the later parts as well. Part b) and part c) were very poorly done. Students need to make sure they understand the terms here and how to find them. It would help to practise a number of forward and backward scans for these.		

30.	a) $FV = 5500 \times 4.1216$ $= \$22{,}668.80$	1 Mark ▪ Indicting the correct interest factor ▪ Finding the future value with the incorrect interest factor 2 Marks ▪ Finding the correct future value
	b) Instalment $\times 4.0604 = 12000$ Instalment $= 12000 \div 4.0604$ $= \$2955.37 \ldots$ So the instalments need to be $\$2956$	1 Mark ▪ Indicting the correct interest factor 2 Marks ▪ Finding the correct instalment amount (not penalised for not rounding properly.

Feedback
Part a) was well done. The most common mistake was mixing up the interest factor, but most students were okay with this.

Part b) was mixed. Students need to understand when to work backwards with these tables.

Some students used the future value formula, which was wrong. If there is a table in the question, you should be using the table to answer it. It's not just sitting there for fun.

31.	Let the unknown side be x. $x^2 = 1800^2 - 1600^2$ $= 680000$ $x = 824.6211 \ldots$ Perimeter $= 824.6211 \ldots + 1600 + 1800$ $= 4244.62 \ldots \text{m}$ $= 4.2246 \ldots \text{km}$ $\text{time} = \frac{\text{d}}{\text{s}}$ $= \frac{4.2246 \ldots}{9}$ $= 0.4694 \ldots \text{h}$ $= 28.16 \text{ min}$ So he will finish his run in 30 minutes.	1 Mark ▪ Finding the unknown side length ▪ Not finding the unknown side, but using the two known sides to calculate the time taken 2 Marks ▪ Finding the perimeter of the triangle, and attempting to use the rate to find the time taken 3 Marks ▪ Calculates the time taken and justifying that he will finish in 30 minutes

Feedback
This question was well done. Many students achieved 3 out of 3 for it, and confidently justified their answer with correct working. Some students used a lot of trigonometry to find the unknown side, and they should remember that Pythagoras' Theorem exists.

However, the setting out for this question was all over the place sometimes. Make sure, after you read the question, you think a little bit about how to approach it, and how you are going to structure your answer clearly and logically.

32.

Amount paid $= 33.90\left(1+\frac{0.1898}{365}\right)^{24}$
$+1906.84\left(1+\frac{0.1898}{365}\right)^{11}$
$= \$1952.10$

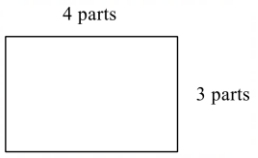
1 Mark
- Attempting to use the future value formula to find the amount paid

2 Marks
- A total is calculated using the FV formula but with incorrect day number

3 Marks
- Correct total calculated

Feedback
This question was okay, but some students clearly had no idea about credit cards. For these, make sure:
- You use the future value formula for compound interest
- You can calculate the number of days properly – if it includes the date of purchase and date of payment
- You consider the different purchases separately

33.



Total perimeter is 14 parts $= 56$ cm
1 part $= 4$ cm
So the dimensions are 16 cm by 12 cm.
The area $= 16 \times 12$
$= 192$ cm^2

1 Mark
- A guess-and-check approach to find the answer
- Finding the dimensions but not the area

2 Marks
- Using ratios or algebra to find the side lengths, and using them to calculate the area

Feedback
Students did reasonably well for this question. Students managed to find the lengths 32 cm and 24 cm, but then forgot to halve them to get the actual dimensions. Not knowing how to divide 56 (or 28) into the ratio $4:3$ is not acceptable.

34.

Radius $= 6$ m
Volume $=$ cone $+$ cylinder
$\frac{1}{3}\pi(6)^2 7 + \pi(6)^2 h = 1500$

$263.98\ldots + h \times 113.097\ldots = 1500$

$h \times 113.097\ldots = 1236.10\ldots$

$h = 10.929\ldots$
$= 10.9$ (3 sig fig)

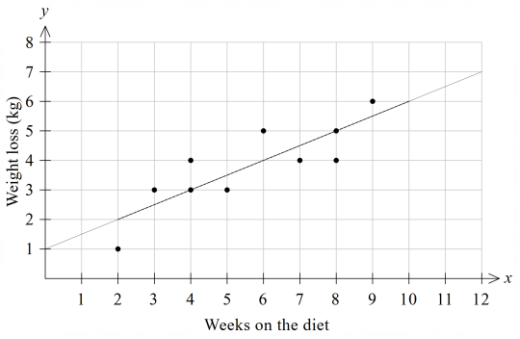
1 Mark
- A correct formula or equation for the volume of a cylinder/cone

2 Marks
- Correct formulas/calculations for both the volume of the cone and cylinder

3 Marks
- Calculating the height, with the correct number of significant figures

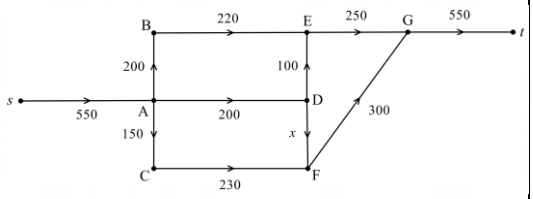
Feedback
This was not well done, and it is clear students are not comfortable with the various formulas. The volume (and surface area) formulas from Year 11 shouldn't be difficult at this point. Significant figure rounding was needed here to receive full marks, and you should make sure you don't round early when working here.

35.	$\frac{1}{2}x^2 \sin(114-41) = 150$ $x^2 = \frac{300}{\sin 73°}$ $= 313.707\ldots$ $x = 17.711\ldots$ $= 17.7 \text{ km}$	1 Mark ▪ Finding/stating angle AOB 2 Marks ▪ A correct set up for the area of the triangle 3 Marks Calculating the side length x from a correct equation
Feedback Most students got at least 1 mark for finding the angle correctly. However, using the area of a triangle formula was not as well done, with a number of students writing $\frac{1}{2}(x+x)\sin 73°$. This was not acceptable.		
36.	a) 3.75 m	1 Mark Stating the correct height
	b) The maximum is when $x = \frac{-3+25}{2}$ $= 11$ $h = 3.75 + 1.1(11) - 0.05(11)^2$ $= 9.8$	1 Mark ▪ Indicating that the max height occurs when $x = 11$ either on the graph or numerically 2 Marks ▪ Finding the height from the equation
	c) $x < 0$ is not practical because it starts at $x = 0$ OR $x > 25$ is not practical because then the height would be below 0.	1 Mark ▪ Stating one of the two domains and giving reasons
Feedback Part a) was surprisingly poor, with a number of students saying 4 metres. By substituting $x = 0$ into the equation (or seeing the vertical incept from the equation), should show you that the height is 3.75 m. Part b) was done a bit better, and many correctly substituted in $x = 11$. The common mistake was choosing the wrong x value to substitute in. Part c) was very poor, and student need to practise their reasoning skills. Students needed to write down a range of x values, not just one value. Appropriate reasoning was also needed.		

37.	a) There is a strong positive relationship between the number of weeks on the diet and weight loss	1 Mark State both strong and positive
	b) $m = 0.5$	1 Mark ▪ Stating the correct m value
	c) On average, people lose 0.5 kg each week on the diet	1 Mark ▪ Using the part (b) answer to correctly give the interpretation
	d)  	1 Mark ▪ Drawing a line with a correct y-intercept or correct gradient 2 Marks ▪ Drawing the correct line
	e) The y-intercept of 1 would indicate people lose 1 kg after no weeks on the diet, which doesn't make sense.	1 Mark ▪ Correctly giving a reason

Feedback
Part a) was done well.
Part b) was also quite good, but some students need to review using the calculator here.
Part c) should have been better, and student need to make sure they use the variables in the question to interpret the gradient.
Part d) was not done well enough. Sketching straight lines should be easy marks.
Part e) A number of students did this quite well, but please make sure you can explain you reasons clearly. You do not need to write an essay here.

38.	a) $\angle CAB = 209 - 125$ $= 84°$ Bearing of A from C is $29°$ $\angle ACB = 85 - 29$ $= 56°$ $\frac{BC}{\sin 84°} = \frac{8.7}{\sin 56°}$ $BC = 8.7 \times \frac{\sin 84°}{\sin 56°}$ $= 10.44 \text{ km}$	1 Mark ▪ Finding angle CAB ▪ Finding the bearing of A from C 2 Marks ▪ Finding 2 correct angles inside the diagram and attempting to use the sine rule?? 3 Marks ▪ Correct side length calculated (rounding not important here)
	b) $\angle ABC = 180 - 84 - 56$ $= 40°$ Area $= \frac{1}{2}(10.44 \times 8.7) \sin 40°$ $= 29.19 \ldots \text{km}^2$ $= 29191556 \text{ m}^2$	1 Mark ▪ Finding angle ACB ▪ An attempt to use the area formula 2 Marks ▪ Calculating the correct area (rounding not necessary. Leaving in square kilometres is fine, or incorrect rounding from a correct answer also isn't penalised).
Feedback These two parts were done reasonably well across the board for a question this late in the paper. For part a), many students recognised to use the sine rule. The most common error was the inability to find $\angle CAB$, which means working on bearing is needed for some. Part b) was also reasonably good, with many students using the area formula appropriately. The intention for this question was to use AB and CB to find the area, but some students did work to find side AC and use that. Make sure you stop and think about the most efficient ways to solve problems.		
39.	Monthly instalments for 2 years: $24500 \div 22.0216 = \$1112.54$ Total instalments for 2 years: $1112.54 \times 24 = \$26701.06$ Monthly instalments for 3 years: $24500 \div 31.7247 = \$772.27$ Total instalments for 3 years: $772.27 \times 36 = \$27801.68$ Savings $= 27801.68 - 26701.06$ $= \$1100.62$	1 Mark ▪ Identifying both interest factors and finding the instalments ▪ Finding one total repayment amount 2 Marks ▪ Correctly calculating one total repayment, and finding both instalment amounts 3 Marks ▪ Correct savings calculated
Feedback Many students were able to identify the correct interest factors but were unable to use them properly. Our cohort needs to make sure we can use the present value tables in a variety of situation, including finding monthly loan repayments. Practice here is needed.		

40.	a)  $x + 150 + 250 = 530$ $x = 530 - 400$ So $x = 130$	1 Mark ▪ Setting up an equation but not using the correct minimum cut 2 Marks ▪ Sets up an equation to solve for the correct x value
	b) No, the capacity from $s \to A$ is still 550 vehicles per hour, so the max flow cannot be more than 550.	1 Mark ▪ A correct answer with reasons
Feedback For part a), many students understood the correct strategy for this question. However, they were unable to identify the correct minimum cut. Part b) needed students to look at the entire network to see if there was another cut below 560. It was done reasonably well.		
41.	Min z-score $= \frac{56.7-57.4}{0.4}$ $= -1.75$ Probability that a ball is NOT rejected: $P(z > -1.75) = P(z < 1.75)$ $= 0.4599 + 0.5$ $= 0.9599$ Probability that neither ball is rejected is $0.9599 \times 0.9599 = 0.9214 \ldots$ $= 92\%$	1 Mark ▪ Calculating the correct z-score 2 Marks ▪ Working out the probability that a ball is rejected or the probability that a ball is not rejected 3 Marks ▪ Attempting to a tree diagram with the correct probability ▪ Finding an incorrect probability, but using a tree diagram (or otherwise) correctly 4 Marks ▪ Finds the correct probability form correct working
Feedback This question was poorly attempted by students. Finding the z-score of a rejected tennis ball should have been an easy 1 mark. There were many attempts at drawing tree diagrams, but many were incorrect.		