SHORE

Year 12
Mathematics Standard 2
Trial HSC Examination
30th August 2021

General Instructions

- Reading time – 10 minutes
- Working time – $2\frac{1}{2}$ hours
- Write using black pen
- Questions 1 to 15 will be answered on the multi-choice answer sheet provided
- Questions 16 to 38 will be answered in the 5 writing booklets provided
- NESA reference sheet will be provided
- Students are to bring approved scientific calculator and other appropriate equipment.
- The task is open book using printed or hand-written notes only. No textbooks or digital resources are to be accessed.

Note: Any time you have remaining should be spent reviewing your answers.

Total marks – 100

Section I Pages 2 – 7

15 marks

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

Section II Pages 8 – 26

85 marks

- Attempt Questions 16 to 38 in the 5 writing booklets provided.
- Booklets 1 to 5 are each worth 17 marks.
- Allow about 2 hours 5 minutes for this section

Section I

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

Use the multiple-choice answer sheet for questions 1−15

Assume 52 weeks in a year, and 365 days in a year, where necessary.

1 Will surveyed the boys in his class. One of his survey questions is shown.

> On a given day, how often do you blow your nose?
> *Tick the appropriate box*
> ☐ Not at all
> ☐ A few times
> ☐ Many times

What type of data would be collected with this survey question?

A. Quantitative discrete.

B. Quantitative continuous.

C. Categorical nominal.

D. Categorical ordinal.

2 Which of the following statements is true about the equation $y = 3x - 2$?

A. The gradient is 3 and the x-intercept is -2.

B. The gradient is -2 and the x-intercept is 3.

C. The gradient is 3 and the y-intercept is -2

D. The gradient is -2 and the y-intercept is 3.

3 The perimeter of a garden is measured as 17.06 m.

What is the absolute error in this measurement?

A. 0.5 cm

B. 1 cm

C. 3 cm

D. 5 cm

4 Which expression correctly calculates the future value of \$1200, invested for 3 years, at 8% per annum, compounding quarterly?

A. $1200 \times 0.02 \times 12$

B. $1200 + (1200 \times 0.02 \times 12)$

C. $1200(1 + 0.08)^3$

D. $1200(1 + 0.02)^{12}$

5 Billy knows that Pearson's correlation coefficient for his data set is –0.95. He graphed the data and included the line of best fit.

Which one of the following statements is true about the line of best fit?

A. The gradient of the line is negative and the scores are not close to the line.

B. The gradient of the line is negative and the scores are very close to the line

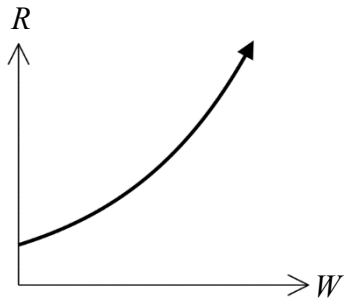
C. The gradient of the line is positive and the scores are not close to the line.

D. The gradient of the line is positive and the scores are very close to the line.

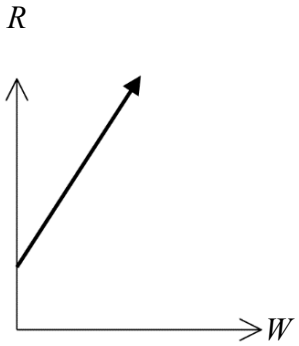
6 It is known that R varies inversely with W.

Which of the following graphs shows this relationship?

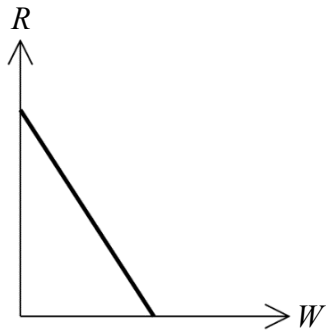
A.



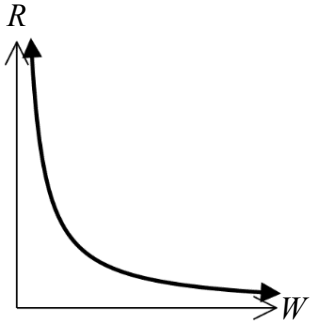
C.



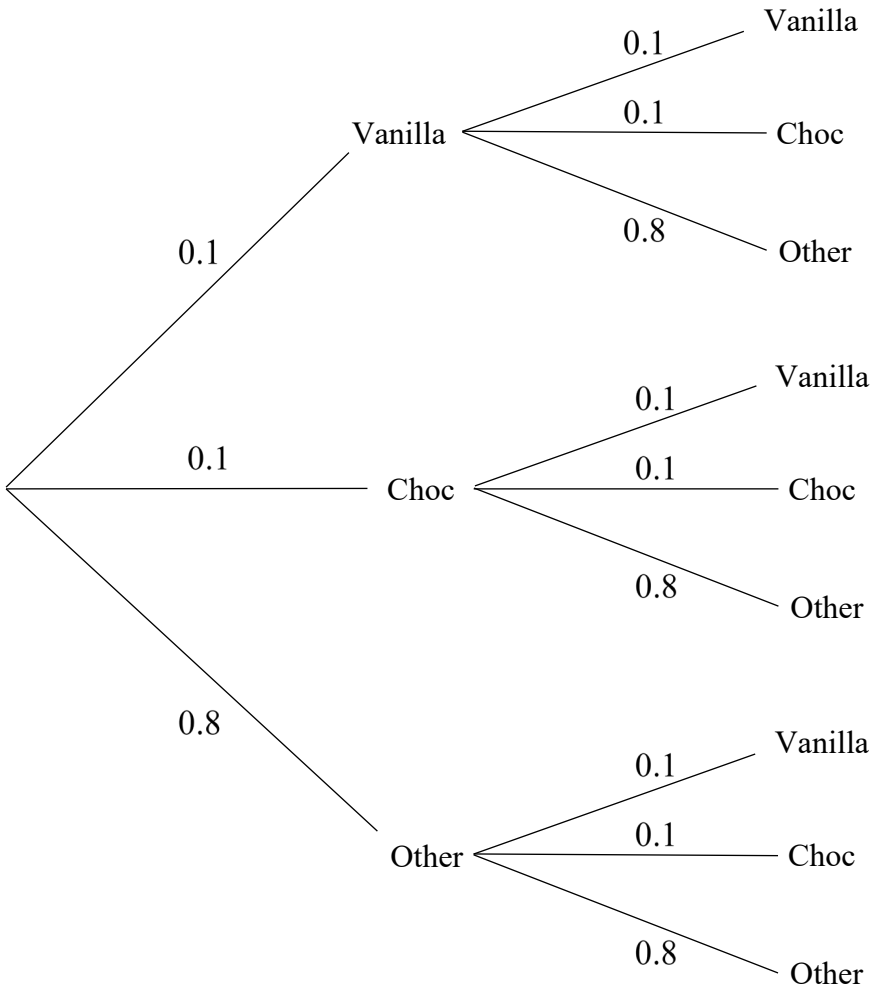
B.



D.



7 An ice cream shop has 10 flavours available, including choc and vanilla. Archer asks for two scoops of ice cream. A probability tree has been drawn to represent this.



What is the probability that Archer will get one scoop of choc and one scoop of vanilla?

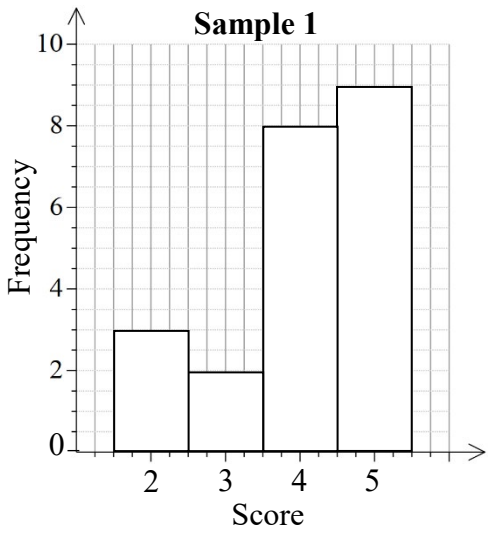
A. 0.01

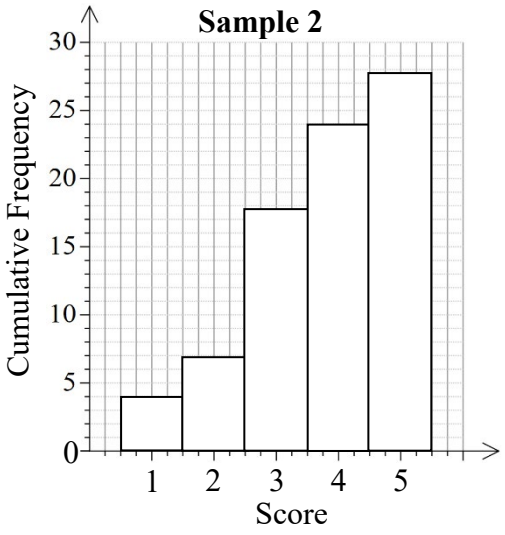
B. 0.02

C. 0.1

D. 0.2

8 Paul is comparing two samples of data taken from the same population, displayed in the histograms below.





Which one of the following statements about these two samples is true?

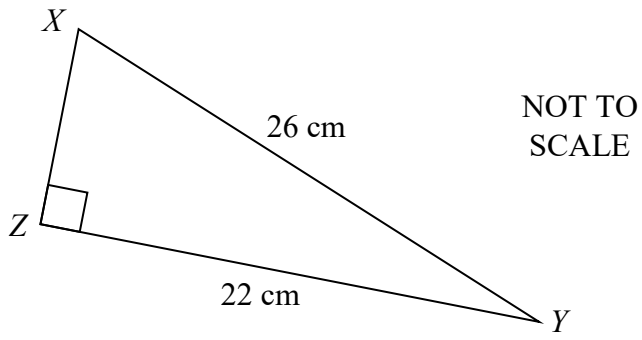
A. The two samples are the same size.

B. The range for the two samples is the same.

C. The frequency of 2 was the same in both samples.

D. Both samples are positively skewed.

9 What is the size of angle Y, to the nearest degree?



A. 14°

B. 32°

C. 40°

D. 58°

10 Which of the following correctly expresses b as the subject of $D = \sqrt{b^2 - 4ac}$?

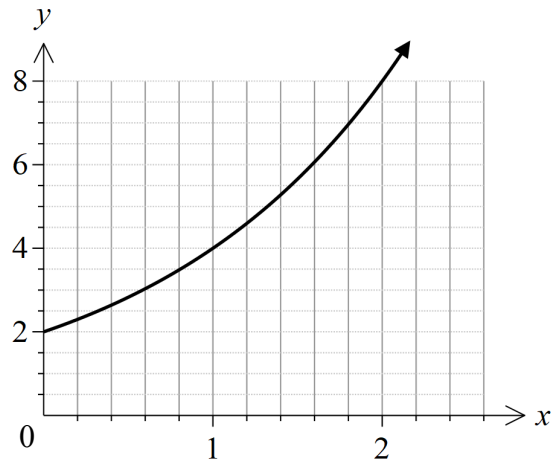
A. $b = \pm\sqrt{D^2 + 4ac}$

B. $b = D^2 + 4ac$

C. $b = D \pm 2\sqrt{ac}$

D. $b = \pm\sqrt{D + 2ac}$

11 Consider the graph shown.



Which one of the following could be the equation of the graph?

A. $y = 2x^2$

B. $y = \dfrac{4}{x}$

C. $y = 4x$

D. $y = 2(2)^x$

12 Two dogs, Anders and Bertil are out in the park with their owner. Anders runs with an average speed of 3 m/s, and Bertil runs with an average speed of 184 m/min. Both dogs run to their owner, who is 350 metres away from the two dogs.

After 2 minutes, which one of the following statements is true?

A. The two dogs have arrived at their owner and got there at the same time.

B. Both dogs have arrived at their owner; Bertil got there before Anders.

C. Both dogs have arrived at their owner; Anders got there before Bertil.

D. Both dogs are still a distance from their owner.

13 Flynn used his new credit card to buy a coffee table for $329 and 4 chairs for $49 each, on 21st May 2021. There was no interest-free period and he made no other purchases with his credit card. Interest was **compounded daily** at a rate of 0.06% per day, including the date of purchase and the date of payment.

What amount did Flynn pay when he paid the account in full on 3rd June 2021?

A. $526.12

B. $526.21

C. $529.11

D. $529.43

14 Naia is driving her car at a speed of 45 km/h, when she sees an obstruction in the road and applies the brakes. Her reaction time, before applying the brake, is 1.4 seconds. Her car's stopping distance is 33.5 metres.

What is her car's braking distance?

A. 12.5 m

B. 16 m

C. 17.5 m

D. 21 m

15 A table of future value interest factors for an annuity of $1 is shown.

Period	Interest rate per period				
	1%	2%	3%	4%	5%
1	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	2.0400	2.0500
3	3.0301	3.0604	3.0909	3.1216	3.1525
4	4.0604	4.1216	4.1836	4.2465	4.3101
5	5.1010	5.2040	5.3091	5.4163	5.5256
6	6.1520	6.3081	6.4684	6.6330	6.8019

Mr Pearce invests in an annuity, depositing $850 at the end of each year for 4 years, at a rate of 3% per annum.

How much interest will Mr Pearce earn on this annuity?

A. $156.06

B. $850.00

C. $3556.06

D. $11 321.07

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2021

Question Numbers
16-22

Booklet 1

Instructions

- **Complete all boxes** on the front cover of your writing booklet.
- Write using black pen.

Section II

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

Assume 52 weeks in a year, and 365 days in a year where necessary.
Your responses should include relevant mathematical reasoning and/or calculations.

Start a new writing booklet for each Booklet section (1-5).
In your writing booklet, clearly indicate which question you are answering.

Booklet 1: Questions 16 – 22 (17 marks)

Question 16 (2 marks)

Tom buys a 150-watt fridge. Electricity costs $0.23 per kWh. **2**

How much will it cost to run Tom's fridge for 24 hours?

Question 17 (2 marks)

The coordinates of island Lagog are 13° N, 128° W. The island Gog is also on latitude 13° N and the time in Gog is 3 hours behind Lagog. **2**

On which meridian of longitude does Gog lie? (1 hour time difference =15°)

Question 18 (1 mark)

Sarah rolled a standard 6-sided die and recorded the number on the upturned face. **1**

If she rolled the die 48 times, how many times could she expect the number 2 to come up?

Question 19 (2 marks)

Luka purchased 250 shares in July 2020. In December 2020 he received a dividend of $1.28 per share, when the market value of his shares had fallen to $8125. **2**

Calculate the percentage dividend yield of his shares to one decimal place.

Question 20 (2 marks)

A group of 120 people were surveyed and the results recorded.

	Prefers cats	*Prefers dogs*	*Total*
Male	16	42	58
Female	31	31	62
	47	73	120

A person is chosen at random from the surveyed group.

(a) What is the probability the person selected prefers dogs? **1**

(b) What is the probability that the person selected is a female who prefers cats? **1**

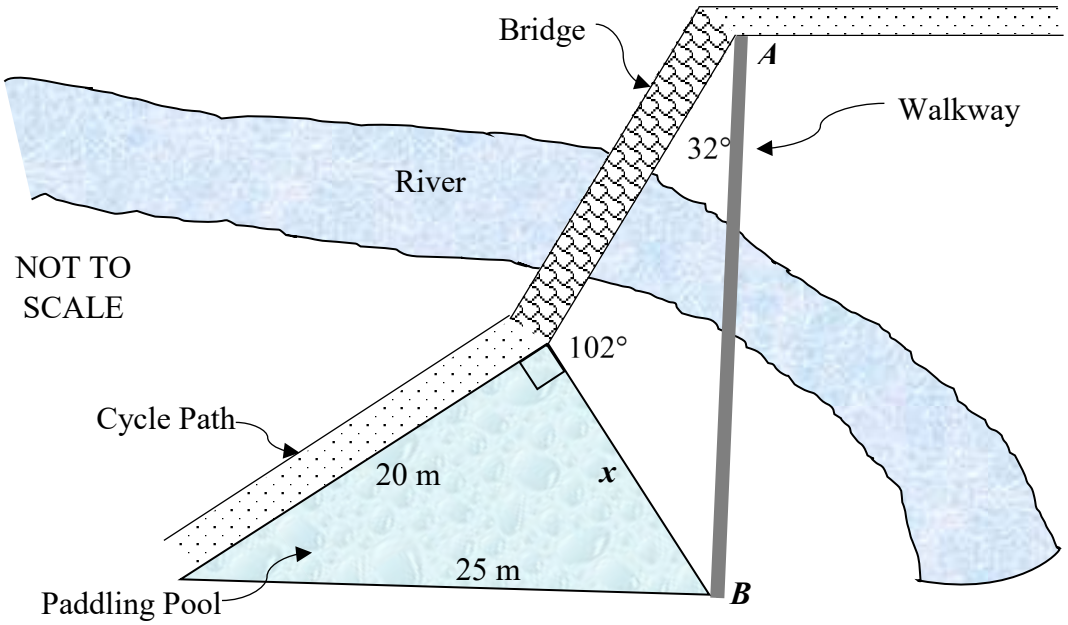
Question 21 (3 marks)

(a) A television costs $3190, inclusive of GST at 10%. How much GST is included? **1**

(b) The same television is reduced from $3190 to $2392.50, in a sale. What was the percentage discount applied? **2**

Question 22 (5 marks)

A cycle path crosses a river via a bridge, as shown. On one side of the bridge there is a triangular paddling pool. In addition to the bridge for cyclists, there is a walkway for pedestrians.



(a) Use Pythagoras' Theorem to show that the side of the paddling pool, x, is 15 metres. **2**

(b) Use the Sine Rule to find the length of the walkway (***AB***). Give your answer correct to the nearest metre. **3**

End of Booklet 1

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Question Numbers
23-26

Booklet 2

Instructions

- **Complete all boxes** on the front cover of your writing booklet.
- Write using black pen.

Start a new writing booklet.
In your writing booklet, clearly indicate which question you are answering.

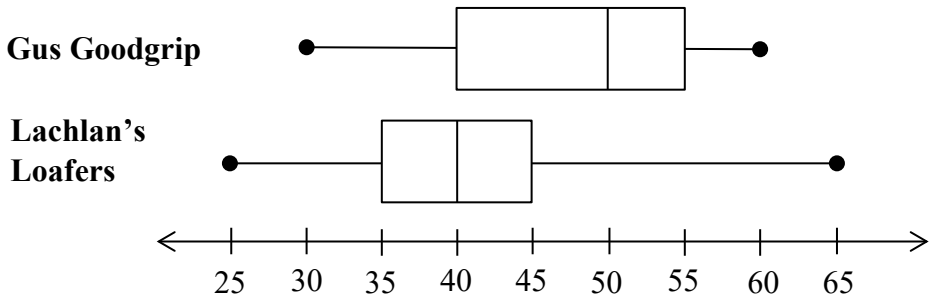
Booklet 2: Questions 23 – 26 (17 marks)

Question 23 (3 marks)

Solve the equation $\frac{2x-1}{5} = 3$ **3**

Question 24 (4 marks)

Two competing shoe shops, Gus Goodgrip and Lachlan's Loafers, analysed their daily sales results over a 28-day period. The results are shown in the box plots below.



Pairs of shoes sold daily

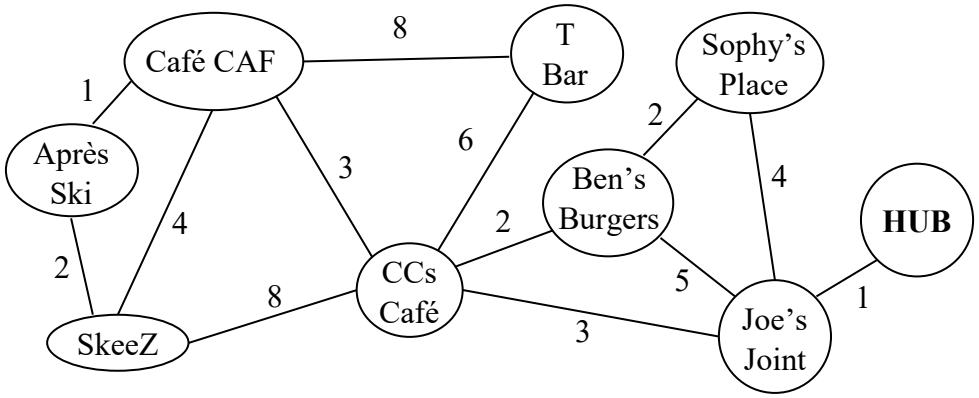
(a) Which of the shoe shops sold more shoes daily, on average? **1**

(b) What is the interquartile range for Gus Goodgrip? **1**

(c) On how many **days** did Lachlan's Loafers sell up to 35 pairs of shoes? **2**

Question 25 (5 marks)

Repisher ski resort has a number of cafés on the slopes. Cables are required to connect the cafés to a broadband hub in the town. In the network diagram below, each vertex is a café, and each weighted edge represents a possible cable connection, and the cost of installing it in thousands of dollars.



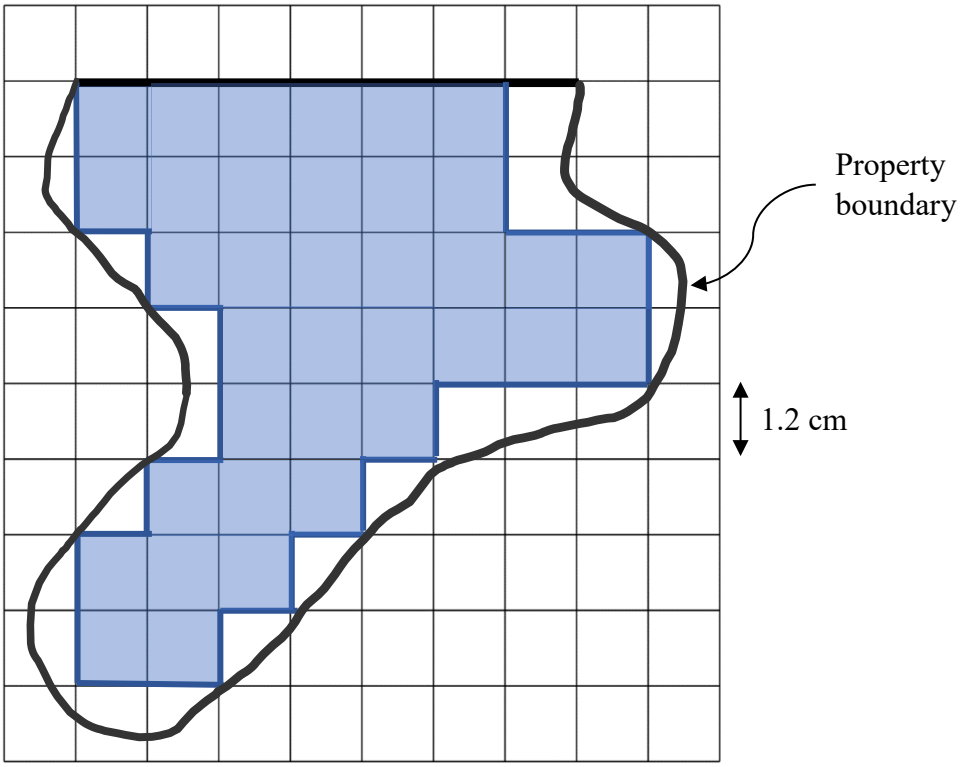
(a) Draw a minimum spanning tree, including edge weights. **2**

(b) What is the minimum cost to connect all of the cafés and the hub? **1**

(c) If Ben's Burgers closed down (before the cables were installed), would the minimum cost to connect all other cafés and the hub increase, decrease, or not change? Explain your answer. **2**

Question 26 (5 marks)

Alex wants to estimate the area of his new property, so he drew a sketch of the property and laid it over a grid, as shown below. He then counted 36 completely filled squares and shaded them blue.



(a) Alex calculated the scale of his grid as 1 : 8000. **1**

Show that the side length of each grid square is 96 metres in reality.

(b) The grid-square method of estimating area uses the formula **2**

$$\text{Area} = (\text{Area of 1 square}) \times \left[(\text{completely filled squares}) + \left(\frac{\text{partly filled squares}}{2}\right)\right]$$

Use the grid square method to estimate the area of Alex's property, giving your answer in square metres.

(c) Alex will irrigate his property with water at a rate of 3.5 megalitres per hectare over a 14-week season. **2**

How many megalitres of water will Alex need each week? Give your answer to the nearest megalitre.

End of Booklet 2

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2021

Question Numbers
27-30

Booklet 3

Instructions

- **Complete all boxes** on the front cover of your writing booklet.
- Write using black pen.

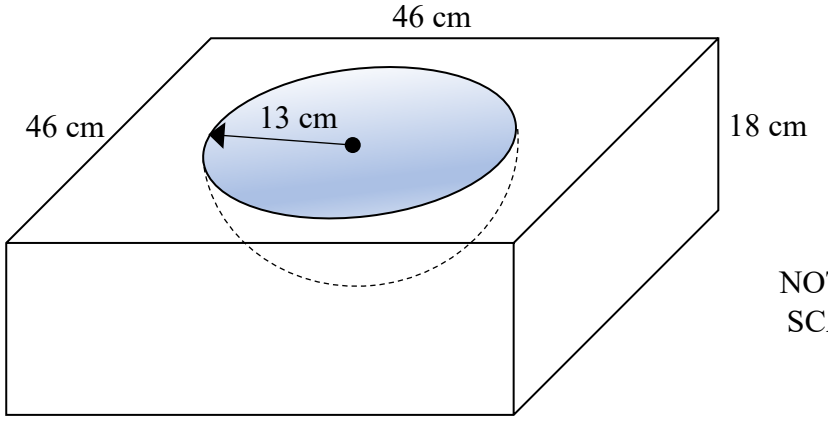
Start a new writing booklet.
In your writing booklet, clearly indicate which question you are answering.

Booklet 3: Questions 27 – 30 (17 marks)

Question 27 (3 marks)

Paul designed a bird bath in the shape of a rectangular prism with a hemispherical bowl cut out of the centre of it. The hemispherical bowl has a radius of 13 cm. **3**

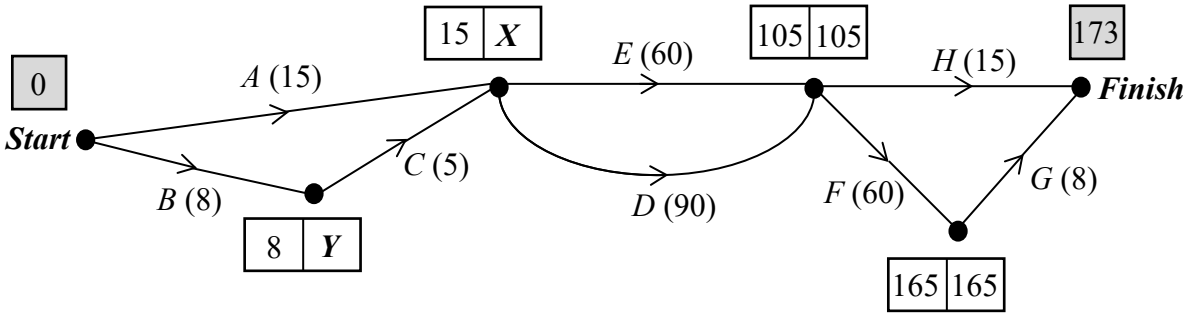
Paul's design is shown below.



What is the volume of concrete required to make the birdbath? Give your answer to the nearest cubic centimetre.

Question 28 (4 marks)

Sophie's friend Nick is going to help her lop a tree in her garden and tidy up the garden afterwards. The network diagram shows the activities *A* through to *G,* which must be completed, along with times in minutes.



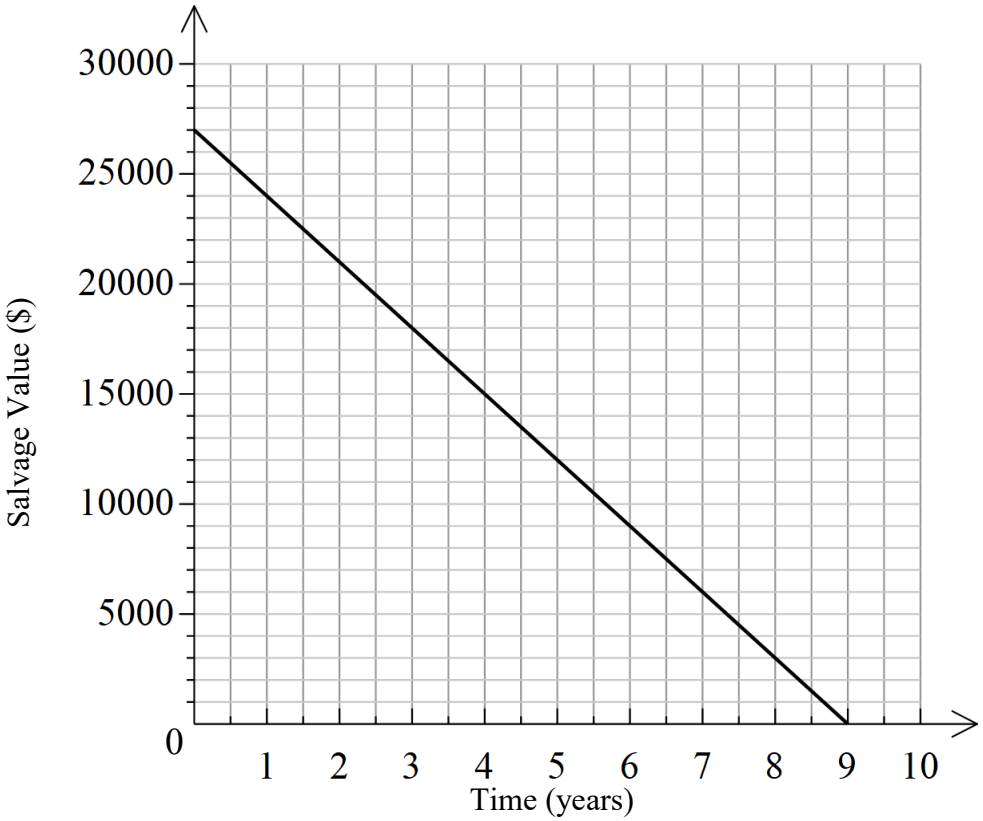
(a) Earliest Start Times (EST) are shown in the left-hand side of each box shown in the diagram, and Latest Start Times (LST) are in the right-hand side. Find the values *X* and *Y*. **2**

(b) Hence determine the critical path. **1**

(c) What is the float time for activity *B*? **1**

Question 29 (6 marks)

Tom bought a new car in 2008. The value of his car depreciated according to the graph shown.



(a) What was the value of Tom's car when he bought it? **1**

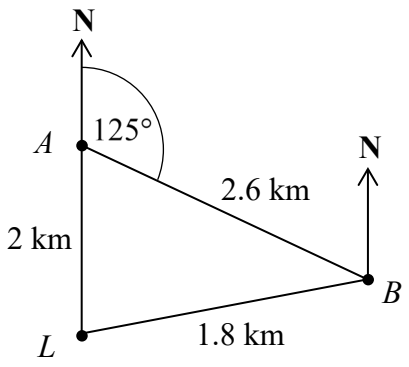
(b) Use the graph to find the salvage value of Tom's car after 5 years. **1**

(c) What was the annual percentage rate of depreciation of Tom's car, correct to 2 decimal places? **2**

(d) What is the equation which relates the salvage value, S, to the number of years, n, shown by the line on the graph? **2**

Question 30 (4 marks)

Ryan sails 2.6 km in his yacht, from a harbour, A, to a beach, B, on a bearing of 125° . Jock travels 1.8 km from his launch point, L, to the same beach in his motorboat. His launch point is 2 km directly south of the harbour (A). This information is shown in the diagram below.



NOT TO SCALE

(a) Use the Cosine Rule to find angle ABL, correct to the nearest degree. **2**

(b) When Jock leaves the beach (B), what is the bearing he must set out on, to return directly to his launch point (L)? **2**

End of Booklet 3

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2021

Question Numbers
31-34

Booklet 4

Instructions

- **Complete all boxes** on the front cover of your writing booklet.
- Write using black pen.

Start a new writing booklet.
In your writing booklet, clearly indicate which question you are answering.

Booklet 4: Questions 31 – 34 (17 marks)

Question 31 (5 marks)

The table shows the income tax rates for the 2019 - 2020 financial year.

Taxable income	*Tax on this income*
0–$18 200	Nil
$18 201–$37 000	19c for each $1 over $18,200
$37 001–$90 000	$3,572 plus 32.5c for each $1 over $37,000
$90 001–$180 000	$20 797 plus 37c for each $1 over $90,000
$180 001 and over	$54,097 plus 45c for each $1 over $180,000

In the 2019 - 2020 financial year, Zac had a taxable income of $108 340. Medicare levy was calculated at 2% of taxable income.

(a) Calculate Zac's total tax payable (including Medicare levy). **3**

(b) Each month of the year, he paid $2400 in Pay As You Go (PAYG) tax. **2**

Did Zac receive a tax refund, or a tax bill, and how much was it? Justify your answer with suitable calculations.

Question 32 (2 marks)

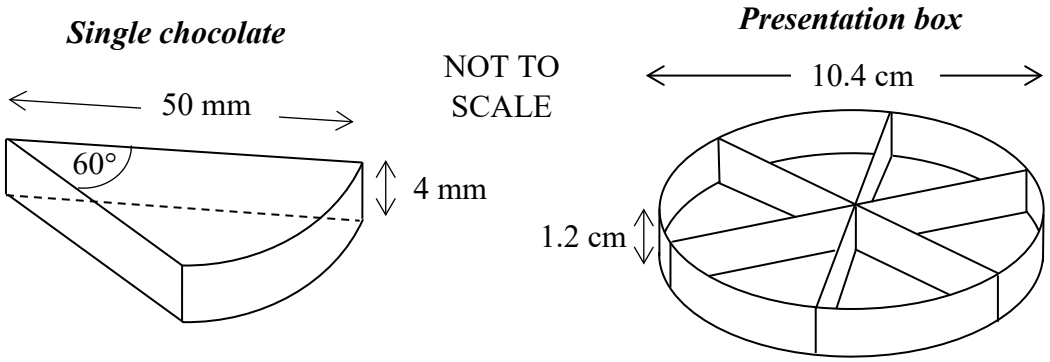
Finn is travelling from Nodnol to Sirap, which is 8 hours behind Nodnol. Finn's flight takes 12 hours and arrives in Sirap at 7 p.m. on Saturday. **2**

What is the day and time in Nodnol, when the flight **leaves** Nodnol?

Question 33 (7 marks)

Chocolates are sold in a box which contains two layers of six equally sized chocolates. The cylindrical presentation box has diameter 10.4 cm and height 1.2 cm.

A diagram of a single chocolate is shown, along with the presentation box.



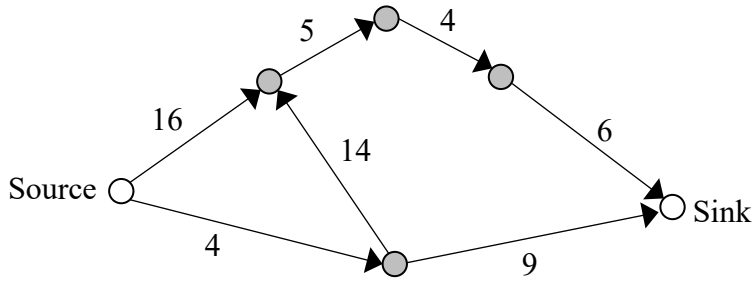
(a) The circular base, the inserts and the curved surface of the presentation box are made of cardboard. **4**

What is the area of cardboard needed to make a single presentation box? Give your answer to one decimal place.

(b) What volume of chocolate is required to make the twelve chocolates for one presentation box, to the nearest cubic centimetre? **3**

Question 34 (3 marks)

A network diagram is shown.



(a) Copy the network diagram into your writing booklet and draw on it a minimum cut. **2**

(b) Determine the maximum flow capacity of this network. **1**

End of Booklet 4

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Year 12
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2021

Question Numbers
35-38

Booklet 5

Instructions

- **Complete all boxes** on the front cover of your writing booklet.
- Write using black pen.

Start a new writing booklet.
In your writing booklet, clearly indicate which question you are answering.

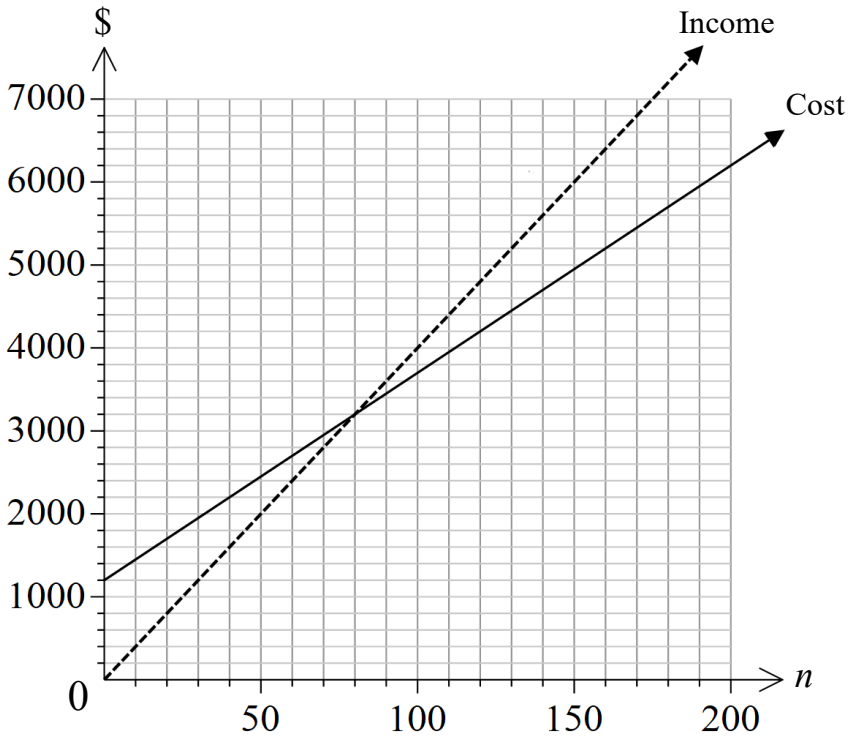
Booklet 5: Questions 35 – 38 (17 marks)

Question 35 (2 marks)

Sam is organising an event to raise money for his favourite charity. He knows that it will cost $1200 to hire a marquee with seating and tables. Catering will cost $25 per person.

Sam plans to charge $40 a ticket.

The graph shows the cost when n people attend the function and Sam's income from ticket sales to n people.

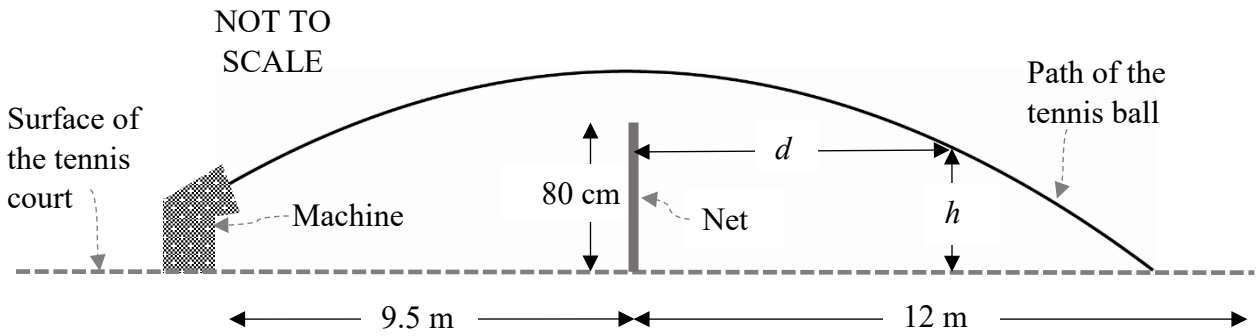


(a) How many tickets must Sam sell to break even? **1**

(b) Use the graph to find the profit Sam will make if 160 people attend the event. **1**

Question 36 (4 marks)

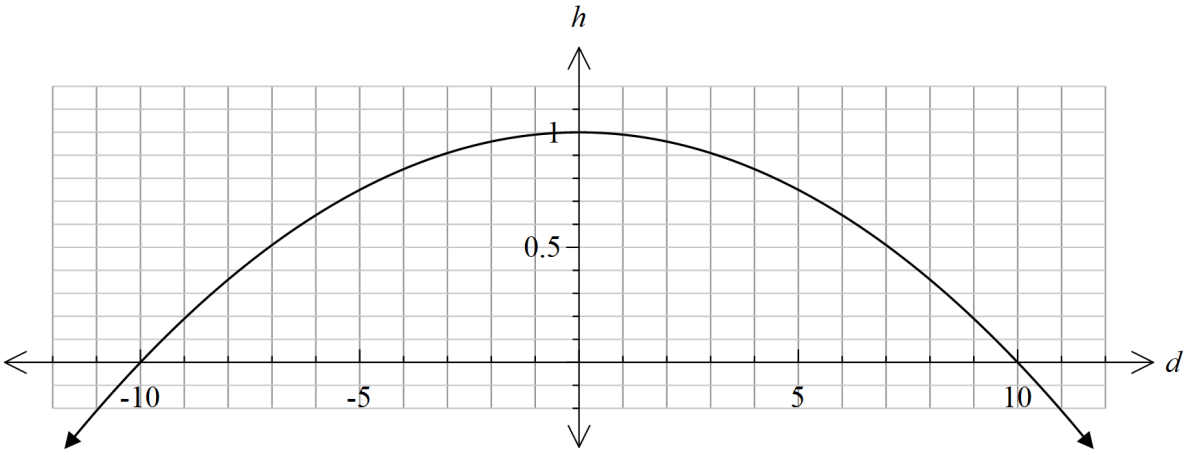
A machine, for players who wish to practise, propels tennis balls over an 80 cm high tennis net.



The path of the tennis ball can be modelled with the equation

$$h = 1 - \frac{1}{100}d^2,$$

where h is the height in metres of the tennis ball above the tennis court, and d is the horizontal distance in metres of the tennis ball from the net. This relationship is graphed below.



(a) What is the vertical distance between the tennis ball and the top of the net when the tennis ball is directly above it? **1**

(b) How far is the ball from the base of the net when it first bounces on the court? **1**

(c) Use the graph to find the height above the court that the tennis ball will be, when the horizontal distance of the ball from the base of the net is 3 metres. **1**

(d) Explain why values of d which are **less than** –9.5 on the graph are not relevant in this context. **1**

Question 37 (5 marks)

Morish Muesli is sold in 400-gram packets. A batch of 1200 packets of the muesli is normally distributed, with a mean mass of 402 grams and a standard deviation of 3 grams.

(a) What percentage of packets will weigh less than 393 grams? **2**

(b) How many of this batch of packets will weigh between 405 grams and 408 grams? **3**

Question 38 (6 marks**)**

The present value of a $1 annuity at different rates and for different periods is shown in the table.

Present values of $1						
	Interest rates (per period)					
Period	**0.50%**	**0.60%**	**0.70%**	**0.80%**	**0.90%**	**1.00%**
48	42.5803	41.5988	40.6486	39.7284	38.8372	37.9740
60	51.7256	50.2621	48.8559	47.5042	46.2047	44.9550
72	60.3395	58.3253	56.4041	54.5710	52.8212	51.1504
84	68.4530	65.8300	63.3463	60.9933	58.7632	56.6485
96	76.0952	72.8149	69.7310	66.8300	64.0995	61.5277
108	83.2934	79.3159	75.6030	72.1345	68.8918	65.8578
120	90.0735	85.3666	81.0035	76.9552	73.1955	69.7005

(a) Charlie took out a loan of $24 600 to buy a car. He repaid the loan in equal monthly instalments over 5 years, at an interest rate of 0.70% per period. **2**

Use the table to calculate the amount of each monthly repayment.

(b) What is the total amount Charlie will repay for this loan? **1**

(c) Neo wants to have $17 000 in 4 years, to pay for a round the world trip he is planning to take. He invests a monthly amount into an annuity, with an interest rate of 6% per annum (0.50% per month). **3**

What is the monthly instalment he must make, to have $17 000 at the end of 4 years?

End of Paper

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