SHORE

School Exam No: | | | |

Set: | |

Year 12
Mathematics Standard 2
Trial HSC Examination
August 2022

General Instructions

- Reading time − 10 minutes
- Working time − $2\frac{1}{2}$ hours
- Write using black pen
- Questions 1 to 15 are to be answered on the multi-choice answer sheet provided
- Questions 16 to 40 are to be answered in the booklets provided
- NESA reference sheet is provided
- Students can use an approved scientific calculator and other appropriate equipment.
  No other materials such as class notes, textbooks or any other reference materials are permitted

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

Total marks – 100

Section I Pages 2 – 8

15 marks

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

Section II Pages 9 – 48

85 marks

- Attempt Questions 16 to 40 in the 5 booklets provided
- Booklets 1 to 5 are each worth 17 marks
- Allow about 2 hours 5 minutes for this section

DO NOT REMOVE THIS PAPER FROM THE EXAMINATION ROOM

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 Which set of data is classified as numerical and continuous?

A. 3 pets, 4 pets, 6 pets

B. low income, middle income, high income

C. red, orange, yellow

D. 1.1 m, 2 m, 4.32 m

2 What is 3 456 000 000 written in scientific notation correct to 2 significant figures?

A. 3.46×10^{7}

B. 3.5×10^{8}

C. 3.46×10^{9}

D. 3.5×10^{9}

3 Lynda works as a shop assistant, earning $22.40 per hour. When she works on Sundays she is paid overtime at time-and-a-half.

In a week where Lynda worked a total of 40 hours, of which 8 hours were on the Sunday, how much would she be paid?

A. $896.00

B. $985.60

C. $1075.20

D. $1164.80

4 Which of the following events would be MOST likely to occur?

A. Randomly selecting a vowel (A, E, I, O or U) from the 26 letters of the alphabet.

B. Getting an ace when selecting a single card from a standard pack of 52 cards.

C. A student selected randomly, having their birthday in the month of June.

D. Rolling two dice and obtaining a sum of 2.

5 Young's formula, shown below, is used to calculate the dosage of medication for children aged 1−12 years, based on the adult dosage.

$$D = \frac{yA}{y + 12}$$

Where D = dosage for children aged 1−12 years
y = age of child (in years)
A = Adult dosage

The dosage of a medication for a 5-year-old child is 15 mg. What is the adult dosage of this medication?

A. 51 mg

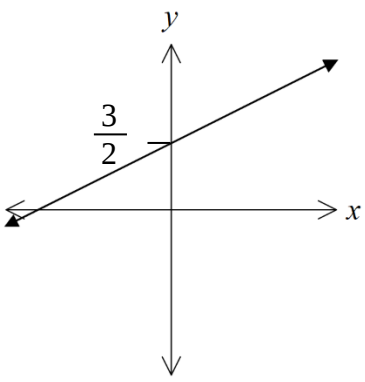
B. 75 mg

C. 92 mg

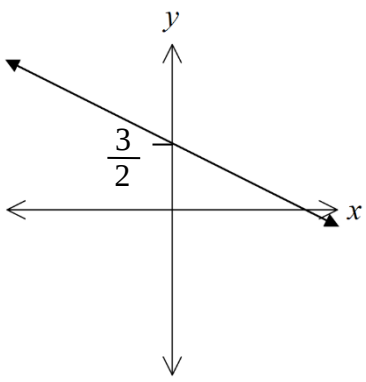
D. 170 mg

4 Which one of the following could be the graph of $x + 2y - 3 = 0$?

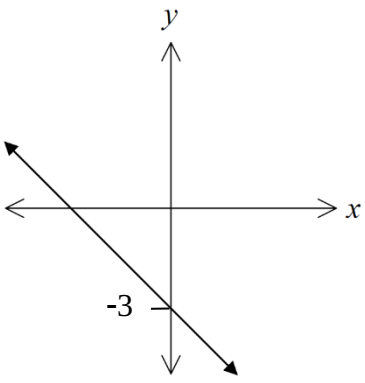
A.



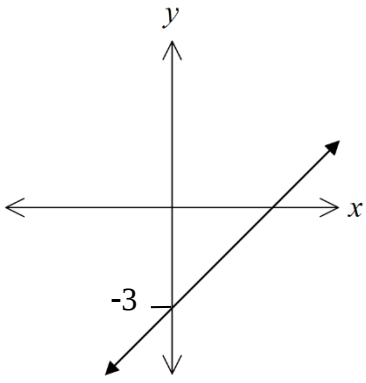
B.



C.



D.



4 In New Zealand, a television costs $2994.60, including 15% GST.

What is the GST on the television?

A. $390.60

B. $449.19

C. $2545.41

D. $2604.00

5 Naia was prescribed medication which was available in the concentration 6 mg/5 mL.

For how many days will a 200 mL bottle of the medication last, if she takes 15 mg of the medication once a day?

A. 2.5

B. 12.5

C. 16

D. 40

4 Henry invested $3000 into an account paying simple interest at a rate of 2.5% per annum, for 18 months.

What will be the value of Henry's investment at the end of 18 months?

A. $112.50

B. $1350

C. $3112.50

D. $4350

5 George purchased a new printer for his business eight years ago. He uses the straight-line method of depreciation to calculate that the current salvage value of his printer is $2800.

If the purchase price of the printer was $32 000, what was the amount of depreciation each year, expressed as a percentage of the purchase price, to one decimal place?

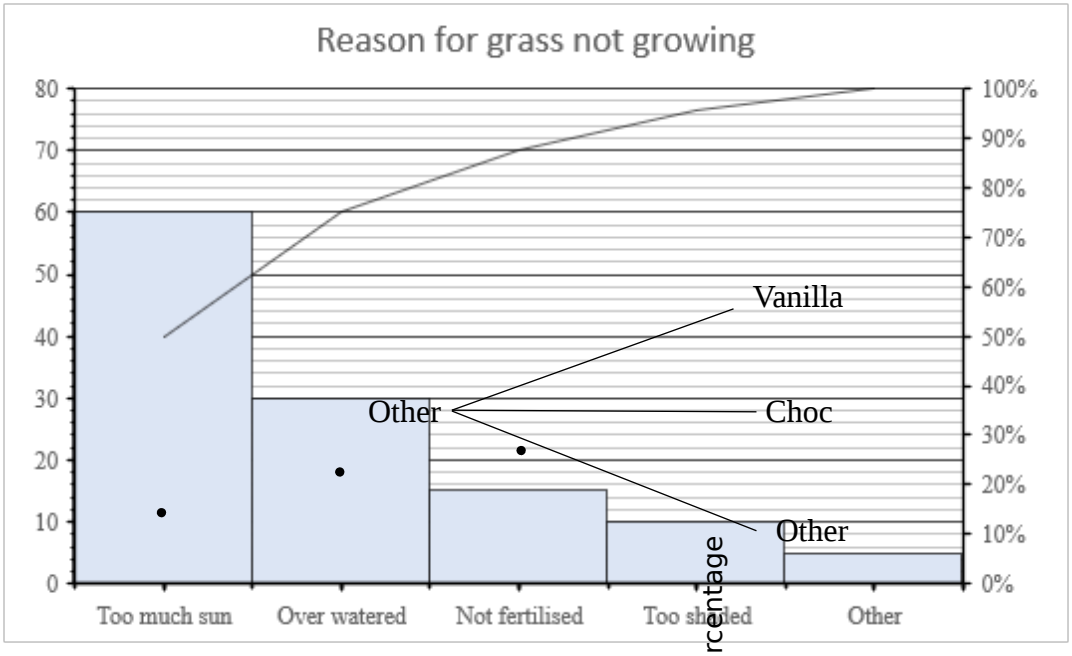
A. 8.8%

B. 11.4%

C. 12.5%

D. 13.6%

6 The pareto chart shows data collected for 120 lawns, and the reason for the grass not growing.



What percentage of lawns had grass not growing because they were over watered?

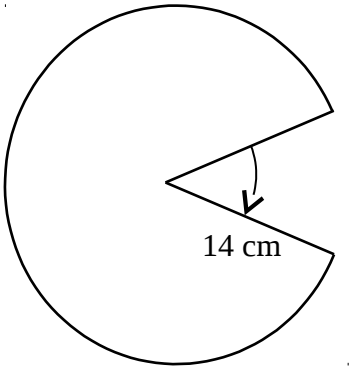
A. 17%

B. 25%

C. 30%

D. 38%

6 What is the perimeter of the sector shown below, correct to 2 decimal places?



A. 8.55 cm

B. 36.55 cm

C. 79.41 cm

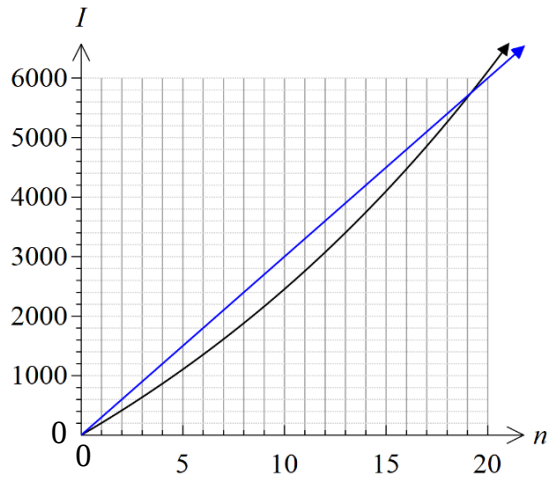
D. 107.41 cm

7 Laura compared two investment accounts. One account offered compound interest at a rate of 4% p.a., compounding monthly and the other offered simple interest at 6% p.a.

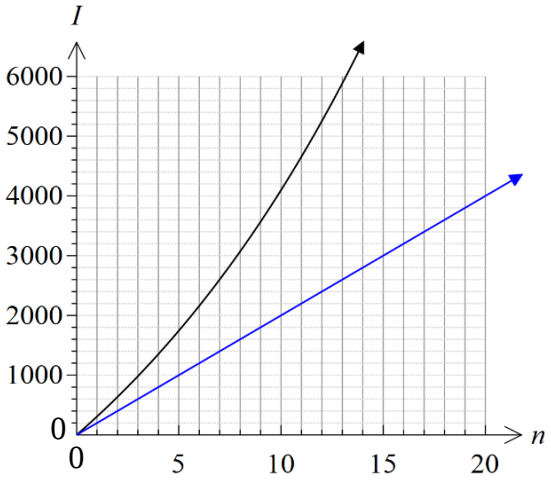
Laura was given a graph showing the **amount of interest** she would earn on her intended investment after n years, with both the simple interest account and the compound interest account shown.

Which graph was Laura given?

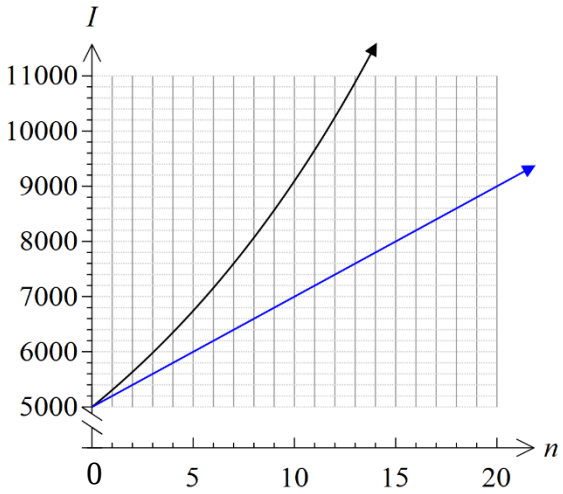
A.



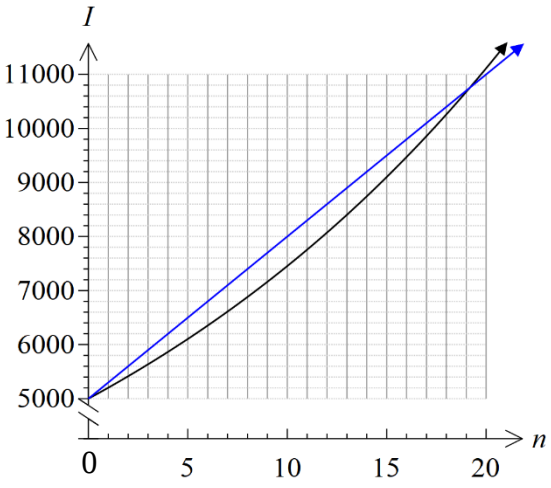
B.



C.

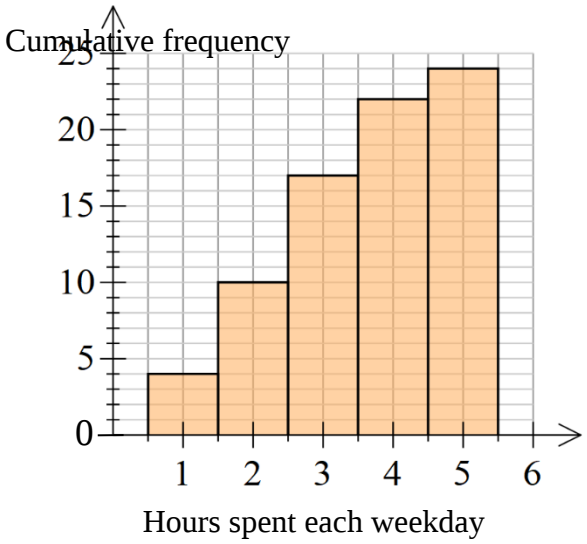


D.



5 Rob selected a stratified sample from Year 10, Year 11 and Year 12 at his school, He asked each student in the sample how many hours (to the nearest hour) each weekday they spent on their mobile phones.

He drew a cumulative frequency histogram from the data he collected, shown below.



The sum of students in Year 10, 11 and 12 is 240.
The students who answered 1 hour or 2 hours were all Year 12 students.
Students answering 3, 4 or 5 hours were all Year 10 or Year 11 students.

How many Year 12 students are there at Rob's school?

A. 24

B. 34

C. 100

D. 140

8 Cameron used the tax table shown below to correctly calculate that he must pay $38 717 in income tax for the financial year.

Taxable income	*Tax on this income*
0-$18 200	Nil
$18 201-$45 000	19c for each $1 over $18,200
$45 001-$120 000	$5092 plus 32.5c for each $1 over $45 000
$120 001-$180 000	$29 467 plus 37c for each $1 over $120 000
$180 001 and over	$51667 plus 45c for each $1 over $180 000

He must also pay a Medicare levy at 2% of his taxable income.

What is the total amount of tax (income tax and the Medicare levy) that Cameron must pay for the financial year, to the nearest dollar?

A. $39 491

B. $41 378

C. $41 617

D. $43 792

SHORE

School Exam No: | | | |

Set: | |

Year 12
Mathematics Standard 2
Trial HSC Examination 2022

Date

Question Numbers
16-21

Booklet 1

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.

Section II

85 marks
Attempt Questions 16–39
Allow about 2 hours and 5 minutes for this section

Answer the questions in the spaces provided.

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

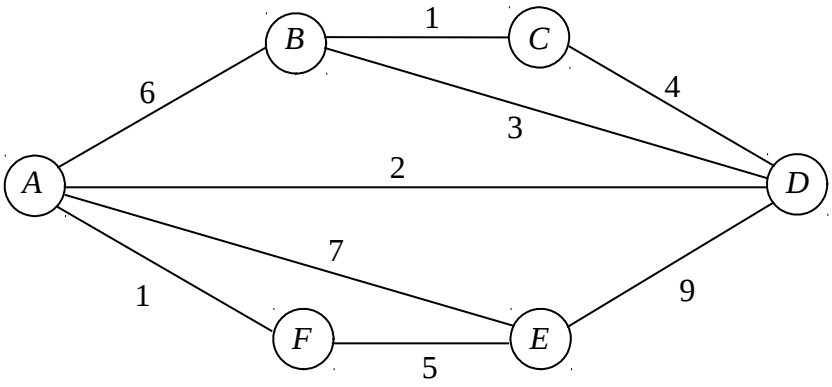
Extra writing space is provided at the end of each question booklet. If you use this space, clearly indicate which question you are answering.

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

Booklet 1: Questions 16 – 21 (17 marks)

Question 16 (2 marks) **Marks**

A network diagram is shown, with vertices *A* to *F*, including weighted edges.



(a) What is the sum of the degrees of vertices *A*, *B* and *C*?

1

.....

.....

(b) State the vertices which identify the shortest path from *E* to *B*.

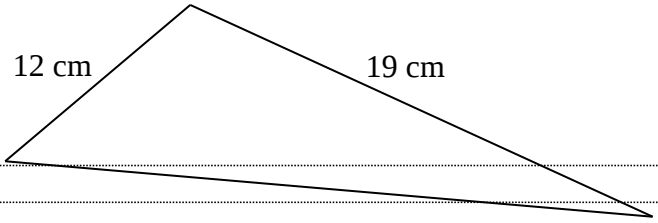
1

.....

.....

Question 17 (2 marks)

Find the area of the triangle shown, to the nearest square centimetre. **2**



Question 18 (4 marks)

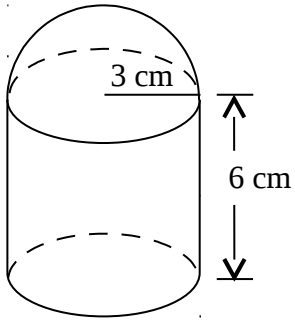
Sam mixed colour pigments into his paint. He used 7 parts blue, 2 parts green and 5 parts violet to get the colour he wanted.

(a) If he uses 10 grams of green pigment, how much violet pigment must he use? **1**

(b) Sam needs to mix pigment into 20 L of paint to make his chosen colour. If he needs 2 grams of violet pigment per litre, what is the total weight of all pigments he will have to mix with the paint? **3**

Question 19 (3 marks)

Finn has designed a solid ornament in the shape of a closed cylinder with a hemisphere which fits exactly on top of it, as shown. The radius of the hemisphere and the cylinder is 3 cm and the height of the cylinder is 6 cm.



NOT TO SCALE

(a) Show that the **volume** of the hemisphere is 18π cm^3 **1**

(b) Show that the **volume** of the cylinder is 54π cm^3 **1**

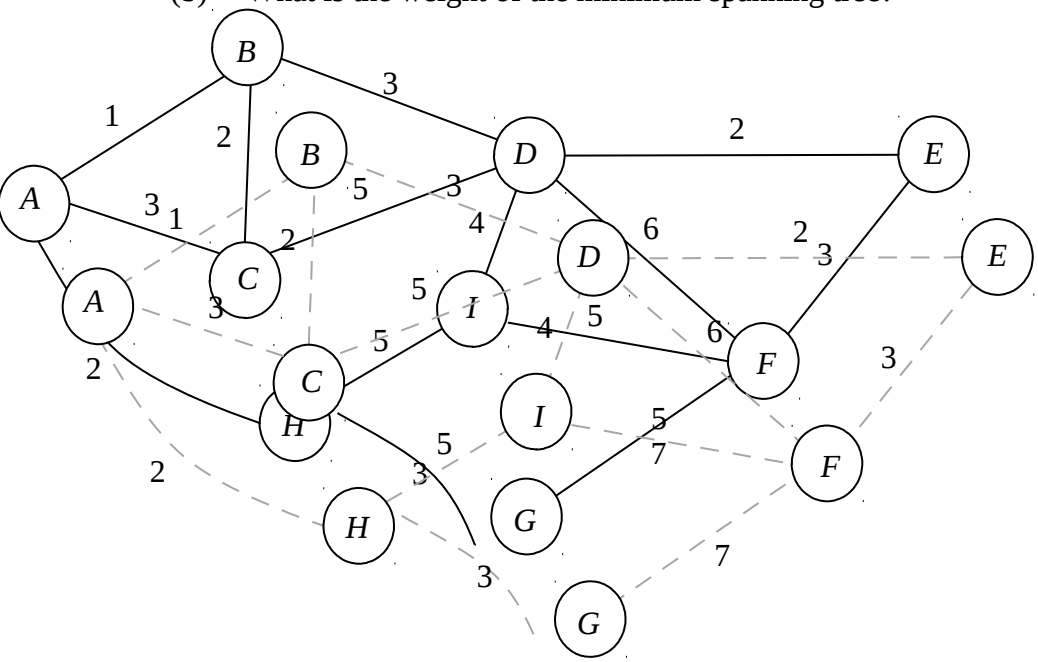
(c) Hence, find the ratio of the volume of the hemisphere, to the volume of the cylinder. Give your answer as a fully simplified ratio. **1**

Question 20 (3 marks)

Consider the network below with vertices *A* to *I*.

(a) Draw a minimum spanning tree on the outline network diagram below. **2**

(b) What is the weight of the minimum spanning tree? **1**



Question 21 (3 marks)

Julian flew from Bora Bora $(16^\circ \text{S}, 150^\circ \text{W})$ to Fiji $(18^\circ \text{S}, 180^\circ \text{E})$. His first flight left Bora **3**
Bora at 6 a.m. on Friday. The total travelling time from Bora Bora to Fiji (including the time spent at airports between flights) was 21 hours 5 minutes.

What was the day and time, locally, when Julian arrived in Fiji? (15° of longitude is equal to a
1 hour time difference).

End of Booklet 1

Questions 16 – 21 Extra writing space
If you use this space, clearly indicate which question you are answering.

……
……

……
……

……
……

……
……

……
……

……
……

……
……

……
……

……
……

……
……

……
……

……
……

……
……

……
……

……
……

……
……

……
……

……

.....

.....

.....

.....

.....

.....

.....

.....

BLANK PAGE

SHORE

School Exam No:

Set:

Year 12
Mathematics Standard 2
Trial HSC Examination
2022

Date

Question Numbers **22-27**

Booklet 2

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.

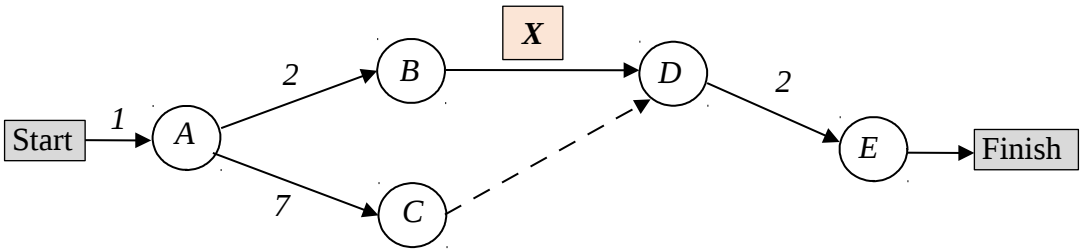
Booklet 2: Questions 22 – 27 (17 marks)

Question 22 (2 marks) **Marks**

Hazel drew up an activity table for a project, made up of 5 tasks, *A* to *E*, as shown.

Task	***Duration (days)***	***Prerequisites Tasks***
A	1	*none*
B	2	*A*
C	7	*A*
D	4	**?**
E	2	*D*

Hazel also drew a network diagram for the project, shown below.



(a) Find the missing 'Prerequisite Tasks' in Hazel's Activity table.

1

.....

.....

(b) What is the value of ***X***, the missing weight on Hazel's network diagram?

1

.....

.....

Question 23 (3 marks)

Jesse organised an outing to the zoo. The total number of children and adults attending the outing is 18. An adult's ticket costs $25 and a child's ticket costs $15.

Jesse writes an equation for the cost of the tickets, using A to be the number of adults and C to be the number of children. The total cost of the tickets is $320, so his equation is:

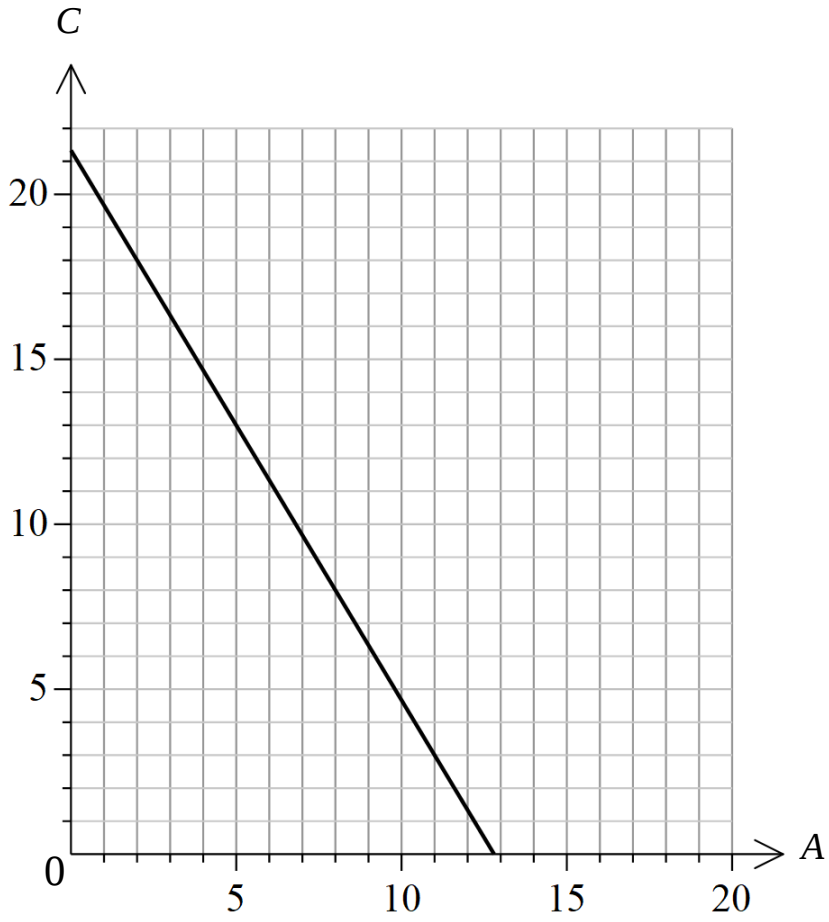
$$25A + 15C = 320$$

(a) Write an equation for the total number of adults (A) and children (C) attending the outing. **1**

.....

.....

(b) Jesse's equation has been graphed below. Graph your equation on the same grid to determine how many **children** went on the outing. **2**



Number of children = _____

Question 24 (4 marks)

James bought a new car for $29 500, which depreciated in the first year by $5015. For the next 6 years, James used the declining-balance method and a rate of depreciation of 15% per annum to find the depreciated value of his car.

(a) What was the rate of depreciation of James' car in the first year?

1

(b) What was the salvage value of James' car at the end of seven years, to the nearest dollar? **3**

Question 25 (3 marks)

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

3

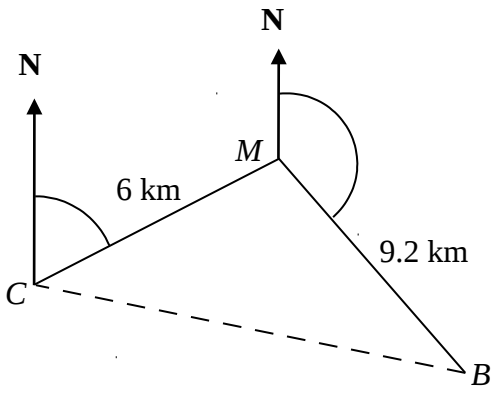
Question 26 (2 marks)

The waiting time for a table in a restaurant varies inversely with the number of staff working in **2** the restaurant. When there are 5 staff working in the restaurant, the waiting time for a table is 14 minutes.

What will be the waiting time if there are 4 staff working in the restaurant?

Question 27 (3 marks)

Gus went on a hike. He set off from the car park (C), on a bearing of 46° and walked for 6 km, to a monument (M). He then walked 9.2 km on a bearing of 121° to a bus stop (B) to catch a bus back to the car park (C). Gus drew a map of his hike, shown below.



NOT TO SCALE

(a) Show that the angle CMB is 105°. **1**

(b) When Gus does his hike there are no buses and he has to walk to the car park. **2**

Find the distance Gus must walk, directly from the bus stop (B) to the car park (C). Give your answer in kilometres to one decimal place.

End of Booklet 2

Questions 22 – 27 Extra writing space
If you use this space, clearly indicate which question you are answering.

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

BLANK PAGE

SHORE

School Exam No: | | | |

Set: | |

Year 12
Mathematics Standard 2
HSC Trial Examination 2022

Date

Question Numbers
28-32

Booklet 3

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.

Booklet 3: Questions 28 – 32 (17 marks)

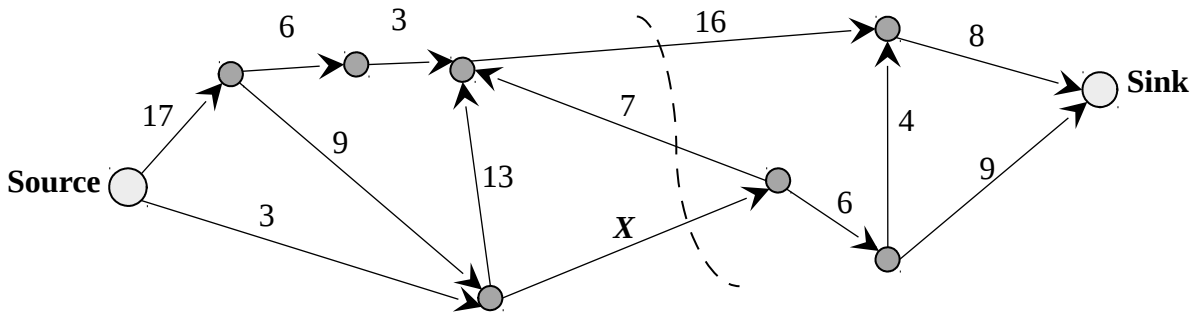
Question 28 (3 marks) **Marks**

(a) If Hugo walks at an average speed of 6 km/h, how long will it take him to walk 10 km? Give your answer in hours and minutes. **1**

(b) Hugo cycled the same distance the next day in 38 minutes. What was his average speed, in km/h, to one decimal place? **2**

Question 29 (2 marks)

A directed network diagram is shown, along with a cut.

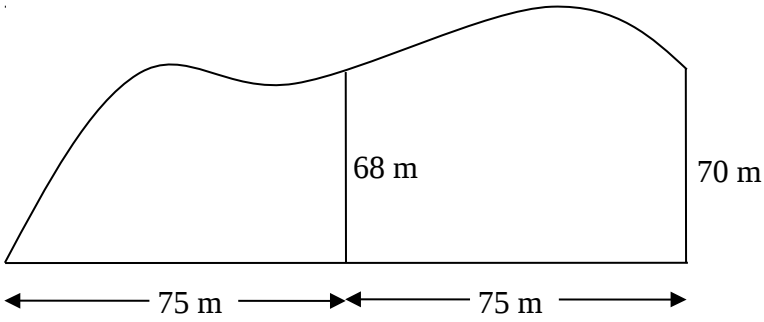


(a) The capacity of the cut shown on the diagram is 24. What is the value of ***X***? **1**

(b) Based on the Maximum Flow/Minimum Cut Theorem, what is the maximum flow capacity of this network? **1**

Question 30 (4 marks)

Fred drew a diagram of his dam, based on an aerial photograph.



NOT TO SCALE

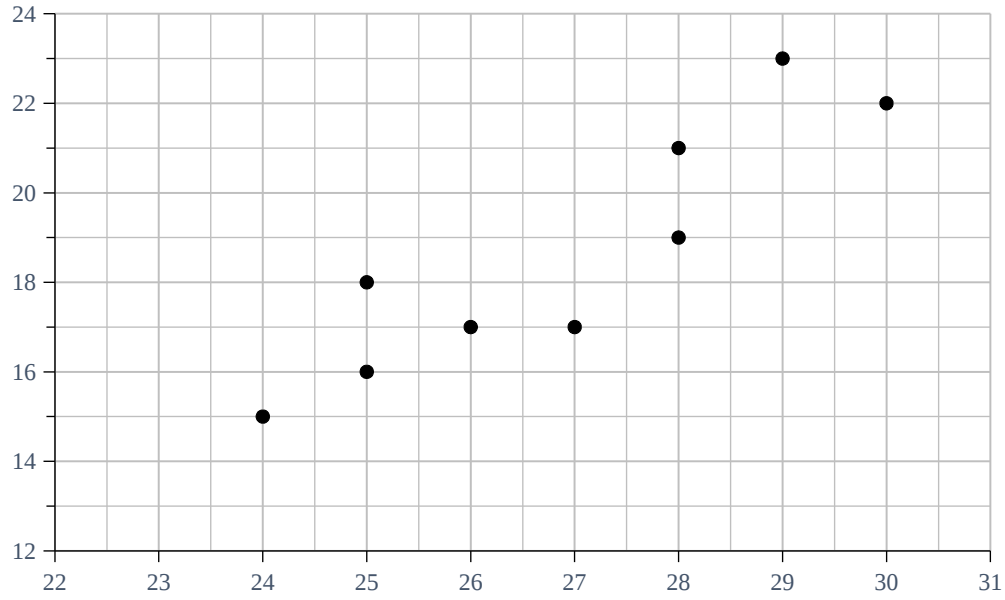
a) Use two applications of the trapezoidal rule to estimate the area of Fred's dam. Give your answer in square metres. **2**

b) In one day, 7 mm of rain falls over the dam. What amount of water is added to the dam on this day, to the nearest kilolitre? **2**

Question 31 (4 marks)

A set of bivariate data was collected by measuring the length of the right foot and the right hand of 9 adult males and recorded in a table.

Right foot length (cm)	24	25	25	26	27	28	28	29	30
Right hand length (cm)	15	16	18	17	17	19	21	23	22



The scatterplot of this data, including the least squares regression line, is shown below.

(a) Use the graph to predict the length of an adult male's right hand, given the length of his right foot is 26 cm. **1**

Right foot length (cm)

.....

(b) Find Pearson's correlation coefficient for this data set to 3 decimal places. **1**

.....

.....

(c) Describe the strength and direction of the correlation between the length of the right foot and the length of the right hand. **1**

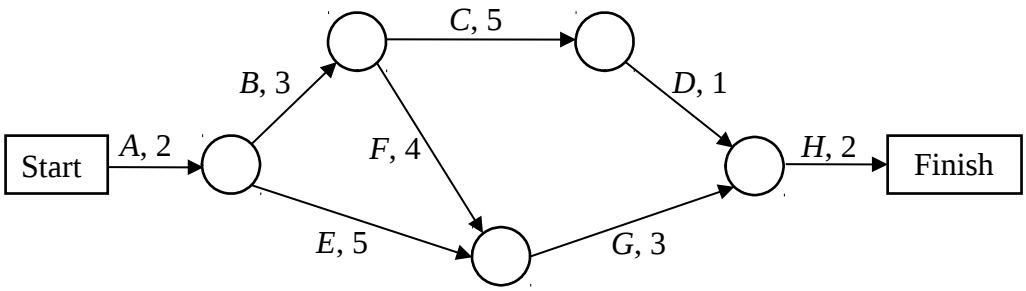
.....

.....

(d) A tenth adult male's right hand and foot lengths are added to the data set. If his right hand length is 19 cm and his right foot length is 23 cm, will this increase or decrease the correlation of the data? **1**

.....

Question 32 (4 marks)
A network diagram is shown, for a project involving activities *A* to *H*. The given weight is the number of days it takes to complete each activity.



(a) Find the minimum number of days required to complete the project. **1**

.....

.....

(b) State the activities which make up the critical path. **1**

.....

.....

(c) What is the float time of activity *E*? **1**

.....

.....

(d) If activity *C* takes 7 days to complete, instead of 5, by how many days would the finish time for the project be extended? **1**

.....

.....

End of Booklet 3

BLANK PAGE

Questions 28 – 32 Extra writing space
If you use this space, clearly indicate which question you are answering.

BLANK PAGE

SHORE

School Exam No:

Set:

Year 12
Mathematics Standard 2
HSC Trial Examination
2022

Date

Question Numbers
33-36

Booklet 4

Instructions

- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.
-

Booklet 4: Questions 33 – 36 (17 marks)

Question 33 (6 marks) **Mark**

Charlie and Bill each borrow money to buy a house.

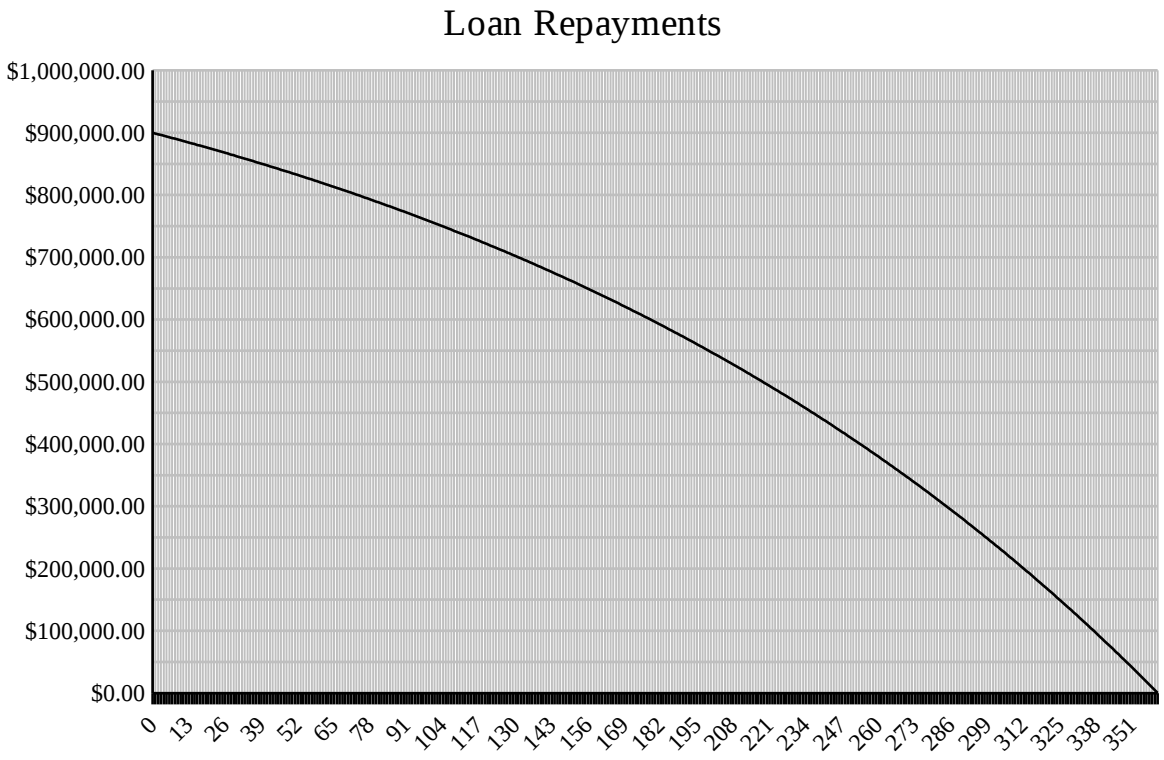
Charlie pays off his loan of $900 000 in equal monthly instalments of $4560.15 over 30 years.

Bill pays off his loan in equal monthly instalments of $4560.15 for the first 10 years, and then pays back $500 000 of the loan, which reduces his monthly instalment to $3270 for the remaining years of the loan.

The graph shows these two loan arrangements.

Charlie's loan:
Bill's loan:
Balance remaining

Number of months



(a) How much does Bill borrow? **1**

.....

.....

(b) What amount does Charlie still owe, after 132 months? **1**

.....

.....

Question 33 continues on following page

Question 33 (continued)

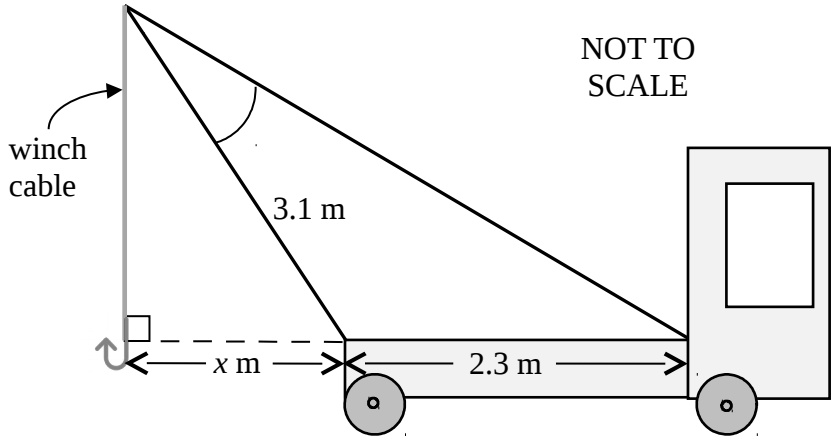
(c) After making the $500 000 payment, what is the total amount that Bill pays in monthly instalments, for the remaining years of his loan? **1**

(d) Who pays more for their loan and by how much, Bill or Charlie? Show suitable calculations to justify your answer. **3**

End of Question 33

Question 34 (4 marks)

A winch cable on the back of a truck is shown in the diagram below.



Find the distance, *x* metres, of the winch cable from the back of the truck. Give your answer to 2 decimal places. **4**

Question 35 (5 marks)

Felix wishes to compare his performance in two exams sat by his class, using *z*-scores. The table shows his results in Geography and History, along with the mean and standard deviation for Geography and the mean and *z*-score for History.

	Geography	History
Mark	74	78
Mean	69	72
Standard Deviation	2.5	-
z-score	-	1.25

(a) What is the *z*-score for his mark in **Geography**?
2

(b) Based on the *z*-scores, in which exam did Felix perform better, History or Geography?
1

Give a reason for your answer.

(c) What was the standard deviation for the **History** exam marks? **2**

Question 36 (2 marks)

Sophie had $15 000 in an account earning interest at a rate of 0.75% per quarter. She then

2

deposited $500 at the end of every quarter into the account.

The amount of money in her account immediately after the n^{th} quarter's deposit, can be determined using the recurrence relation

$$A_n = A_{n-1}(1.0075) + 500$$

where $n = 1,2,3,\ldots$ and $A_0 = 15\,000$

Use the recurrence relation to find the amount of money in the account immediately after the third deposit.

End of Booklet 4

Questions 33 – 36 Extra writing space
If you use this space, clearly indicate which question you are answering.

BLANK PAGE

SHORE

School Exam No:

Set:

Year 12
Mathematics Standard 2
HSC Trial Examination
2022

Date

Question Numbers **37-40**

Booklet 5

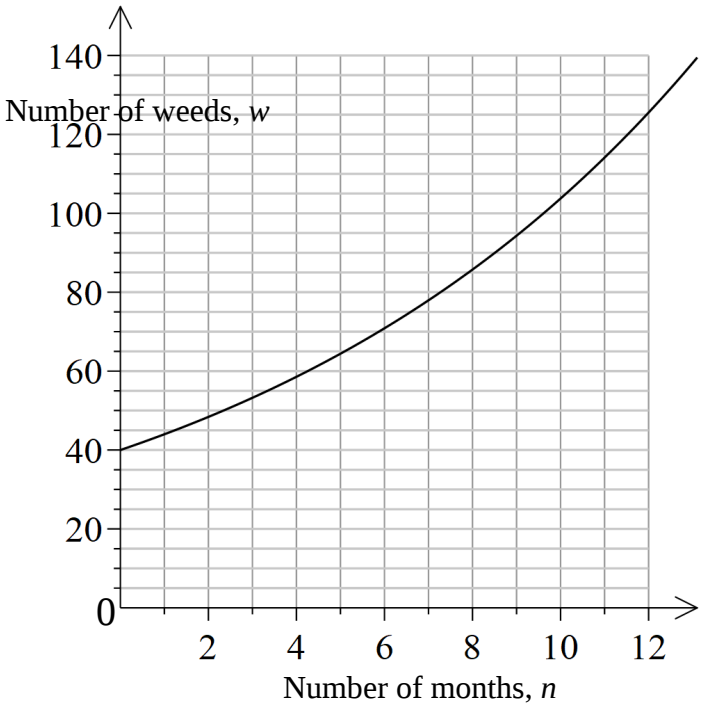
Instructions

- **Complete all boxes** on the front cover of this writing booklet.
- Write using black pen.
- If you need more space, use the extra writing space at the back of this writing booklet.

Booklet 5: Questions 37 – 40 (17 marks)

Question 37 (5 marks) **Marks**

Nathan researched the number of weeds in his garden over a period of 12 months and found that the number grew exponentially. He drew a graph of his results, shown below.



The equation Nathan used to create his graph was of the form $w = p(b)^n$, where p and b are constants.

(a) What is the value of the constant p? **1**

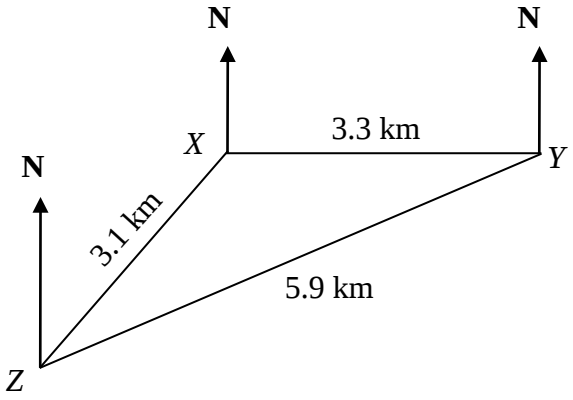
(b) How many weeds were there in Nathan's garden after 12 months? **1**

(c) Find the rate of population growth of the weeds in Nathan's garden as a percentage to the nearest whole number. **3**

Question 38 (3 marks)
Consider the layout of a yacht race, marked with 3 buoys, *X*, *Y* and *Z*.

3

Y is due east of *X*.
X is north-east of *Z*.



NOT TO SCALE

What is the bearing of *Y* from *Z*?

Question 39 (7 marks)

A table of **present values** for an annuity of $1 is shown.

	Interest rate per period					
Period	**1%**	**2%**	**3%**	**4%**	**5%**	**6%**
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334
3	2.9410	2.8839	2.8286	2.7751	2.7232	2.6730
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651
5	4.8534	4.7135	4.5797	4.4518	4.3295	4.2124
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173

(a) Millie invests $1000 at the end of every year for 4 years, in an annuity paying 3% per annum compounding annually. What is the **present value** of Millie's annuity? **1**

(b) What is the **future value** of Millie's investment? **2**

Question 39 continues on the next page

(c) How much must be invested at the end of every 6 months for 3 years, in an annuity paying 2% per annum, compounding 6-monthly, to have the same **future value** as Millie's investment? **4**

End of Question 39

Question 40 (2 marks)

Data collected on the number of seeds in packets of Square Peg seeds is found to be normally
2 distributed. The number of seeds in each packet is counted so that a *z*-score can be found for the packet.

The table gives the probability that a packet chosen at random will have a *z*-score that lies between 0 and *z* for certain values of *z*.

z	.00	.01	.02	.03	.04
0.0	.00000	.00399	.00798	.01197	.01595
0.1	.03983	.04380	.04776	.05172	.05567
0.2	.07926	.08317	.08706	.09095	.09483

The probability that a packet of Square Peg seeds has a *z*-score greater than 0.3 is 0.38209.

What is the probability that a packet of Square Peg seeds will have a *z*-score between 0.21 and 0.3?

End of Paper

☺

Questions 37 – 40 Extra writing space
If you use this space, clearly indicate which question you are answering.

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……

……