STUDENT NAME: _____

TEACHER: _____

HURLSTONE
AGRICULTURAL
HIGH
SCHOOL

2022

Year 12
HSC Task 4
Trial HSC Examination

Mathematics Standard 2

Examiner Mr. D. Potaczala

General Instructions

- Reading time – 10 minutes
- Working time – 2 hours and 30 minutes
- Write using black pen
- NESA approved calculators may be used
- A reference sheet is provided at the back of this paper
- For questions in Section II, show relevant mathematical reasoning and/or calculations

Total marks: 100

Section I – 15 marks (pages 2 – 8)
- Attempt Questions 1-15
- Allow about 25 minutes for this section
- Answer these questions on the separate Multiple Choice Answer sheet at the end of the question booklet. You may detach it from the paper.

Section II – 85 marks (pages 10 – 30)
- Attempt all questions (i.e. Questions 16 – 43) in Section II
- Allow about 2 hours and 5 minutes for this section
- Extra writing paper is provided at the end of the paper

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2022 HSC Mathematics Standard 2 Examination.

This examination paper is not to be removed from the examination centre.

Section I

15 marks
Attempt questions 1 – 15 (pages 2 – 8)
Allow about 25 minutes for this section

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

1) A spinner with different coloured sectors is spun 40 times. The results are recorded in the table. What is the relative frequency of obtaining the colour orange?

Colour obtained	*Frequency*
Red	2
Yellow	4
Blue	6
Orange	
Green	10
Purple	12

A) $\frac{3}{20}$ B) $\frac{1}{5}$

C) 6 C) 8

2) The probability of winning a game is $\frac{7}{10}$. Which expression represents the probability of winning two consecutive games?

A) $\frac{7}{10}\times\frac{6}{9}$ B) $\frac{7}{10}\times\frac{6}{10}$

C) $\frac{7}{10}\times\frac{7}{9}$ D) $\frac{7}{10}\times\frac{7}{10}$

3) The formula below gives the blood alcohol concentration for a male.

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

where N is the number of standard drinks consumed, H is the number of hours of drinking, and M is the person's weight in kilograms.

Charles weighs 80 kg and consumes 6 standard drinks in 3 hours. What is his BAC, correct to 1 significant figure?

A) 0.04 B) 0.05

C) 0.06 D) 0.07

4) Which of the following is the simplified form of $6w \times \frac{1}{3}w$?

A) $3w$ B) $2w$

C) $2w^2$ D) $3w^2$

5) Sofia starts a new job on a salary of \$54 080 p.a. She has a deduction of \$54.00 per week for her health fund and PAYG tax is deducted at 19% of her gross salary per week.

What is her take home pay each week?

A) \$787.56 B) \$788.40

C) \$798.66 D) \$986.00

6) Nick bought a portfolio of 2000 MNRA shares with his retrenchment payout. The value of each share is currently $12.50, and Nick is paid an annual dividend of $0.75 per share.

What is the dividend yield on the shares?

A) 6.0%

B) 6.25%

C) 7.5%

D) 12.5%

7) Elizabeth lives in New York, USA (UTC –5) and Margaret lives in Sydney, NSW (UTC +10). Margaret makes a call to Elizabeth at 12:30 pm on Monday 24th February. February is a month when NSW has daylight saving time and the USA doesn't.

What it the time in New York when Elizabeth receives the call?

A) 8:30 pm Sunday 23rd February

B) 10:30 pm Sunday 23rd February

C) 2:30 am Tuesday 25th February

D) 4:30 am Tuesday 25th February

8) What is 54.9864 rounded to 3 significant figures?

A) 54.986

B) 54.987

C) 54.9

D) 55.0

9) A data set of nine scores has a median of 9.

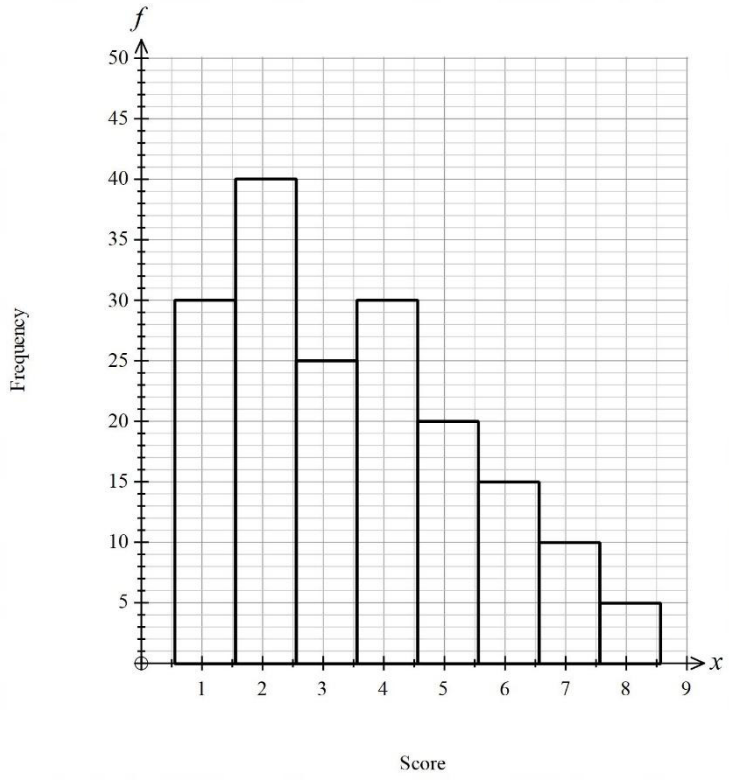
The scores 6, 6, 12 and 17 are added to this data

What is the median of the data set now?

A) 6 B) 7

C) 8 D) 9

10) The frequency histogram below displays the scores on a test.

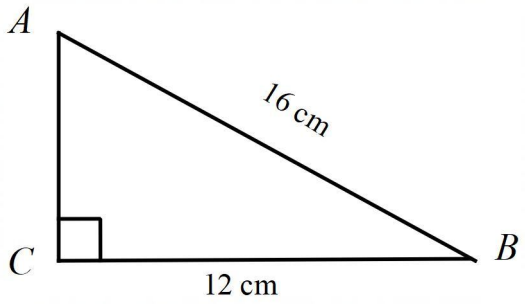


What was the mean score on the test?

A) 3.00 B) 3.46

C) 4.50 D) 21.88

11) In triangle ABC, AB = 16 cm and BC = 12 cm. The triangle is right angled at C.



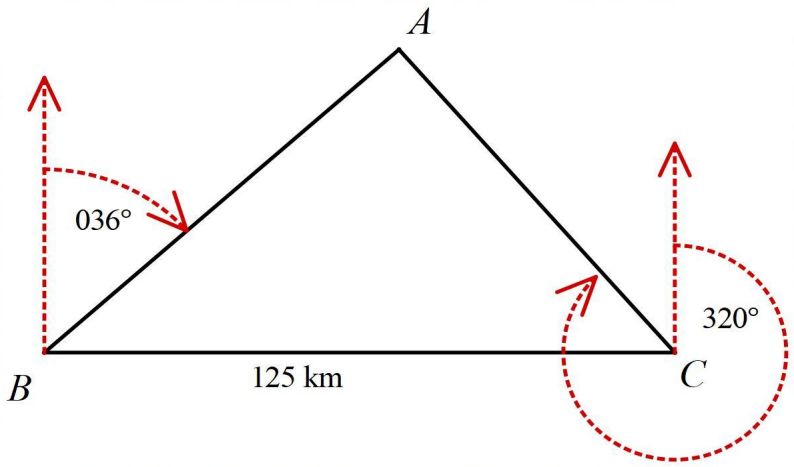
Find the size of angle ABC, correct to the nearest minute.

A) 41°24’ B) 41°25’

C) 41°24’34” D) 41°24’35”

12) Town B is 125 km due west of town C

Town A is on a bearing 036° from B and on a bearing 320°from C.

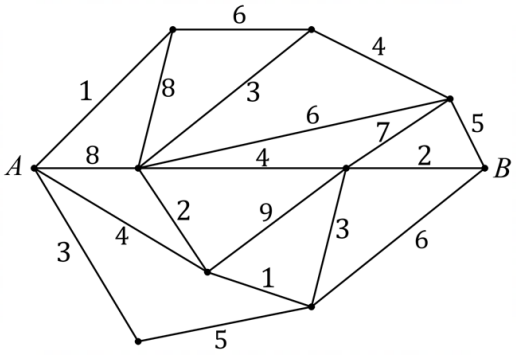


Which calculation could be used to find the distance from A to B?

A) $AB = \frac{125\sin(36°)}{\sin(320°)}$ B) $AB = \frac{125\sin(50°)}{\sin(54°)}$

C) $AB = \frac{125\sin(54°)}{\sin(76°)}$ D) $AB = \frac{125\sin(50°)}{\sin(76°)}$

13) The network diagram below shows the distances, in kilometres, along a series of roads that connect town *A* to town *B*.

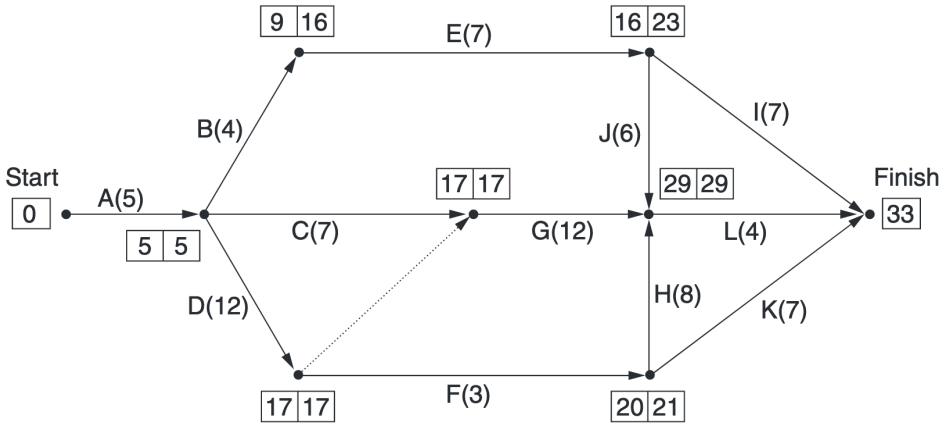


What is the shortest distance, in kilometres, from town *A* to town *B* ?

A) 10 B) 11

C) 12 D) 14

14) The network below shows the earliest start and latest start times of each activity for a project. All times are in terms of hours.

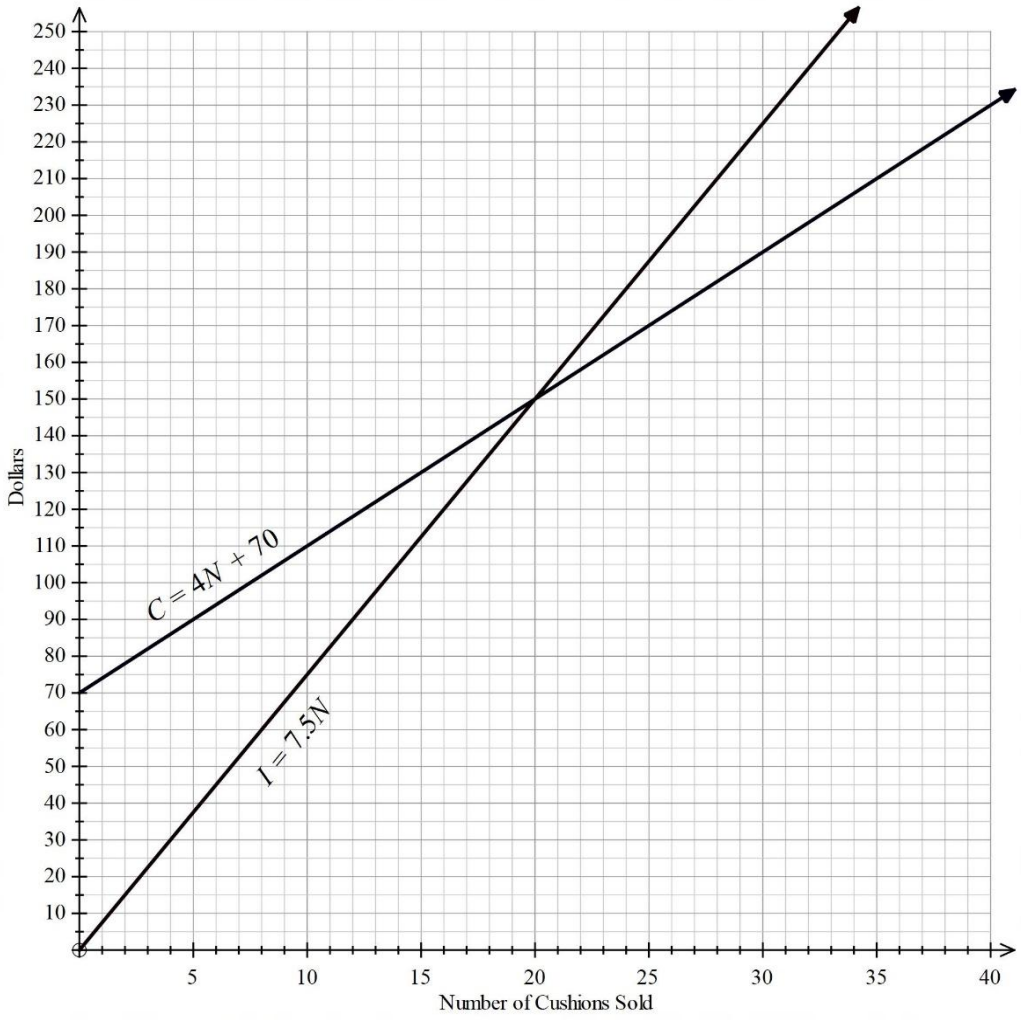


If activity *I* is delayed by 10 hours from its earliest starting time, 16 hours, how many hours will the project finish be delayed?

A) 0 B) 1

C) 2 D) 3

15) An online retailer of cushions draws the graph below to analyse sales. The lines representing the equations for daily cost (C) and daily income (I) are shown. What is the result on a day where 30 cushions were sold?



A.) A loss of $190.00

B) A loss of $35.00

C) A profit of $190.00

D) A profit of $35.00

STUDENT NAME: _____

TEACHER: _____

Mathematics Standard 2
Section II Answer Booklet

85 marks
Attempt Questions 16 – 43 (pages 10 – 30)
Allow about 2 hours and 5 minutes for this section

Instructions

- Answer the questions in the spaces provided.
- Your responses should include relevant mathematical reasoning and/or calculations.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

Marks

16) Jaz has 2 bags of apples. Bag A contains 4 red apples and 3 green apples. Bag B contains 3 red apples and 1 green apple. Jaz chooses an apple from one of the bags.

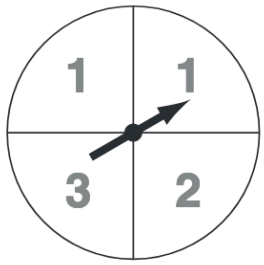
i) Draw a Tree Diagram to represent this situation. **2**

ii) Determine the probability that Jaz chooses a red apple. **2**

Marks

17) The two spinners shown are used in a game

Spinner A



Spinner B

Each arrow is spun once. The score is the total of the two numbers shown by the arrows. A table is drawn up to show all scores that can be obtained in this game.

		Spinner B			
		1	**1**	**2**	**3**
Spinner A	**1**	2	2	3	4
	1	2	2	3	4
	3	4	4	X	6

i) What is the value of X in the table? **1**

_____

ii) What is the probability of obtaining a score less than 4? **1**

_____

iii) On Spinner B, a 2 is obtained. What is the probability of obtaining a score of 3? **1**

_____

Question 17 continues on the next page

Marks

iv) Elise plays a game using the spinners with the following 3 financial outcomes. **3**

- Win $12 for a score of 4
- Win nothing for a score of less than 4
- Lose $3 for a score of more than 4
- It costs $5 to play this game.

Will Elise expect a gain or a loss and how much will it be?
Justify your answer with suitable calculation

_____

_____

_____

_____

_____

_____

18) Postcodes in Australia are made up of four digits e.g. 2040. **1**
How many different postcodes beginning with 2 are possible?

_____

_____

Marks

19) Expand $-2(x-4)$ **2**

20) Solve $x+\frac{x-1}{2}=9$. **3**

21) For the equation $s=ut-\frac{1}{2}at^2$, make a the subject **2**

Marks

22) A business has initial daily running costs of \$450 and \$50 per item it produces.
The business sells these items for \$100.

i) Construct equations for I (income) and C (costs) **1**

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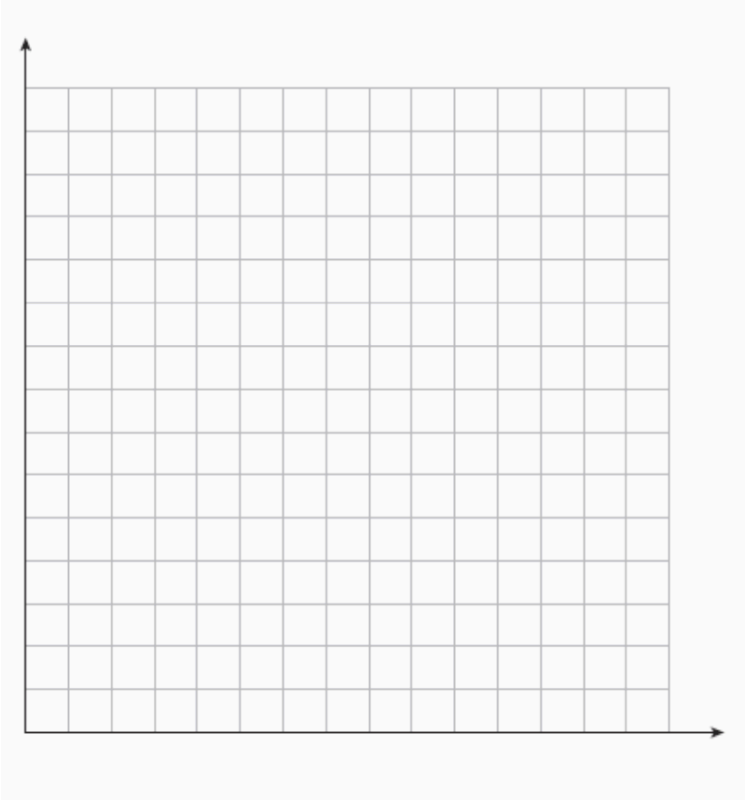
ii) Graph the equations onto the plane below for positive values of x. **2**



iii) How many items need to be sold for the business to breakeven? **1**

Marks

23) A brand new computer which costs $2500 will depreciate at 30% per annum for the next 3 years using the declining balance method. **2**

What will it be worth at the end of three years?

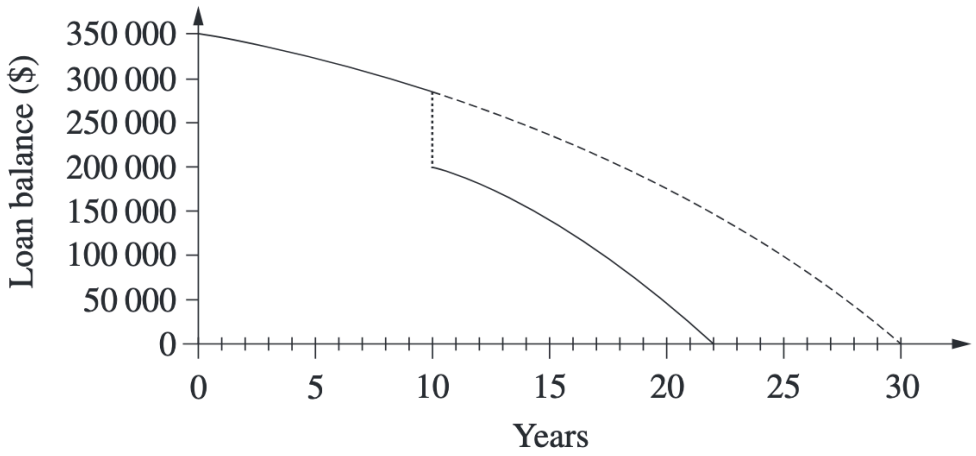
_____

_____

_____

_____

24) Jamal borrowed $350 000 to be repaid over 30 years, with monthly repayments of $1880. However, after 10 years he made a lump sum payment of $80 000. The monthly repayment remained unchanged. The graph shows the balances owing over the period of the loan. **2**



Over the period of the loan, how much less did Jamal pay by making the lump sum payment

_____

_____

Marks

25) The table gives the present value interest factors for an annuity of $1 per period. For various interest rates (R) and number of periods (N).

Table of present value interest factors					
r / *N*	Interest rate per period (as a decimal)				
	0.0075	0.0080	0.0085	0.0090	0.0095
70	54.30462	53.43960	52.59397	51.76724	50.95891
71	54.89293	54.00754	53.14226	52.29657	51.46995
72	55.47685	54.57097	53.68593	52.82118	51.97618
73	56.05643	55.12993	54.22502	53.34111	52.47764
74	56.63169	55.68446	54.75957	53.85641	52.97438

i) Oscar plans to invest $200 each month for 74 months. His investment will earn interest at the rate of 0.0080 (as a decimal) per month. Use this information in the table to calculate the present value of this annuity. **1**

_____

_____

ii) Lucy is using the same table to calculate the loan repayment for her car loan. Her loan is $21 500 and will be repaid in equal monthly repayments over 6 years. The interest rate on her loan is 10.8% per annum. Calculate the amount of each monthly repayment, correct to the nearest dollar. **2**

_____

_____

_____

_____

Marks

26) During the previous financial year, Diego earned a gross salary of $79 348 for his work as a forensic statistician. Diego also earned $8 920 from being a Twitch streamer. All up, Diego's taxable income has been calculated to be $83 356.

i) Calculate how much Diego is claiming in tax deductions for his streaming/work equipment and home energy consumption. **1**

_____

ii) Using the tax table below, calculate Diego's tax payable to the nearest cent. **2**

Taxable income	*Tax payable 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
$180 001 and over	$51 667 plus 45 cents for each $1 over $180 000

_____

_____

_____

iii) Diego's employer has already taken $11 905 as PAYG tax. Calculate Diego's refund or liability, justifying your answer with calculations to the nearest cent. Do not include the Medicare Levy in your calculation. **1**

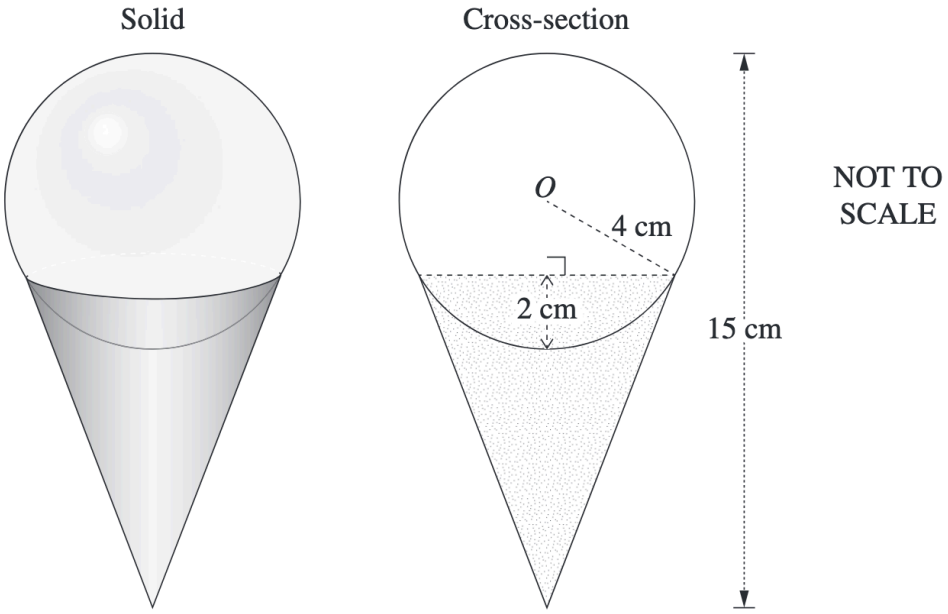
_____

_____

Marks

27) A solid is made up of a sphere sitting partially inside a cone. **3**

The sphere, centre O, has a radius of 4 cm and sits 2 cm inside the cone. The solid has a total height of 15 cm. The solid and its cross-section are

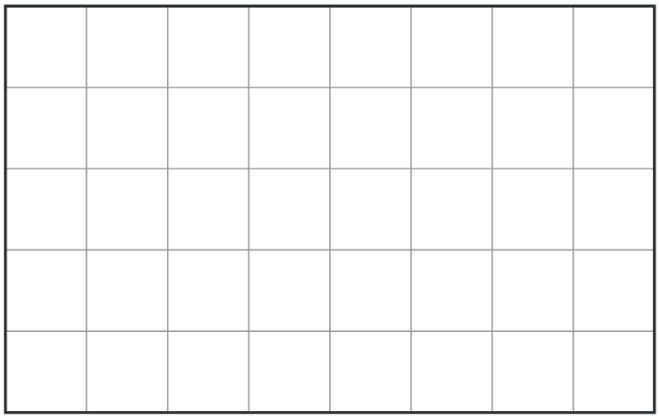


What is the volume of the cone, correct the nearest square centimetre?

Marks

28) A rectangular sportsground has been drawn to scale on a 1- cm grid as shown. **4**

The scale used is 1 : 3000



Kerry took 12 minutes to walk around the perimeter of this sportsground.

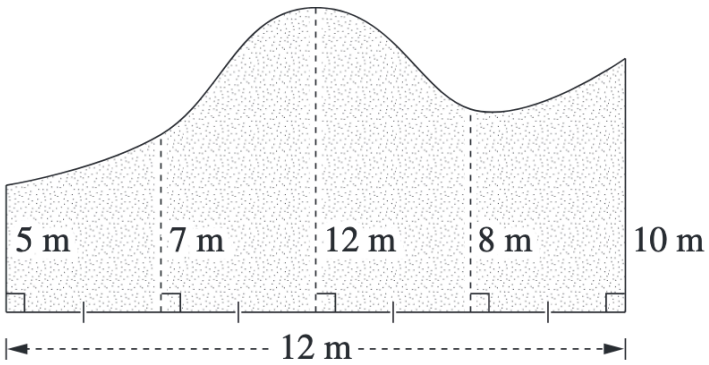
What was Kerry's average speed in kilometres per hour?

Marks

29) The sizes of the angles of a triangle are in the ratio 2 : 3 : 5. **2**

Find the size of the largest angle.

30) The diagram represents a field **2**



NOT TO SCALE

Find the area of the field, using two applications of the trapezoidal rule.

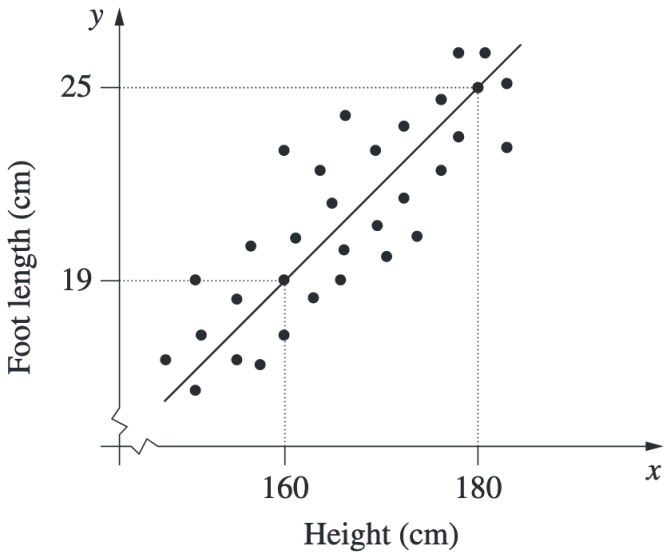
Marks

31) Data was collected from 30 students on the number of text messages they had sent in the previous 24 hours. The set of data collected is displayed below. **3**

Male		*Female*
9 9 8 7 6 5 5 4 2 1	0	8 9
1 1 0 0	1	1 1 2 5 6 8 8 8
0	2	0 1 7
	3	4
	4	
	5	
	6	
1	7	

Determine whether the data has an outlier. Justify your answer with calculations.

32) Each member of a group of males had his height and foot length measured and recorded. The results were graphed and a line of fit drawn.



NOT TO SCALE

i) Why does the value of the y-intercept have no meaning in this situation? **1**

_____

ii) George is 10 cm taller than his brother Harry. Use the line of fit to estimate the difference in their foot lengths. **1**

_____

iii) Sam calculated a correlation coefficient of −1.2 for the data. Give TWO reasons why Sam must be incorrect. **2**

_____

_____

Marks

33) The marks in a class test are normally distributed. The mean is 100 and the standard deviation is 10.

i) Jason's mark is 115. What is his *z*-score? **1**

_____

ii) Mary has a *z*-score of 0. What mark did she achieve in the test? **1**

_____

iii) What percentage of marks lie between 80 and 110? **2**

_____

_____

34) Find the area of an equilateral triangle that has 4 cm sides. **2**

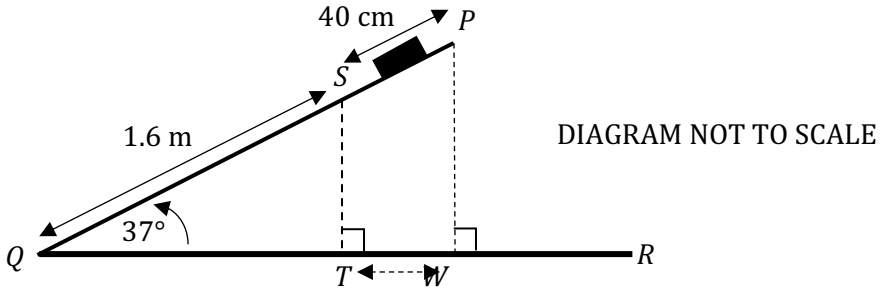
_____

_____

_____

Marks

35) A coin is slid down a ramp PQ which is at an angle of elevation of 37° to a horizontal bench QR.



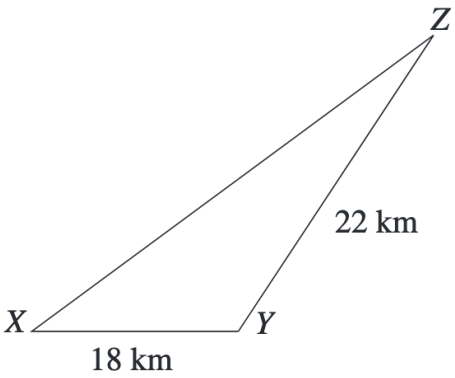
When the coin reaches the point S on the ramp 40 cm from P, it has 1.6 m to slide to reach Q.

i) Use Trigonometry to calculate the distance QT correct to TWO decimal places. **2**

ii) What is the horizontal distance TW in the diagram, correct to 1 decimal place? **2**

Marks

36) In the diagram X, Y and Z represent the locations of three towns.
The town Y is due east of X, and the bearing of Z from Y is 046°



NOT TO SCALE

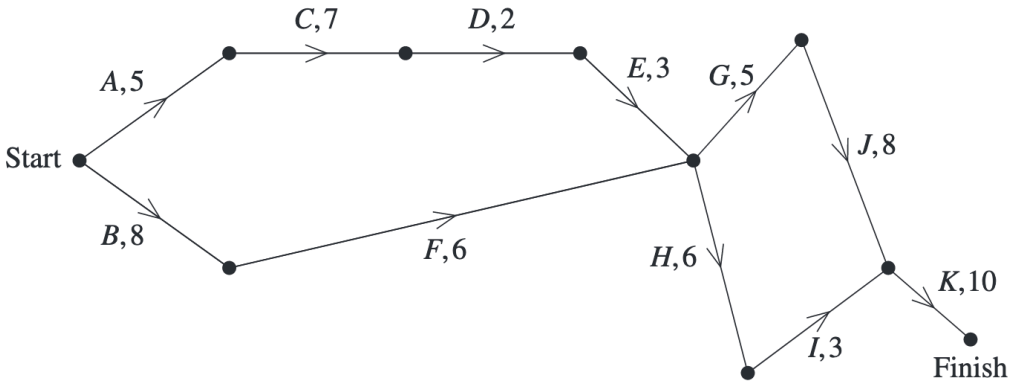
i) Find the size of $\angle XYZ$. **1**

ii) Find the distance XZ correct to one decimal place **2**

iii) What is the bearing of Y from Z? **2**

Marks

37) A project requires completion of 11 tasks A, B, C, . . . , K.
A network diagram for the project giving the completion time for each task, in minutes, is shown.



i) Find the minimum time to complete the project. **1**

---

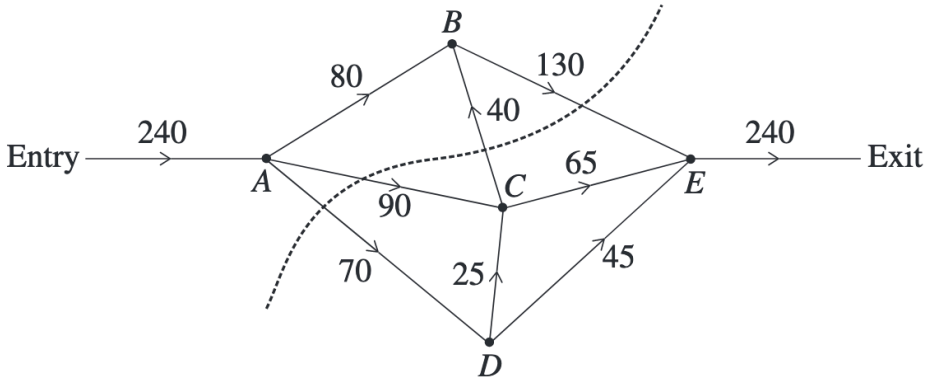
ii) State the critical path for this project **1**

---

iii) A new task, X, is to be added to the project. The earliest starting time for X is 17 minutes, the latest starting time for X is 18 minutes and X has a completion time of 12 minutes. Add task X to the given network diagram above AND state the float time for this task. **2**

Marks

38) A museum is planning an exhibition using five rooms. The vertices A,B, C, D and E represent the five rooms. The numbers on the edges represent The maximum number of people per hour who can pass through the security checkpoints between the rooms.



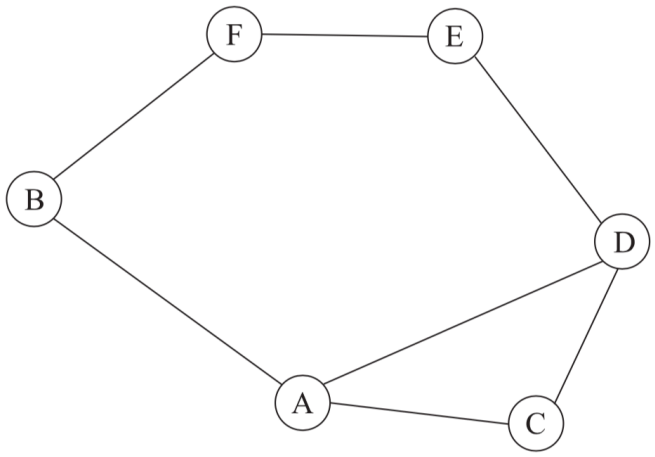
i) What is the capacity of the cut shown? **1**

_____

ii) What is the flow capacity of the network? **1**

_____

39) State a trail for the following network. **1**



_____

Marks

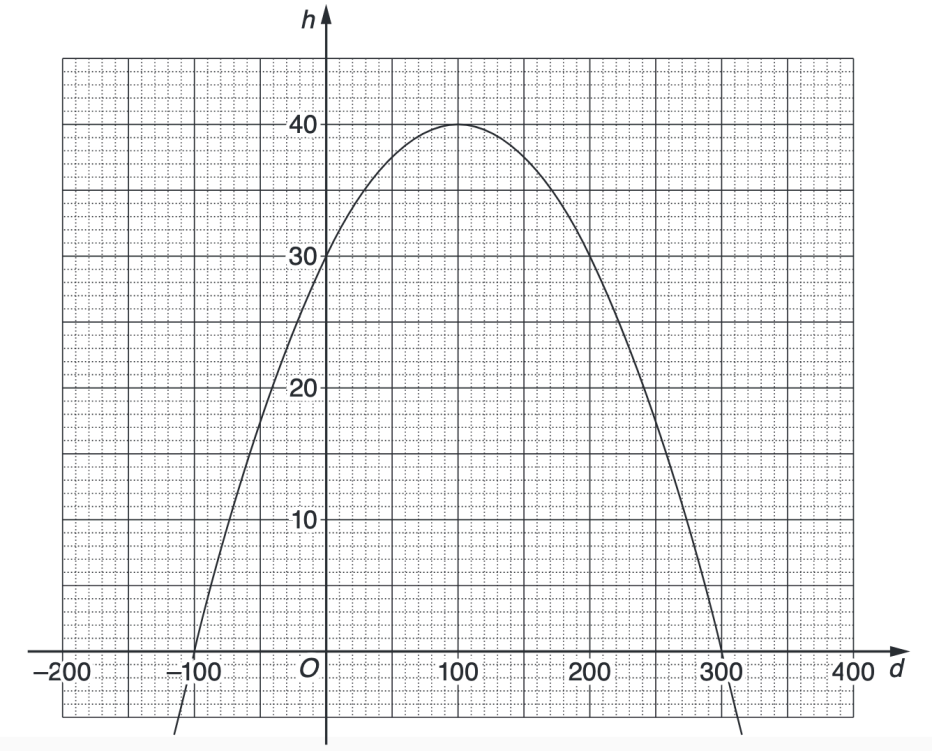
40) The activity chart below shows the immediate prerequisite(s) and duration for each activity in a project.

Activity	Immediate Prerequisites	Time (days)
A	-	2
B	A	3
C	A	3
D	B, C	3
E	A	5
F	B, C	8
G	D, E	4
H	F, G	2

Draw a directed network diagram for the table above **2**

Marks

41) A ball is thrown upward from a raised platform. The path of the ball's trajectory is modelled by $h = -0.001d^2 + 0.2d + 30$ where h is the height above the ground and d is the horizontal distance the ball travels. A graph of the equation is shown below.



i) From what height is the ball thrown? **1**

ii) What is the maximum distance above the ground the ball reaches? **1**

iii) What is the horizontal distance travelled? **1**

iv) What is the height when $d = 215.2$? **1**

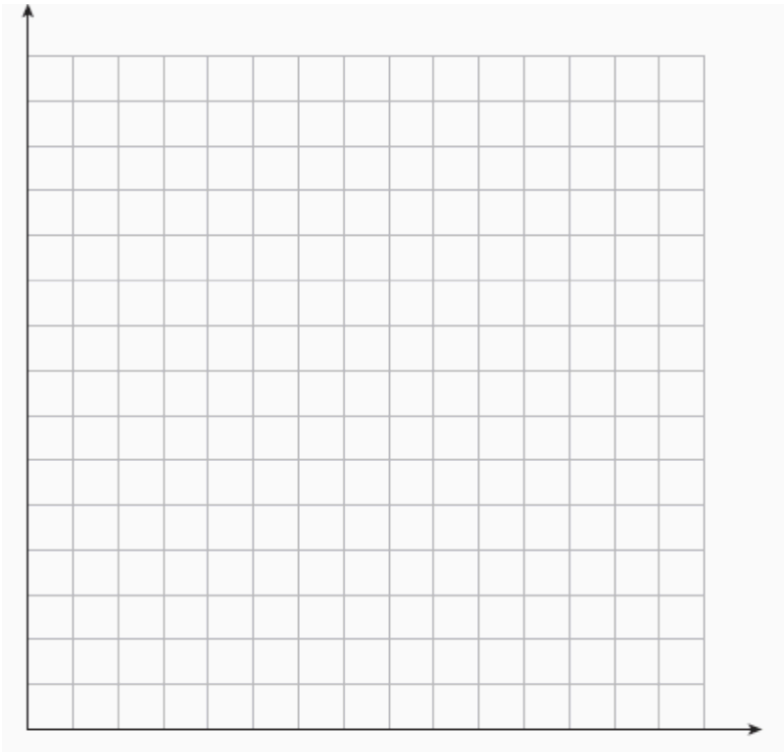
Marks

42) An infectious disease grows exponentially according to the equation $I = 3.8^t$, where I is the number of infections after t days.

i) Create a table of values of I and t **2**
(express the number of infections to the nearest whole number).

t	0	1	2	3	4	5
I						

ii) Using part i), graph the exponential function on the axis below. **2**



43) If pressure (P) varies inversely with volume (V), write a formula to correctly express in terms of P and V. **2**

End of Examination

Section II extra writing space

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

Section II extra writing space

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

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

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NSW Education Standards Authority

2020 **HIGHER SCHOOL CERTIFICATE EXAMINATION**

Mathematics Standard 1
Mathematics Standard 2

REFERENCE SHEET

Measurement

Limits of accuracy

Absolute error = $\frac{1}{2} \times$ precision

Upper bound = measurement + absolute error

Lower bound = measurement – absolute error

Length

$$l = \frac{\theta}{360} \times 2\pi r$$

Area

$$A = \frac{\theta}{360} \times \pi r^2$$

$$A = \frac{h}{2}(a + b)$$

$$A \approx \frac{h}{2}(d_f + d_l)$$

Surface area

$$A = 2\pi r^2 + 2\pi rh$$

$$A = 4\pi r^2$$

Volume

$$V = \frac{1}{3}Ah$$

$$V = \frac{4}{3}\pi r^3$$

Trigonometry

$$\sin A = \frac{\text{opp}}{\text{hyp}}, \quad \cos A = \frac{\text{adj}}{\text{hyp}}, \quad \tan A = \frac{\text{opp}}{\text{adj}}$$

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

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$c^2 = a^2 + b^2 - 2ab\cos C$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Financial Mathematics

$$FV = PV(1 + r)^n$$

Straight-line method of depreciation

$$S = V_0 - Dn$$

Declining-balance method of depreciation

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

Statistical Analysis

An outlier is a score

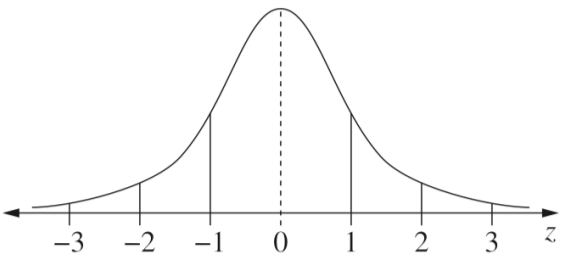
less than $Q_1 - 1.5 \times IQR$

or

more than $Q_3 + 1.5 \times IQR$

$$z = \frac{x - \mu}{\sigma}$$

Normal distribution



- approximately 68% of scores have z-scores between –1 and 1
- approximately 95% of scores have z-scores between –2 and 2
- approximately 99.7% of scores have z-scores between –3 and 3

Hurlstone Agricultural High School
Year 12 Mathematics Standard 2 Trial HSC 2022 Section I - Answer Sheet

Student Name _____ Teacher Name_____

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

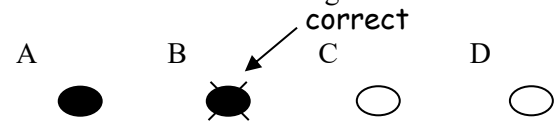
Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

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

A ● B ⊗ C ○ D ○

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



1. A ○ B ○ C ○ D ○
2. A ○ B ○ C ○ D ○
3. A ○ B ○ C ○ D ○
4. A ○ B ○ C ○ D ○
5. A ○ B ○ C ○ D ○
6. A ○ B ○ C ○ D ○
7. A ○ B ○ C ○ D ○
8. A ○ B ○ C ○ D ○
9. A ○ B ○ C ○ D ○
10. A ○ B ○ C ○ D ○
11. A ○ B ○ C ○ D ○
12. A ○ B ○ C ○ D ○
13. A ○ B ○ C ○ D ○
14. A ○ B ○ C ○ D ○
15. A ○ B ○ C ○ D ○

STUDENT NAME: _____

TEACHER: _____

HURLSTONE
AGRICULTURAL
HIGH
SCHOOL

2022

Year 12
HSC Task 4
Trial HSC Examination

Mathematics Standard 2

Examiner Mr. D. Potaczala

General Instructions

- Reading time – 10 minutes
- Working time – 2 hours and 30 minutes
- Write using black pen
- NESA approved calculators may be used
- A reference sheet is provided at the back of this paper
- For questions in Section II, show relevant mathematical reasoning and/or calculations

Total marks: 100

Section I – 15 marks (pages 2 – 8)

- Attempt Questions 1-15
- Allow about 25 minutes for this section
- Answer these questions on the separate Multiple Choice Answer sheet at the end of the question booklet. You may detach it from the paper.

Section II – 85 marks (pages 10 – 30)

- Attempt all questions (i.e. Questions 16 – 43) in Section II
- Allow about 2 hours and 5 minutes for this section
- Extra writing paper is provided at the end of the paper

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2022 HSC Mathematics Standard 2 Examination.

This examination paper is not to be removed from the examination centre.

Section I

15 marks
Attempt questions 1 – 15 (pages 2 – 8)
Allow about 25 minutes for this section

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

1) A spinner with different coloured sectors is spun 40 times. The results are recorded in the table. What is the relative frequency of obtaining the colour orange?

Colour obtained	*Frequency*
Red	2
Yellow	4
Blue	6
Orange	
Green	10
Purple	12

$40 = x + 34$

$x = 6$

A) $\frac{3}{20}$ B) $\frac{1}{5}$

C) 6 C) 8

2) The probability of winning a game is $\frac{7}{10}$. Which expression represents the probability of winning two consecutive games? probability stays the same

A) $\frac{7}{10} \times \frac{6}{9}$ B) $\frac{7}{10} \times \frac{6}{10}$

C) $\frac{7}{10} \times \frac{7}{9}$ D) $\frac{7}{10} \times \frac{7}{10}$

3) The formula below gives the blood alcohol concentration for a male.

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

where N is the number of standard drinks consumed, H is the number of hours of drinking, and M is the person's weight in kilograms.

Charles weighs 80 kg and consumes 6 standard drinks in 3 hours. What is his BAC, correct to 1 significant figure?

A) 0.04 B) 0.05

C) 0.06 D) 0.07

$\frac{10\times 6 - 7.5\times 3}{6.8\times 80}$

$= 0.07$

4) Which of the following is the simplified form of $6w \times \frac{1}{3}w$?

A) $3w$ B) $2w$

C) $2w^2$ D) $3w^2$

$6\times\frac{1}{3}\times w\times w$

$= 2w^2$

5) Sofia starts a new job on a salary of \$54 080 p.a. She has a deduction of \$54.00 per week for her health fund and PAYG tax is deducted at 19% of her gross salary per week.

What is her take home pay each week?

A) \$787.56 B) \$788.40

C) \$798.66 D) \$986.00

Gross weekly

$54080 \div 52 = 1040$

Take home

$1040\times 0.81 - 54$

$= 788.4$

6) Nick bought a portfolio of 2000 MNRA shares with his retrenchment payout. The value of each share is currently $12.50, and Nick is paid an annual dividend of $0.75 per share.

What is the dividend yield on the shares?

A) 6.0%

B) 6.25%

C) 7.5%

D) 12.5%

$\frac{0.75}{12.50} = 0.06$

7) Elizabeth lives in New York, USA (UTC –5) and Margaret lives in Sydney, NSW (UTC +10). Margaret makes a call to Elizabeth at 12:30 pm on Monday 24th February. February is a month when NSW has daylight saving time and the USA doesn't.

What it the time in New York when Elizabeth receives the call?

A) 8:30 pm Sunday 23rd February

B) 10:30 pm Sunday 23rd February

C) 2:30 am Tuesday 25th February

D) 4:30 am Tuesday 25th February

Sydney is ahead
5 + 10 + 1 (daylight savings)

12 − 16 = −4
which is 4 hours before midnight
8:30 pm Sunday

8) What is 54.9864 rounded to 3 significant figures?

A) 54.986

B) 54.987

C) 54.9

D) 55.0

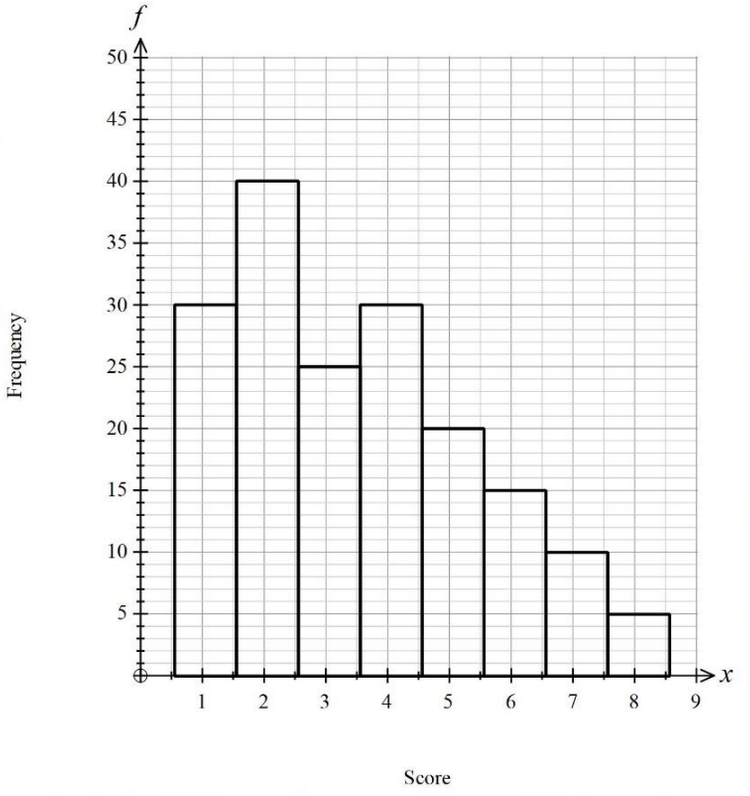
9) A data set of nine scores has a median of 9.
The scores 6, 6, 12 and 17 are added to this data
What is the median of the data set now?

6, 6 ... 9 ... 12, 17
doesn't change

A) 6 B) 7

C) 8 D) 9

10) The frequency histogram below displays the scores on a test.



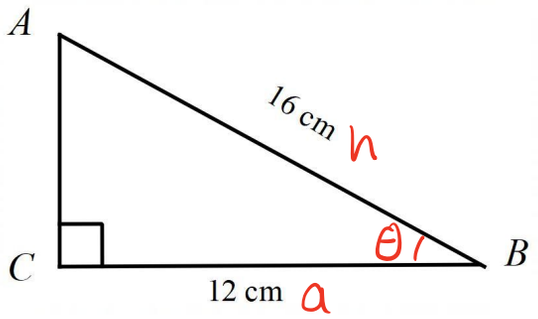
What was the mean score on the test?

A) 3.00 B) 3.46

C) 4.50 D) 21.88

$$\text{mean} = \frac{30\times1 + 40\times2 + 25\times3 + 30\times4 + 20\times5 + 15\times6 + 10\times7 + 5\times8}{175} = 3.46$$

11) In triangle ABC, $AB = 16$ cm and $BC = 12$ cm. The triangle is right angled at C.



$\cos\theta = \frac{12}{16}$

$\theta = \cos^{-1}\left(\frac{12}{16}\right)$

$= 41°24'35''$

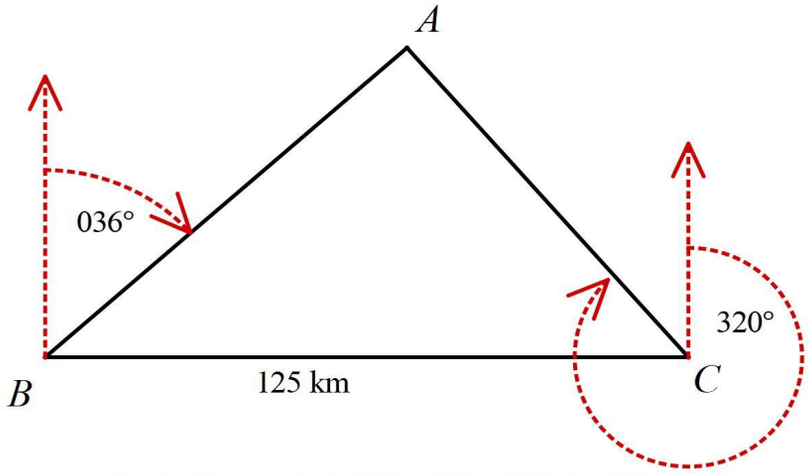
Find the size of angle ABC, correct to the nearest minute.

A) 41°24’ B) 41°25’

C) 41°24’34” D) 41°24’35”

12) Town B is 125 km due west of town C

Town A is on a bearing 036° from B and on a bearing 320°from C.



$\angle C = 320 - 270$
$= 50°$

$\angle B = 90 - 36$
$= 54°$

$\angle A = 180 - 50 - 54$
$= 76°$

$\frac{AB}{\sin 50} = \frac{125}{\sin 76}$

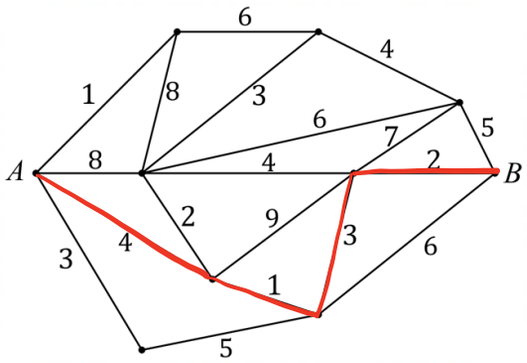
$AB = \frac{125\sin 50}{\sin 76}$

Which calculation could be used to find the distance from A to B?

A) $AB = \dfrac{125\sin(36°)}{\sin(320°)}$ B) $AB = \dfrac{125\sin(50°)}{\sin(54°)}$

C) $AB = \dfrac{125\sin(54°)}{\sin(76°)}$ D) $AB = \dfrac{125\sin(50°)}{\sin(76°)}$

13) The network diagram below shows the distances, in kilometres, along a series of roads that connect town *A* to town *B*.

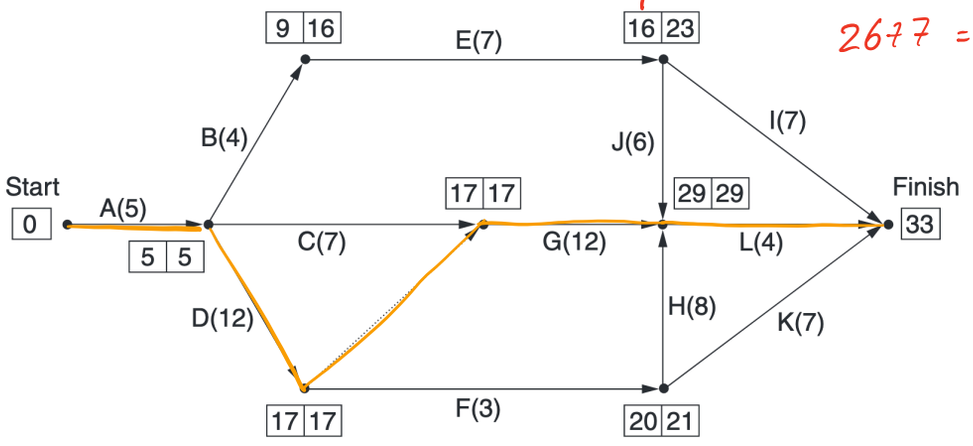


What is the shortest distance, in kilometres, from town *A* to town *B* ?

A) 10 B) 11

C) 12 D) 14

14) The network below shows the earliest start and latest start times of each activity for a project. All times are in terms of hours.

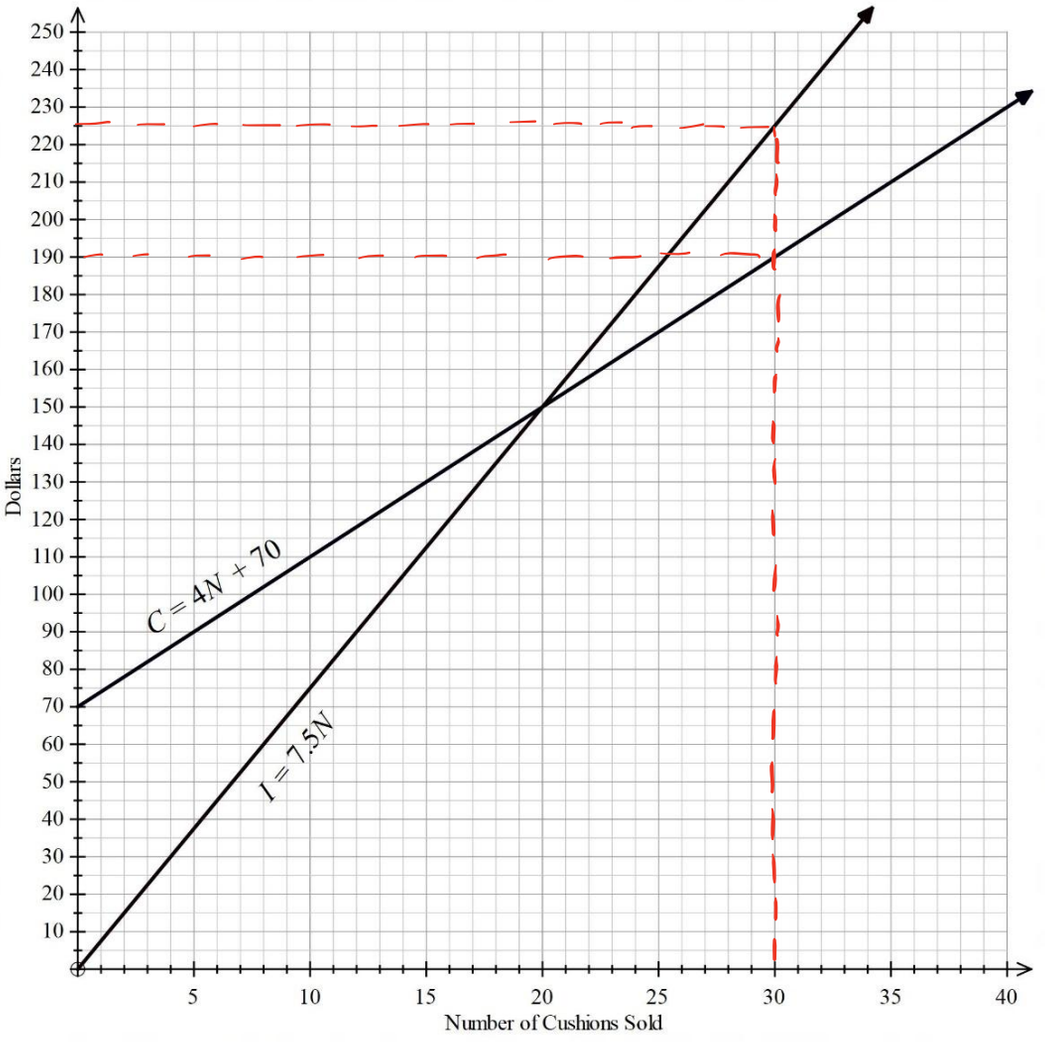


If activity *I* is delayed by 10 hours from its earliest starting time, 16 hours, how many hours will the project finish be delayed?

A) 0 B) 1

C) 2 D) 3

15) An online retailer of cushions draws the graph below to analyse sales. The lines representing the equations for daily cost (C) and daily income (I) are shown. What is the result on a day where 30 cushions were sold?



225 - 190
= 35

A.) A loss of $190.00

B) A loss of $35.00

C) A profit of $190.00

D) A profit of $35.00

STUDENT NAME: _____

TEACHER: _____

Mathematics Standard 2
Section II Answer Booklet

85 marks
Attempt Questions 16 – 43 (pages 10 – 30)
Allow about 2 hours and 5 minutes for this section

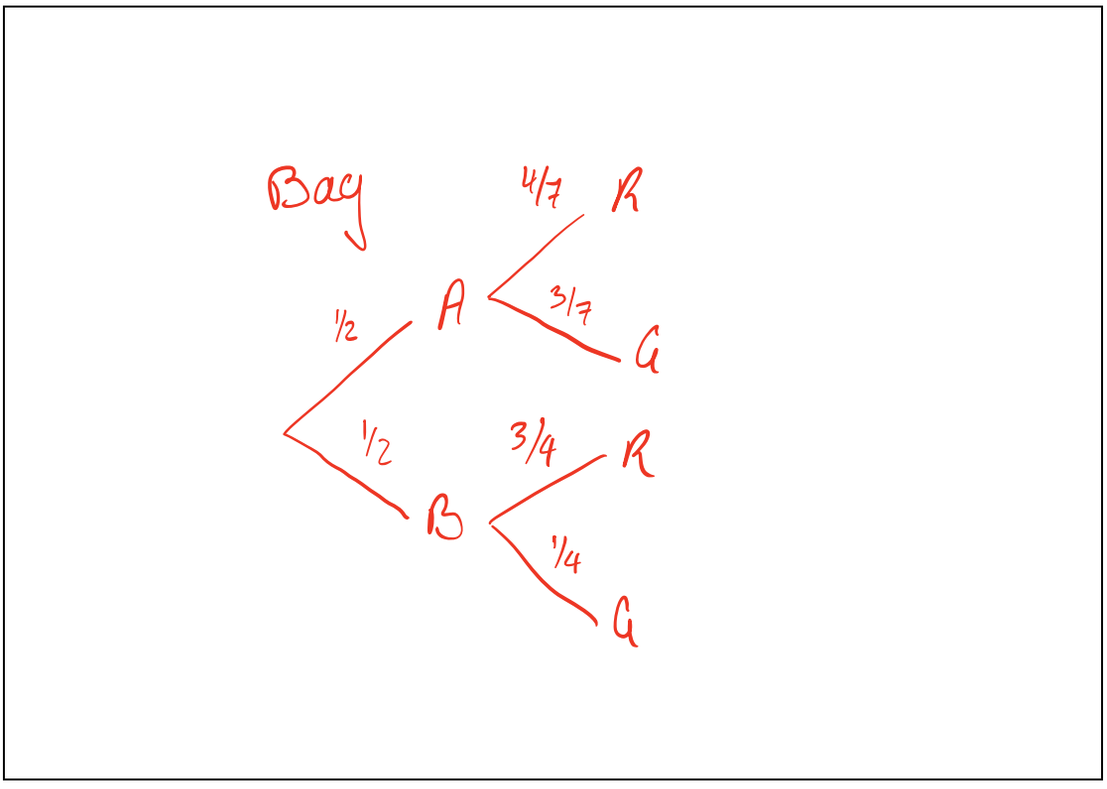
Instructions

- Answer the questions in the spaces provided.
- Your responses should include relevant mathematical reasoning and/or calculations.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

Marks

16) Jaz has 2 bags of apples. Bag A contains 4 red apples and 3 green apples. Bag B contains 3 red apples and 1 green apple. Jaz chooses an apple from one of the bags.

i) Draw a Tree Diagram to represent this situation. **2**



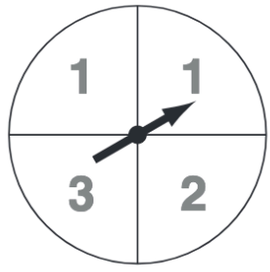
ii) Determine the probability that Jaz chooses a red apple. **2**

$P(R) = \frac{1}{2} \times \frac{4}{7} + \frac{1}{2} \times \frac{3}{4} = \frac{37}{56}$

Marks

17) The two spinners shown are used in a game

Spinner A



Spinner B

Each arrow is spun once. The score is the total of the two numbers shown by the arrows.
A table is drawn up to show all scores that can be obtained in this game.

		Spinner B			
		1	**1**	**2**	**3**
Spinner A	**1**	2	2	3	4
	1	2	2	3	4
	3	4	4	X	6

i) What is the value of X in the table? **1**

5

---

ii) What is the probability of obtaining a score less than 4? **1**

$\frac{6}{12} = \frac{1}{2}$

---

iii) On Spinner B, a 2 is obtained. What is the probability of obtaining a score of 3? **1**

2/3

Question 17 continues on the next page

Marks

iv) Elise plays a game using the spinners with the following 3 financial outcomes. **3**

- Win $12 for a score of 4
- Win nothing for a score of less than 4
- Lose $3 for a score of more than 4
- It costs $5 to play this game.

Will Elise expect a gain or a loss and how much will it be?

Justify your answer with suitable calculation

Expected Return $= \frac{1}{3} \times 12 + \frac{1}{2} \times 0 - \frac{1}{6} \times 3 - 5$

$= -1.5$

Expect to loose $1.50 on average

18) Postcodes in Australia are made up of four digits e.g. 2040. **1**

How many different postcodes beginning with 2 are possible?

2 _ _ _ → there are 10 digits possible in each space.

$10 \times 10 \times 10 = 1000$

Marks

19) Expand $-2(x-4)$ **2**

$-2x - 4(-2) = -2x + 8$

20) Solve $x + \frac{x-1}{2} = 9$. **3**

$2x + x - 1 = 18$

$3x - 1 = 18$

$3x = 19$

$x = \frac{19}{3}$

21) For the equation $s = ut - \frac{1}{2}at^2$, make a the subject **2**

$s - ut = -\frac{1}{2}at^2$

$\frac{s-ut}{-\frac{1}{2}t^2} = a$ OR $a = \frac{2ut - 2s}{t^2}$

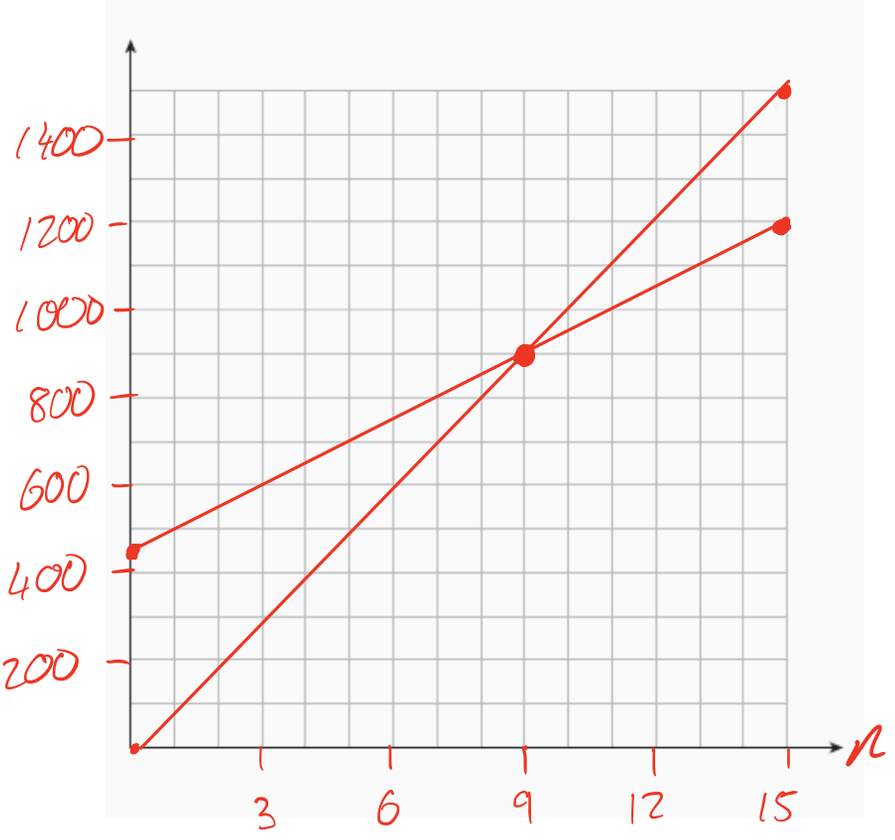
Marks

22) A business has initial daily running costs of \$450 and \$50 per item it produces.
The business sells these items for \$100.

i) Construct equations for I (income) and C (costs) **1**

$I = 100n$ $C = 450 + 50n$

ii) Graph the equations onto the plane below for positive values of x. **2**



iii) How many items need to be sold for the business to breakeven? **1**

9

Marks

23) A brand new computer which costs $2500 will depreciate at 30% per annum for the next 3 years using the declining balance method. **2**

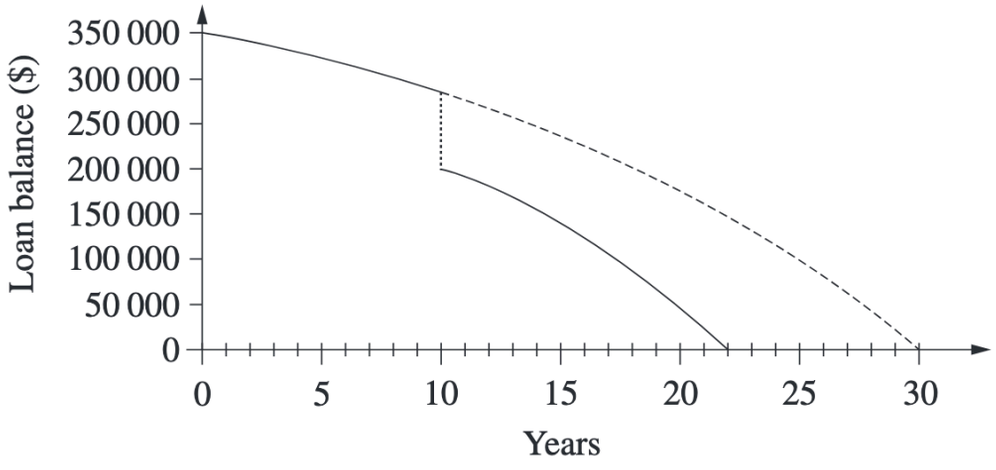
What will it be worth at the end of three years?

$\text{Salvage} = V_0(1-r)^n$

$= 2500(1-0.3)^3$

$= \$857.50$

24) Jamal borrowed $350 000 to be repaid over 30 years, with monthly repayments of $1880. However, after 10 years he made a lump sum payment of $80 000. The monthly repayment remained unchanged. The graph shows the balances owing over the period of the loan. **2**



Over the period of the loan, how much less did Jamal pay by making the lump sum payment

$30 - 22 = 8$ year, so 96 month

$96 \times 1880 = 180480$

$180480 - 80000 = 100480$

(lump sum)

Marks

25) The table gives the present value interest factors for an annuity of $1 per period. For various interest rates (R) and number of periods (N).

Table of present value interest factors					
r / N	Interest rate per period (as a decimal)				
	0.0075	0.0080	0.0085	0.0090	0.0095
70	54.30462	53.43960	52.59397	51.76724	50.95891
71	54.89293	54.00754	53.14226	52.29657	51.46995
72	55.47685	54.57097	53.68593	52.82118	51.97618
73	56.05643	55.12993	54.22502	53.34111	52.47764
74	56.63169	55.68446	54.75957	53.85641	52.97438

i) Oscar plans to invest $200 each month for 74 months. His investment will earn interest at the rate of 0.0080 (as a decimal) per month. Use this information in the table to calculate the present value of this annuity. **1**

$PV = 200 \times 55.68446$

$= 11136.89$

ii) Lucy is using the same table to calculate the loan repayment for her car loan. Her loan is $21 500 and will be repaid in equal monthly repayments over 6 years. The interest rate on her loan is 10.8% per annum. Calculate the amount of each monthly repayment, correct to the nearest dollar. **2**

$0.108 \div 12 = 0.0090$

repayment is the annuity

$21500 = 52.82118 \times \text{repayment}$

$\text{repayment} = \$407.03$

$= \$407$

Marks

26) During the previous financial year, Diego earned a gross salary of $79 348 for his work as a forensic statistician. Diego also earned $8 920 from being a Twitch streamer. All up, Diego's taxable income has been calculated to be $83 356.

i) Calculate how much Diego is claiming in tax deductions for his streaming/work equipment and home energy consumption. **1**

79348 + 8920 − 83356 = $4912

ii) Using the tax table below, calculate Diego's tax payable to the nearest cent. **2**

Taxable income	*Tax payable 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
$180 001 and over	$51 667 plus 45 cents for each $1 over $180 000

5092 + 0.325(83356 − 45000)
= $17 557.70

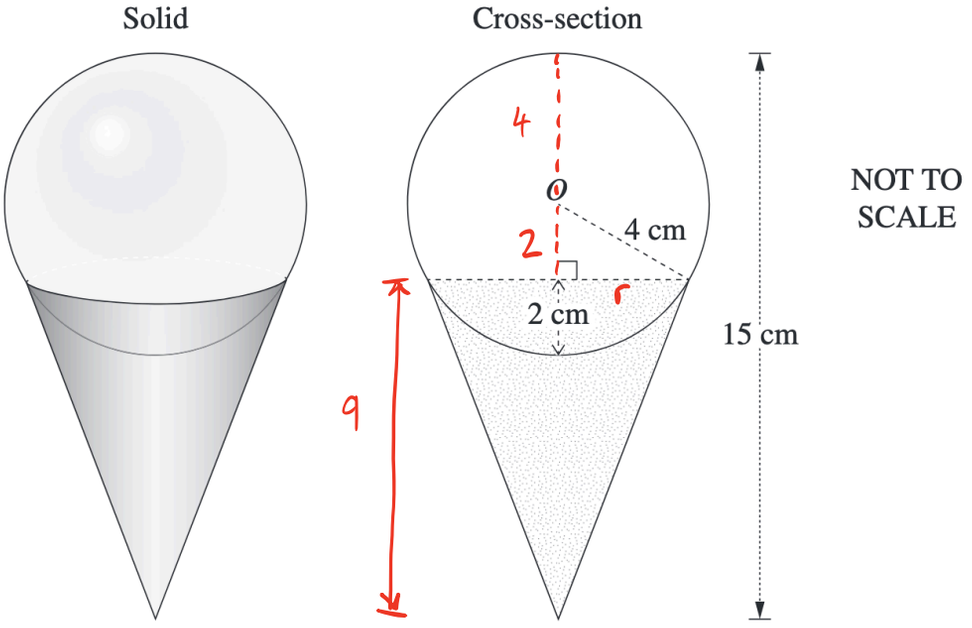
iii) Diego's employer has already taken $11 905 as PAYG tax. Calculate Diego's refund or liability, justifying your answer with calculations to the nearest cent. Do not include the Medicare Levy in your calculation. **1**

17 557.70 − 11905 = 5652.70

Marks

27) A solid is made up of a sphere sitting partially inside a cone. **3**

The sphere, centre O, has a radius of 4 cm and sits 2 cm inside the cone. The solid has a total height of 15 cm. The solid and its cross-section are



What is the volume of the cone, correct the nearest ~~square~~ cubic centimetre?

radius of cone → $r^2 = 4^2 - 2^2$

$r = \sqrt{12}$

Volume of cone → $\frac{1}{3}\pi r^2 h$

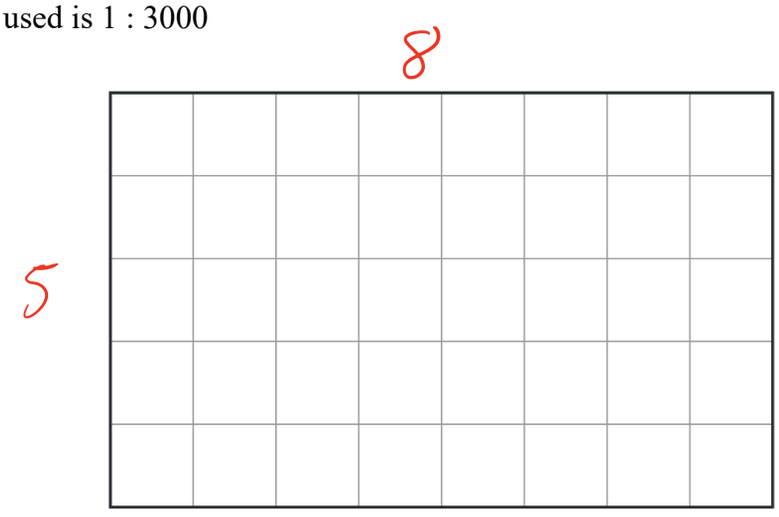
$= \frac{1}{3} \pi \times (\sqrt{12})^2 \times 9$

$= 113 \text{ cm}^3$

Marks

28) A rectangular sportsground has been drawn to scale on a 1- cm grid as shown. **4**

The scale used is 1 : 3000



Kerry took 12 minutes to walk around the perimeter of this sportsground.

What was Kerry's average speed in kilometres per hour?

5 × 3000 = 15000 cm in real life

8 × 3000 = 24 000 cm in real life

Total distance = 2 × (15000 + 24000)

= 78000 cm

= 0·78 km

12 minutes is 0·2 hours

speed = 0·78 ÷ 0·2 = 3·9 km/h

Marks

29) The sizes of the angles of a triangle are in the ratio 2 : 3 : 5. **2**

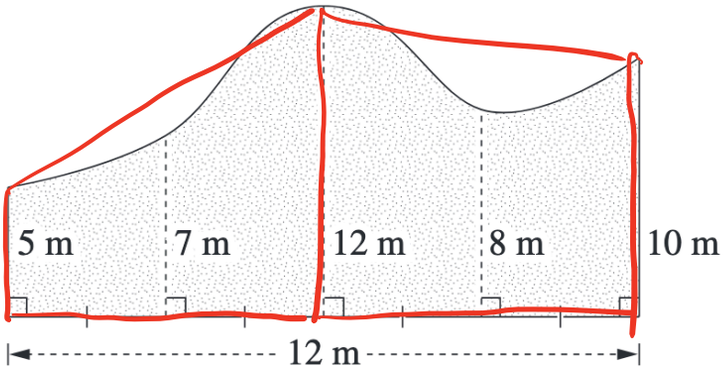
Find the size of the largest angle.

Total parts = 2+3+5 = 10

180 ÷ 10 = 18° each part

largest angle = 18 × 5 = 90°

30) The diagram represents a field **2**



NOT TO SCALE

Find the area of the field, using two applications of the trapezoidal rule.

h = 6

$A \approx \frac{6}{2}(5+12) + \frac{6}{2}(12+10)$

$= 117\ m^2$

31) Data was collected from 30 students on the number of text messages they had sent in the previous 24 hours. The set of data collected is displayed below. **3**

Male		Female
9 9 8 7 6 5 5 4 2 1	0	8 9
1 1 0 0	1	1 1 2 5 6 8 8 8
15th 0	2	16th 0 1 7
	3	4
	4	
	5	
	6	
1	7	

Determine whether the data has an outlier. Justify your answer with calculations.

median = $\frac{15^{th} + 16^{th} \text{ score}}{2} = 11$

$Q_1 = 8^{th}$ score $= 8$

$Q_3 = 22^{nd}$ score $= 18$

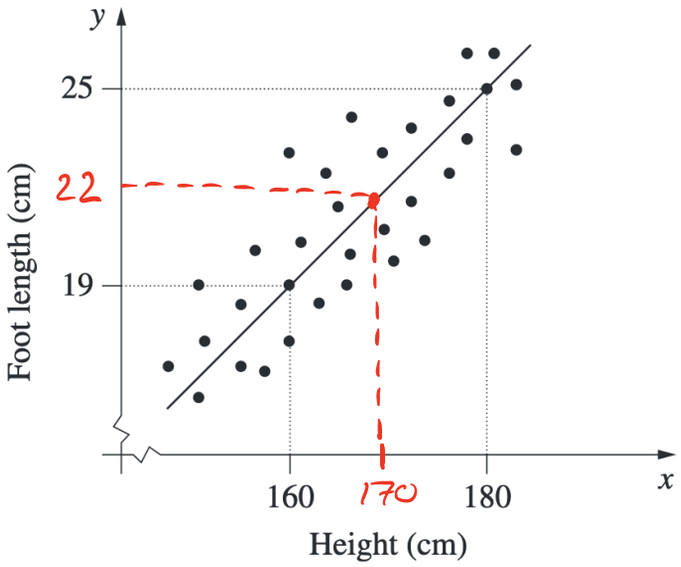
$IQR = 18 - 8 = 10$

Outlier → $Q_3 + 1.5\,IQR = 18 + 1.5 \times 10$

$= 33$

∴ 71 is an outlier

32) Each member of a group of males had his height and foot length measured and recorded. The results were graphed and a line of fit drawn.



NOT TO SCALE

i) Why does the value of the y-intercept have no meaning in this situation? **1**

A person cannot have zero height

ii) George is 10 cm taller than his brother Harry. Use the line of fit to estimate the difference in their foot lengths. **1**

difference is 3cm

iii) Sam calculated a correlation coefficient of −1.2 for the data. Give TWO reasons why Sam must be incorrect. **2**

values of $-1 < r < 1$ and the correlation is positive not negative

33) The marks in a class test are normally distributed. The mean is 100 and the standard deviation is 10.

i) Jason's mark is 115. What is his *z*-score? **1**

$$z = \frac{115-100}{10} = 1.5$$

ii) Mary has a *z*-score of 0. What mark did she achieve in the test? **1**

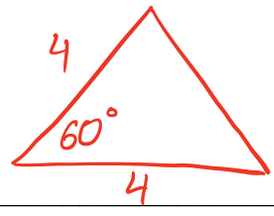
100 (i.e. the mean)

iii) What percentage of marks lie between 80 and 110? **2**

110 is $+1\sigma$ & 80 is -2σ

$$68 + (95-68) \times \tfrac{1}{2} = 81.5\%$$

34) Find the area of an equilateral triangle that has 4 cm sides. **2**



$$A = \frac{1}{2} \times 4 \times 4 \times \sin 60$$

$$= 6.928 \text{ cm}^2$$

35) A coin is slid down a ramp PQ which is at an angle of elevation of 37° to a horizontal bench QR.

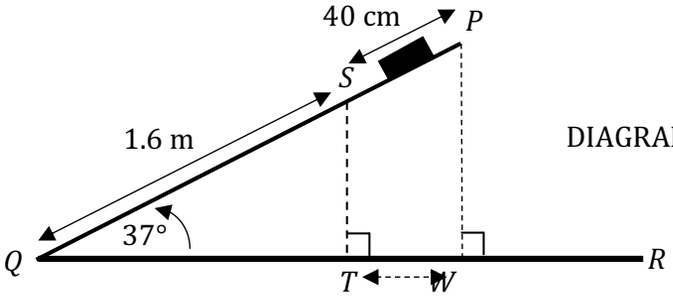


DIAGRAM NOT TO SCALE

When the coin reaches the point S on the ramp 40 cm from P, it has 1.6 m to slide to reach Q.

i) Use Trigonometry to calculate the distance QT correct to TWO decimal places. **2**

$\cos 37 = \frac{QT}{1.6}$

$QT = 1.6 \cos 37$

$= 1.28 m$

ii) What is the horizontal distance TW in the diagram, correct to 1 decimal place? **2**

using the fact that similar triangles have sides in proportion

$\frac{2}{1.6} = \frac{QW}{1.28}$

$QW = 1.6$

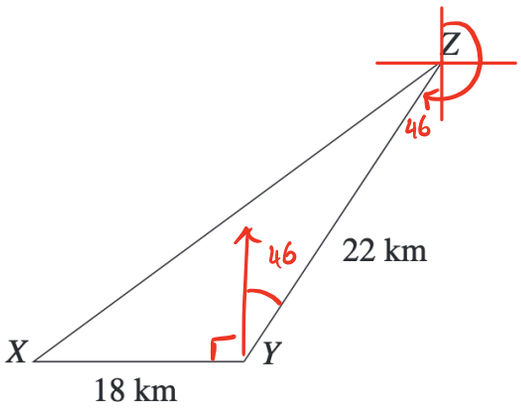
$TW = 1.6 - 1.28 = 0.32$

$= 0.3$

Marks

36) In the diagram X, Y and Z represent the locations of three towns.

The town Y is due east of X, and the bearing of Z from Y is 046°



NOT TO SCALE

i) Find the size of $\angle XYZ$. **1**

$90 + 46 = 136^\circ$

ii) Find the distance XZ correct to one decimal place **2**

$XZ^2 = 18^2 + 22^2 - 2 \times 18 \times 22 \times \cos 136$

$XZ^2 = 1377.72$

$XZ = 37.1 \text{ km}$

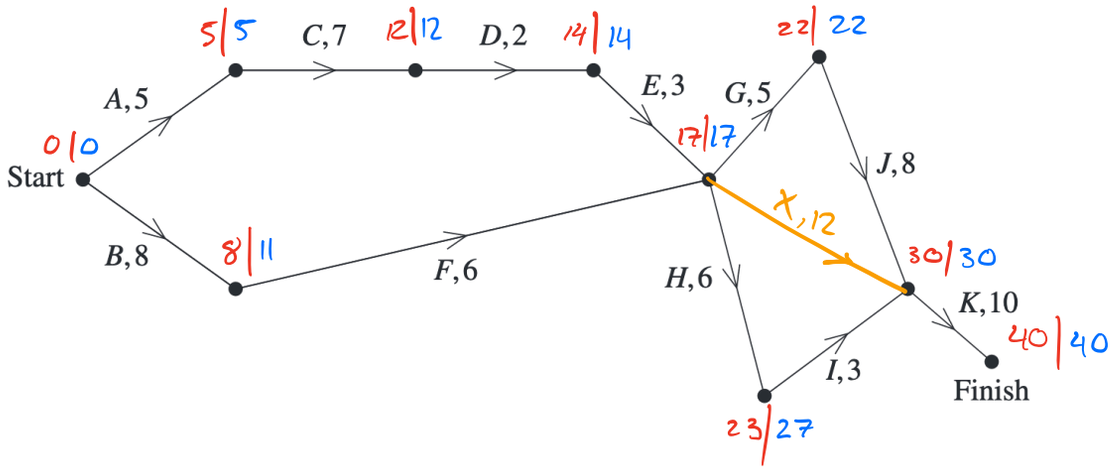
iii) What is the bearing of Y from Z? **2**

$180 + 46 = 226^\circ$

Marks

37) A project requires completion of 11 tasks A, B, C, . . . , K.

A network diagram for the project giving the completion time for each task, in minutes, is shown.



i) Find the minimum time to complete the project. **1**

40

---

ii) State the critical path for this project **1**

A, C, D, E, G, J, K

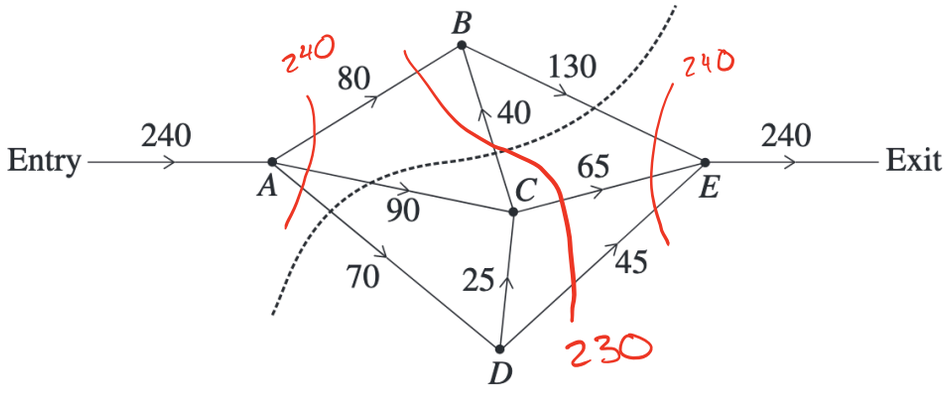
---

iii) A new task, X, is to be added to the project. The earliest starting time for X is 17 minutes, the latest starting time for X is 18 minutes and X has a completion time of 12 minutes. Add task X to the given network diagram above AND state the float time for this task. **2**

1 minute

Marks

38) A museum is planning an exhibition using five rooms. The vertices A,B, C, D and E represent the five rooms. The numbers on the edges represent The maximum number of people per hour who can pass through the security checkpoints between the rooms.



i) What is the capacity of the cut shown? **1**

130 + 90 + 70 = 290

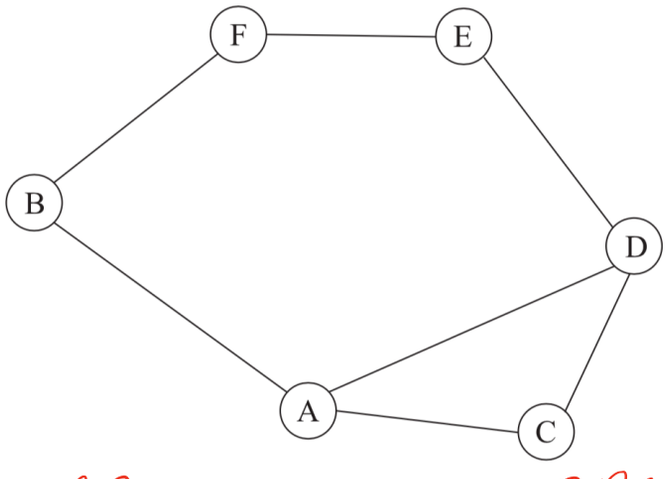
---

ii) What is the flow capacity of the network? **1**

230

---

39) State a trail for the following network. **1**



ABFEDCAD OR ABFEDACD

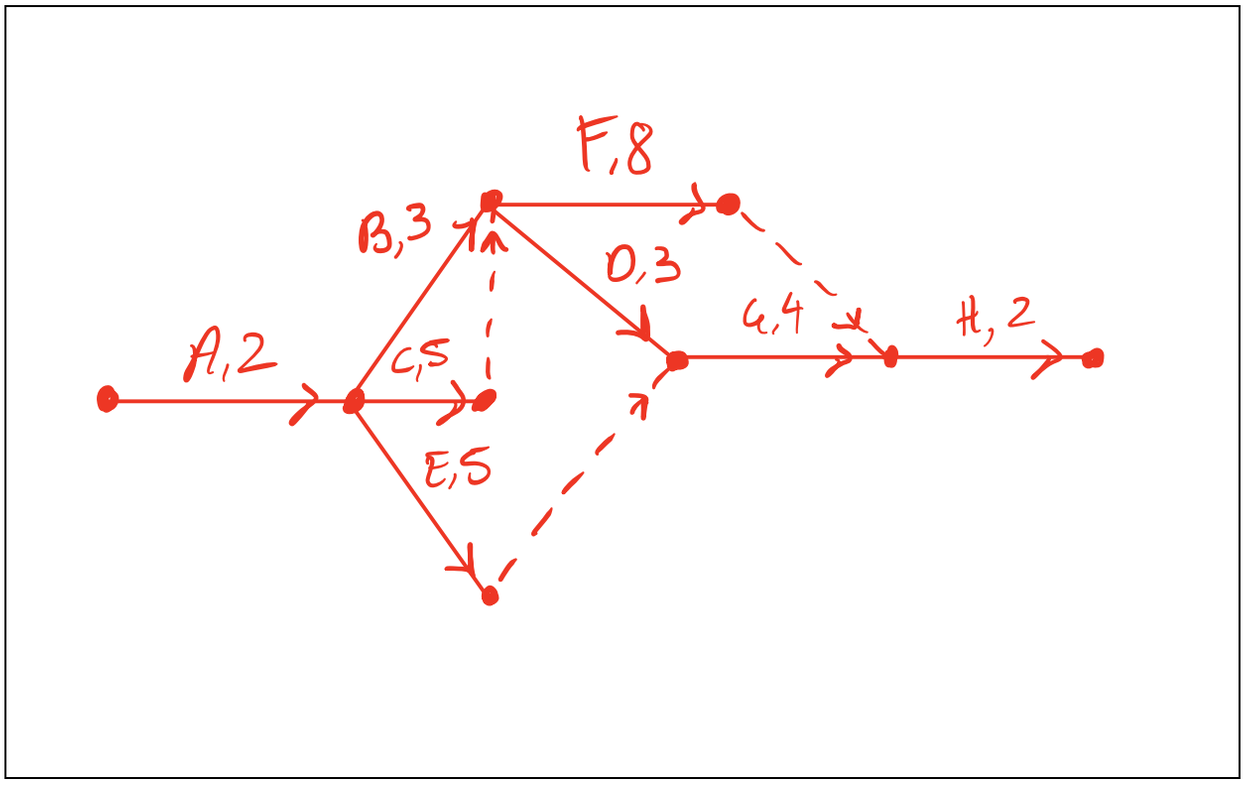
Marks

40) The activity chart below shows the immediate prerequisite(s) and duration for each activity in a project.

Activity	Immediate Prerequisites	Time (days)
A	-	2
B	A	3
C	A	3
D	B, C	3
E	A	5
F	B, C	8
G	D, E	4
H	F, G	2

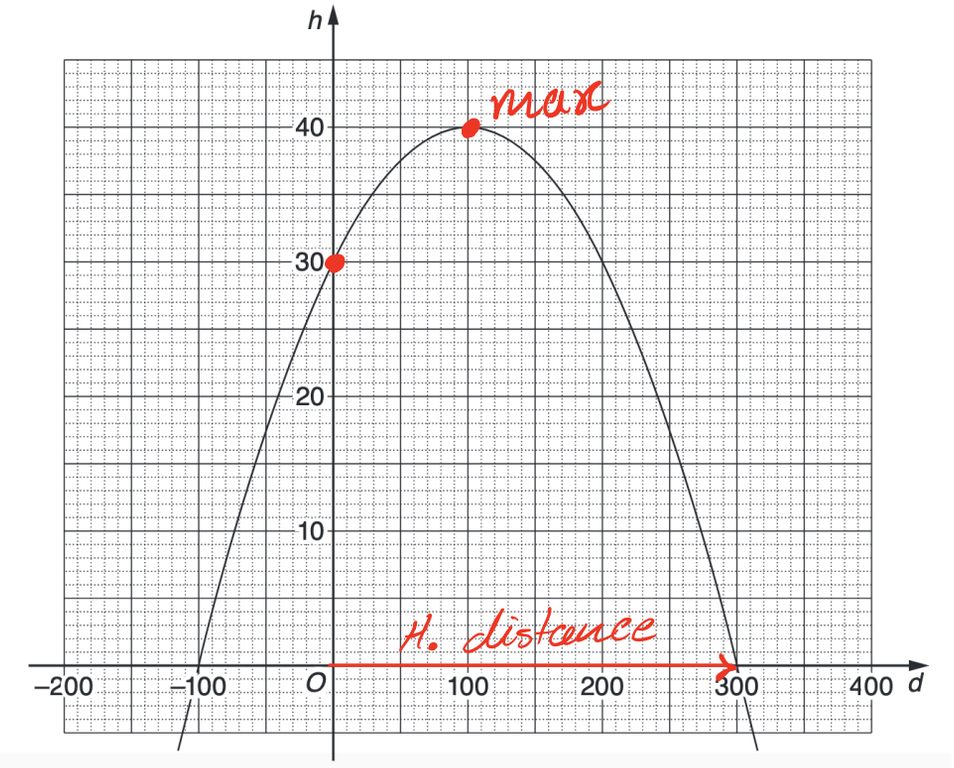
→ also known as network diagram or activity graph / diagram

Draw a directed network diagram for the table above **2**



Marks

41) A ball is thrown upward from a raised platform. The path of the ball's trajectory is modelled by $h = -0.001d^2 + 0.2d + 30$ where h is the height above the ground and d is the horizontal distance the ball travels. A graph of the equation is shown below.



i) From what height is the ball thrown? **1**

30m

ii) What is the maximum distance above the ground the ball reaches? **1**

40m

iii) What is the horizontal distance travelled? **1**

300m

iv) What is the height when $d = 215.2$? **1**

$h = -0.001(215.2)^2 + 0.2(215.2) + 30 = 26.7m$

Marks

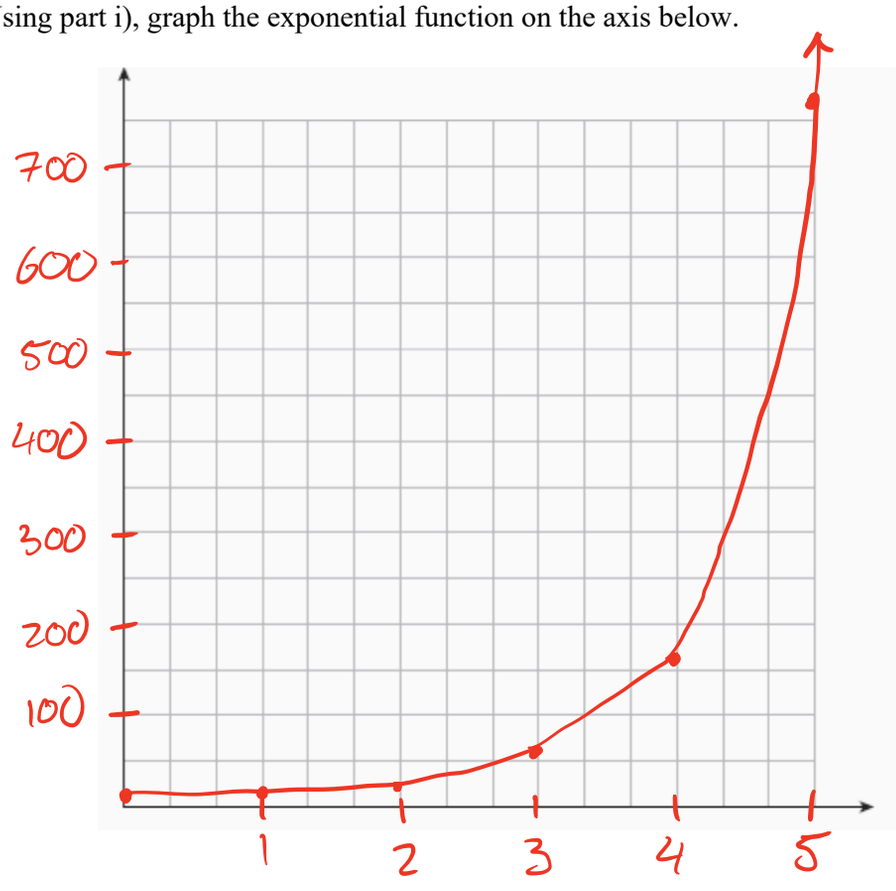
42) An infectious disease grows exponentially according to the equation $I = 3.8^t$, where I is the number of infections after t days.

i) Create a table of values of I and t **2**

(express the number of infections to the nearest whole number).

t	0	1	2	3	4	5
I	1	4	14	55	209	792

ii) Using part i), graph the exponential function on the axis below. **2**



43) If pressure (P) varies inversely with volume (V), write a formula to correctly express in terms of P and V. **2**

$P = \frac{k}{V}$

End of Examination

Section II extra writing space

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

Section II extra writing space

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

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NSW Education Standards Authority

2020 **HIGHER SCHOOL CERTIFICATE EXAMINATION**

Mathematics Standard 1
Mathematics Standard 2

REFERENCE SHEET

Measurement

Limits of accuracy

Absolute error = $\frac{1}{2} \times$ precision

Upper bound = measurement + absolute error

Lower bound = measurement − absolute error

Length

$$l = \frac{\theta}{360} \times 2\pi r$$

Area

$$A = \frac{\theta}{360} \times \pi r^2$$

$$A = \frac{h}{2}\left(a + b\right)$$

$$A \approx \frac{h}{2}\left(d_f + d_l\right)$$

Surface area

$$A = 2\pi r^2 + 2\pi rh$$

$$A = 4\pi r^2$$

Volume

$$V = \frac{1}{3}Ah$$

$$V = \frac{4}{3}\pi r^3$$

Trigonometry

$$\sin A = \frac{\text{opp}}{\text{hyp}}, \quad \cos A = \frac{\text{adj}}{\text{hyp}}, \quad \tan A = \frac{\text{opp}}{\text{adj}}$$

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

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$c^2 = a^2 + b^2 - 2ab\cos C$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Financial Mathematics

$$FV = PV\left(1 + r\right)^n$$

Straight-line method of depreciation

$$S = V_0 - Dn$$

Declining-balance method of depreciation

$$S = V_0\left(1 - r\right)^n$$

Statistical Analysis

An outlier is a score

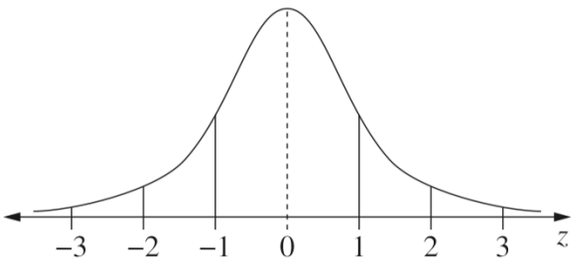
less than $Q_1 - 1.5 \times IQR$

or

more than $Q_3 + 1.5 \times IQR$

$$z = \frac{x - \mu}{\sigma}$$

Normal distribution



- approximately 68% of scores have z-scores between −1 and 1
- approximately 95% of scores have z-scores between −2 and 2
- approximately 99.7% of scores have z-scores between −3 and 3

Hurlstone Agricultural High School
Year 12 Mathematics Standard 2 Trial HSC 2022 Section I - Answer Sheet

Student Name _____ Teacher Name_____

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

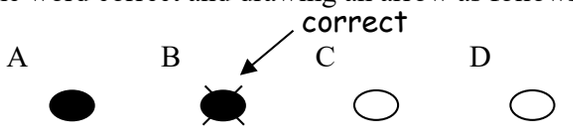
Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

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

A ● B ⊗ C ○ D ○

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



1. A ● B ○ C ○ D ○
2. A ○ B ○ C ○ D ●
3. A ○ B ○ C ○ D ●
4. A ○ B ○ C ● D ○
5. A ○ B ● C ○ D ○
6. A ● B ○ C ○ D ○
7. A ● B ○ C ○ D ○
8. A ○ B ○ C ○ D ●
9. A ○ B ○ C ○ D ●
10. A ○ B ● C ○ D ○
11. A ○ B ● C ○ D ○
12. A ○ B ○ C ○ D ●
13. A ● B ○ C ○ D ○
14. A ● B ○ C ○ D ○
15. A ○ B ○ C ○ D ●