



HURLSTONE
AGRICULTURAL HIGH
SCHOOL

STUDENT'S NAME: _____

TEACHER'S NAME: _____

2025

HSC ASSESSMENT TASK 4

Mathematics Standard 2

Examiner: Mrs. D. Crancher

General Instructions

- Reading time – 10 minutes
- Working time – 2 hours 30 minutes
- Write using a black pen
- NESA approved calculators may be used
- A reference sheet has been provided
- For Section I, multiple choice answers must be written on multiple choice answer sheet provided
- For questions in Section II, **all relevant mathematical reasoning and/or calculations must be shown**

Total marks:
100 marks

Section I: (Multiple Choice) 15 marks

- Attempt all questions
- Allow about 20 minutes for this section

Sections II: (Extended Response) 85 marks

- Attempt all questions
- Allow about 2 hours 10 minutes for this section

This examination paper is not to be removed from the Examination Centre

Disclaimer: Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2025 HSC Mathematics Standard 2 Examination.

Section I

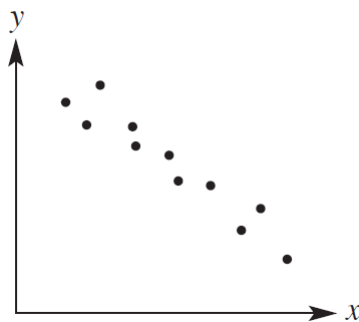
15 marks

Attempt Questions 1-15

Allow about 20 minutes for this section.

Use the multiple-choice answer sheet provided for Questions 1 to 15.

- 1 Which description best describes the relationship shown in the scatterplot below?



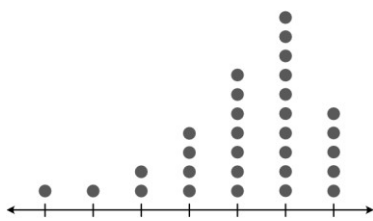
- (A) Linear, negative, strong
- (B) Non-linear, positive, strong
- (C) Non-linear, negative, weak
- (D) Linear, positive, weak
- 2 Sugar is sold in 4 different-sized packs.

Which pack is the best buy?

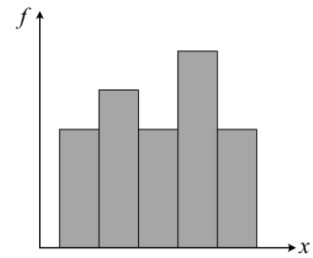
- (A) 250 g pack for \$0.70
- (B) 500 g pack for \$1.30
- (C) 1 kg pack for \$2.30
- (D) 2 kg pack for \$4.80

3 Which of the data sets below represents a distribution that is negatively skewed?

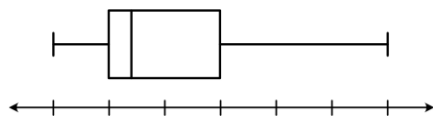
(A)



(B)



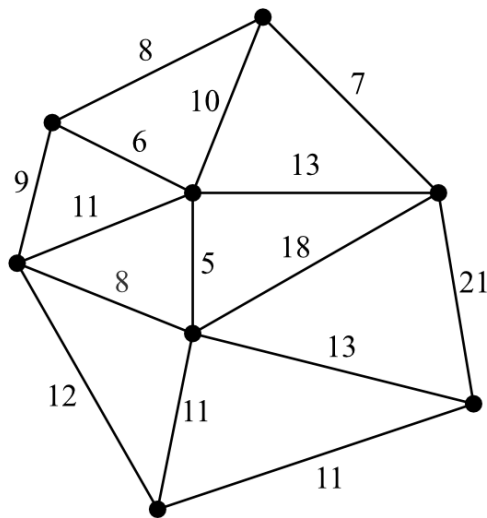
(C)



(D)

stem	leaf
14	6 9
15	2 3 4 8 8
16	4 4 5 7 7 7
17	1 2 6 8 9
18	0 1

4 What is the length of the minimum spanning tree in the network below?



(A) 55

(B) 56

(C) 57

(D) 58

- 5 A farmer has 245 cows and 385 sheep.

What is the simplified ratio of sheep to cows?

- (A) 3 : 1
- (B) 7 : 11
- (C) 11 : 7
- (D) 175 : 275

- 6 Matthew weighs 85 kg and drinks 4 glasses of beer between 7 pm and 9:30 pm on a Saturday night. Each glass of beer is equivalent to 1.2 standard drinks. Matthew's blood alcohol content (BAC) can be calculated using the following formula:

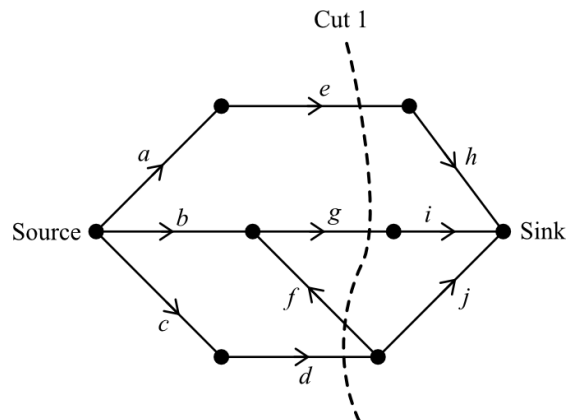
$$BAC_{male} = \frac{10N - 7.5H}{5.5M}$$

where N = number of standard drinks
 H = number of hours drinking
 M = male's mass, in kilograms

What is Matthew's approximate BAC at 9:30 pm?

- (A) 0.063
- (B) 0.050
- (C) 0.024
- (D) 0.006

- 7 Water pipes connect 8 locations. The flow network below shows the capacities of the pipes.



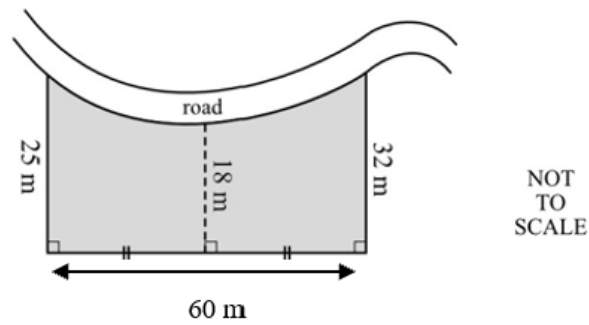
What is the capacity of cut 1?

- (A) $e + g + f$
- (B) $e + g - f + d$
- (C) $e + g + d$
- (D) $c + d$
- 8 Last week, Eden earned \$403.20 when she worked 18 hours at a normal rate in her part-time job. This week she worked 12 hours at a normal rate and 3 hours at time-and-a-half.

How much did she earn this week?

- (A) \$268.80
- (B) \$336.00
- (C) \$369.60
- (D) \$403.20

- 9 The shaded region represents a block of land bounded on one side by a road.



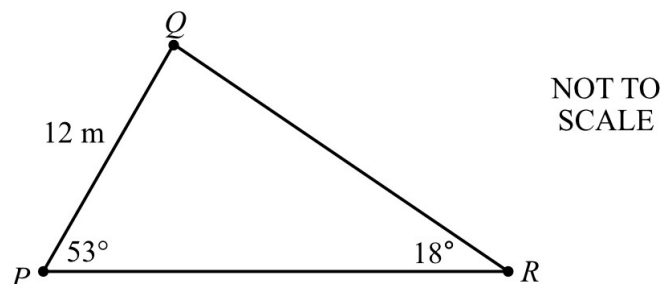
What is the approximate area of the block of land using two applications of the Trapezoidal rule?

- (A) 2790 m^2
- (B) 1395 m^2
- (C) 1710 m^2
- (D) 1080 m^2
- 10 The length of a desert spoon is measured to be 13.6 cm long.

What is the percentage error of this measurement, correct to two decimal places?

- (A) 0.60%
- (B) 0.37%
- (C) 0.74%
- (D) 4.41%

- 11 What is the distance from Q to R in the diagram below, correct to the nearest metre?



- (A) 5 m
- (B) 31 m
- (C) 35 m
- (D) 39 m
- 12 Ashfia's target heart rate when exercising is calculated using the following formula:

$$\text{THR} = I \times (\text{MHR} - \text{RHR}) + \text{RHR}$$

where I = exercise intensity
 MHR = maximum heart rate
 RHR = resting heart rate

Ashfia wants to undertake an exercise of 0.85 intensity and achieve a target heart rate of 165.

If she has a resting heart rate of 80 beats per minute, what is her maximum heart rate?

- (A) 185
- (B) 180
- (C) 175
- (D) 170

- 13** Eric achieved a z-score of 2.2 on his latest Geography test.

If the test scores were normally distributed with a mean of 64 and a standard deviation of 5, what was Eric's actual test mark?

- (A) 58
- (B) 65
- (C) 72
- (D) 75

- 14** Rosie is driving along the highway at 100 km/h. She notices a wombat on the road and applies the brakes 1.6 seconds after noticing the wombat. Her braking distance is 98 metres.

What is her approximate stopping distance?

- (A) 48 m
- (B) 57 m
- (C) 63 m
- (D) 142 m

- 15** Electricity prices have risen by 3.4% p.a.

If the average electricity bill in 2016 was \$523, what was the average electricity bill in 2024?

- (A) \$537.75
- (B) \$589.22
- (C) \$673.67
- (D) \$683.39

End of Section I

Section II

85 marks

Attempt all questions.

Allow about 2 hours and 10 minutes for this section.

Answer each question in the space provided.

Show all relevant mathematical reasoning and/or calculations

- 16** A set of data has a lower quartile of 26 and an upper quartile of 34. **3**

What is the maximum possible range if there are no outliers in the data set? (Use the definition of an outlier provided on your reference sheet.)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

17 Solve the following equations.

(a) $5b + 2 = 22 - 3b$

2

[illegible]

(b) $\frac{m-5}{3} + 7 = 9$

2

- 19** Soha has a total of \$90 000 in an investment account earning interest at a rate of 0.7% per month. Each month, immediately after the interest has been paid, Soha withdraws \$1400 from the account. The amount in the account immediately after the n th withdrawal can be determined using the recurrence relation

$$A_n = A_{n-1}(1.007) - 1400$$

where $n = 1, 2, 3, \dots$ and $A_0 = 90\,000$

- (a) Use the recurrence relation to find the amount of money in the account immediately after the third withdrawal. 2

[illegible]

- (b) Calculate the amount of interest earned in the first three months. 2

20 Amira had saved \$400 to use on fuel for a road trip during her holidays.

2

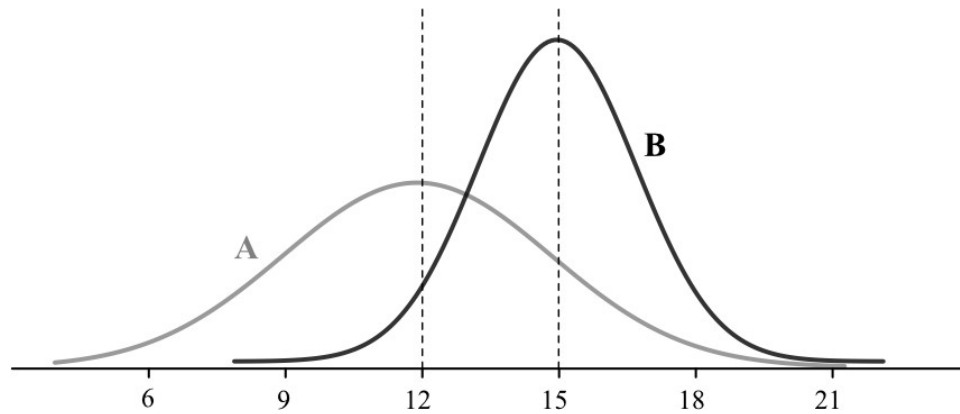
Her car has a fuel consumption of 6.7 L/100 km and she paid \$1.99 per litre for fuel throughout the trip.

How many kilometres was Amira able to travel using the money she had saved?
Answer correct to the nearest kilometre.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

21 The diagram below shows two different normal distribution curves A and B.

2



Compare the curves using the terms 'mean' and 'standard deviation'.

22 In a normally distributed set of scores, the mean is 37 and the standard deviation is 3.

2

What percentage of scores lie between 28 and 31?

- 23** Crystle contributes \$1200 per month at the start of each month into an investment which pays interest at 3.6 % per annum, compounded monthly.

- (a) Show that at the end of the second month, the future value of Crystle's investment will be \$2410.81. **2**

- (b) After 18 months, the future value of Crystle's investment will be \$22 226.19. **2**

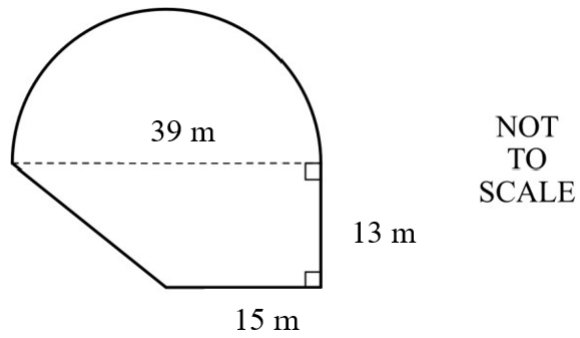
Alveena has a lump sum of \$21 600 which is equivalent to the total of Crystle's contributions. Alveena invests her lump sum into the same investment account paying 3.6% per annum, compounded monthly.

How much more than Crystle will Alveena have in her investment account after 18 months?

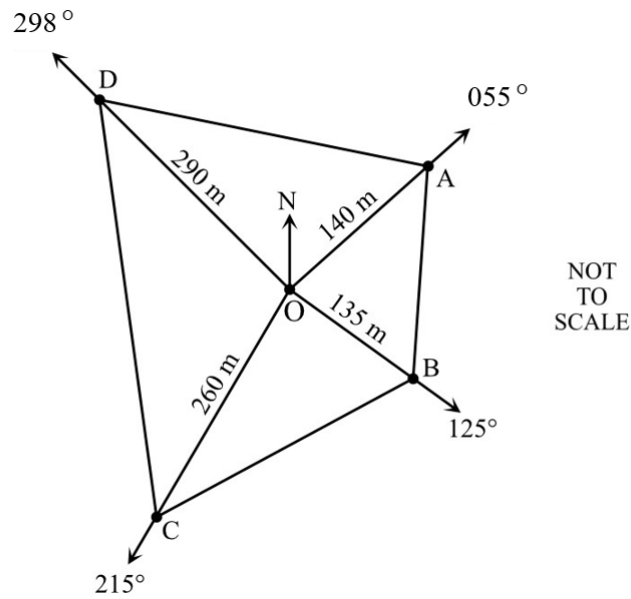
24 The composite shape below is made up of a semicircle and a trapezium.

3

Calculate the perimeter of the shape, correct to the nearest metre.



- 25 A radial survey for the block of land ABCD, is shown in the diagram below.



- (a) Calculate the size of angle AOD. 1

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- (b) Calculate the distance along the boundary of the land from A to D, correct to the nearest metre. 2

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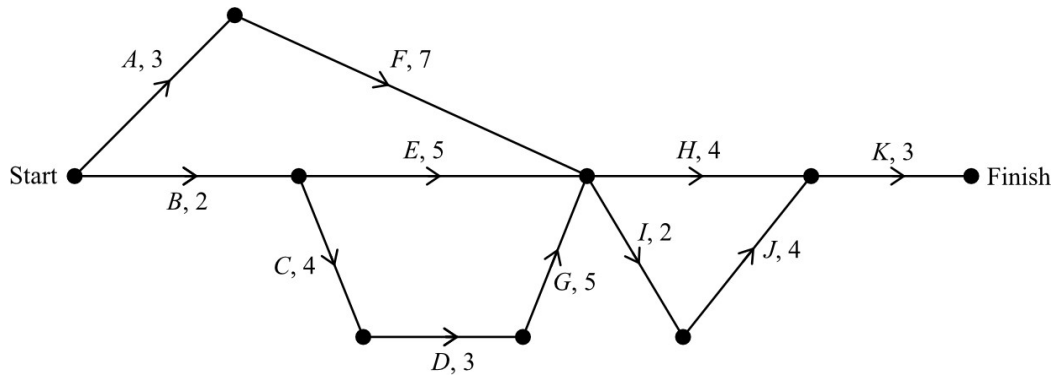
26 Prachi is buying her first car. She takes out a loan for \$17 000 and agrees to repay the loan in monthly repayments at 7.2% per annum for 5 years.

Use the present value of an annuity table to determine how much interest she will pay on the loan.

Table of present value interest factors						
$r \backslash N$	Interest rate per period					
	0.5%	0.6%	0.7%	0.8%	0.9%	1%
36	32.8710	32.2907	31.7247	31.1723	30.6334	30.1075
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

[illegible]

- 27 The network diagram shows tasks that must be completed to finish a project. Each edge weight represents the time taken to complete the task, in days.



- (a) What is the earliest start time (EST) of activity H ? 2

- (b) What is minimum completion time for the project? 1

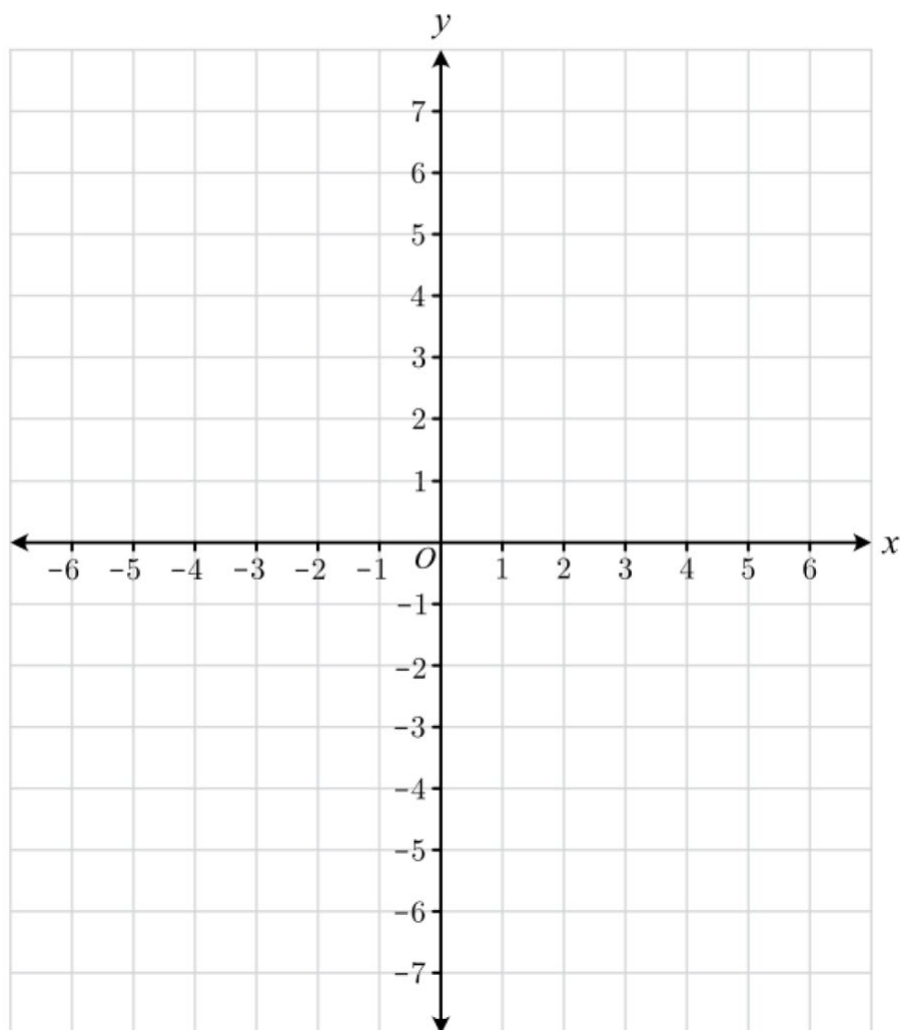
- (c) What is the critical path for the project? 2

- (d) What is the float time of activity E ? 1

29

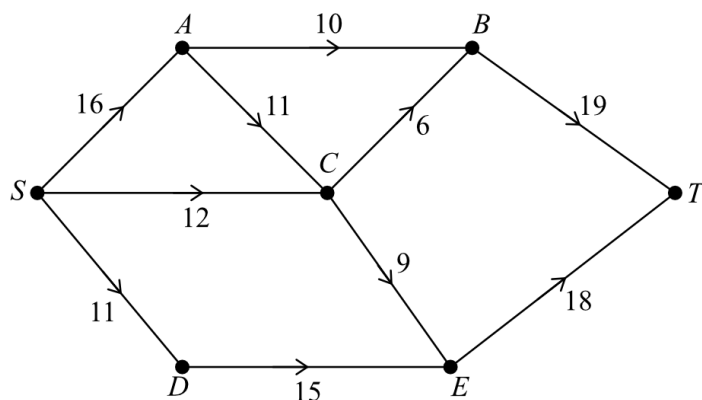
On the number plane below, graph the equations $y = -\frac{x}{2} + 1$ and $y = 2x + 6$, and hence, solve the equations simultaneously.

3



Solution: _____

- 30** The flow of water through a series of pipes is shown in the network below. The water flows from the source (S) to the sink (T) and the numbers on the edges show the maximum capacity of each pipe in litres per minute.



- (a) Find the maximum flow from S to T . **2**

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- (b) By increasing the capacity of one edge in the network, the maximum flow could be increased by 3 litres per minute. **2**

Identify the edge that could be increased. Justify your answer.

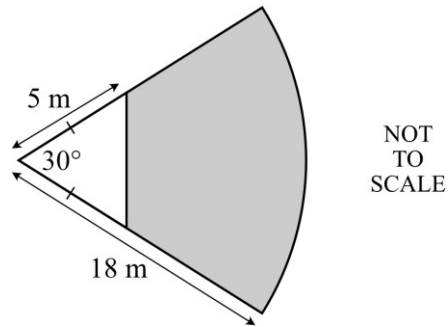
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31 Calculate the area of the shaded region in the sector below, correct to two decimal places.

3

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

32 Cairo in Egypt is located at (30° N, 31° E).
Sydney, in Australia, is located at (33° S, 151° E).

3

Sophie lives in Sydney and needs to attend an online meeting with her business partners in Cairo starting at 9:00 am on Monday, local time in Cairo.

What time and day, in Sydney, does Sophie need to log on to the meeting? Ignore daylight saving.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

33 Abbey spends \$4000 on a new photocopier for her business.

She uses the declining-balance method to calculate the depreciation of the photocopier. She claims this amount as a tax deduction each year. She can only claim the depreciation for that particular year.

- (a) If the rate of depreciation is 27% per annum, show that the depreciation she can claim in the second year is equal to \$788, rounded correct to the nearest dollar. **2**

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- (b) Abbey earned \$130 000 for the last financial year. The depreciation for her photocopier in part (a) is the only tax deduction she claims. **3**
Using the tax table below and ignoring the Medicare levy, calculate the amount of tax she needs to pay.

Income tax rates for Australian residents

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	\$3572 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

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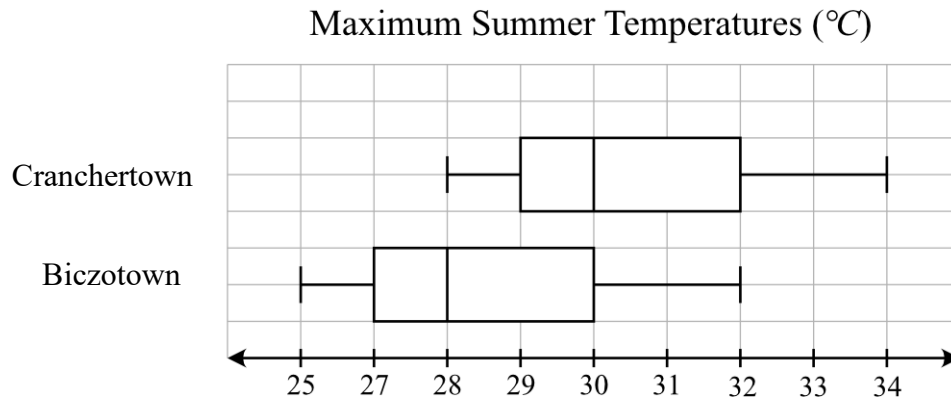
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- 34 In one particular Australian summer, the summer months of December, January and February had a total of 90 days.
The box plots below display data on the maximum daily temperatures in Cranchertown and Biczotown during these summer months.



- (a) What is the median maximum summer temperature of Cranchertown? 1
-
-
- (b) What percentage of summer days in Cranchertown were warmer than Biczotown's warmest day? 1
-
-
- (c) How many summer days in Biczotown were at least 28°C ? 2

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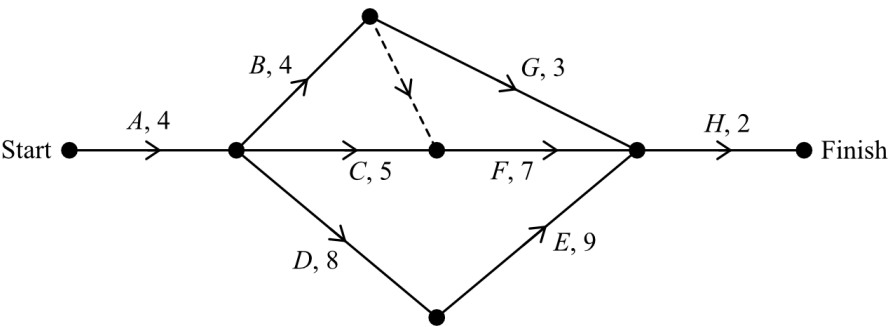
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- 35

The network below shows the activities that need to occur for a project to be completed.

3



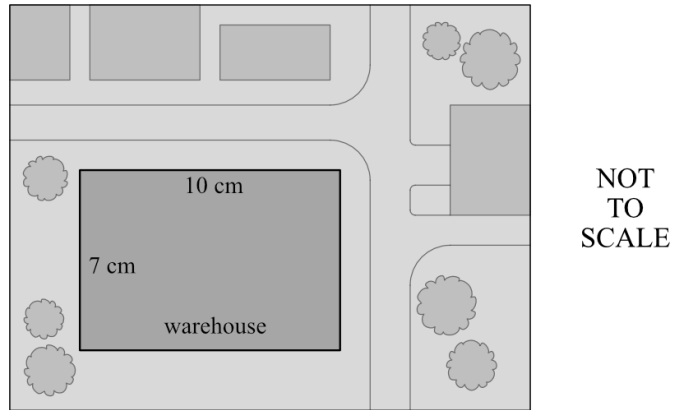
Complete the activity table below for the network shown.

Activity	Duration	Immediate predecessor
<i>A</i>	4	
	4	<i>A</i>
<i>C</i>		
<i>D</i>		<i>A</i>
	9	
<i>F</i>		
<i>G</i>		
<i>H</i>	2	

- 36** A company buys a new warehouse to improve their manufacturing capacity. They plan to save money by collecting rainwater from the entire area of the rectangular roof of the warehouse.

The diagram below shows a plan view of the warehouse and its location within its surroundings.

The dimensions of the warehouse on the diagram are 10 cm and 7 cm.



- (a) If 10 cm on the diagram represents 100 m, what would be the scale of the diagram? Express the scale as a ratio in simplest form. **1**

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- (b) If the company's goal is to collect 1200 kL of water from the roof, how much rain must fall? Answer in millimetres, correct to the nearest millimetre. **3**

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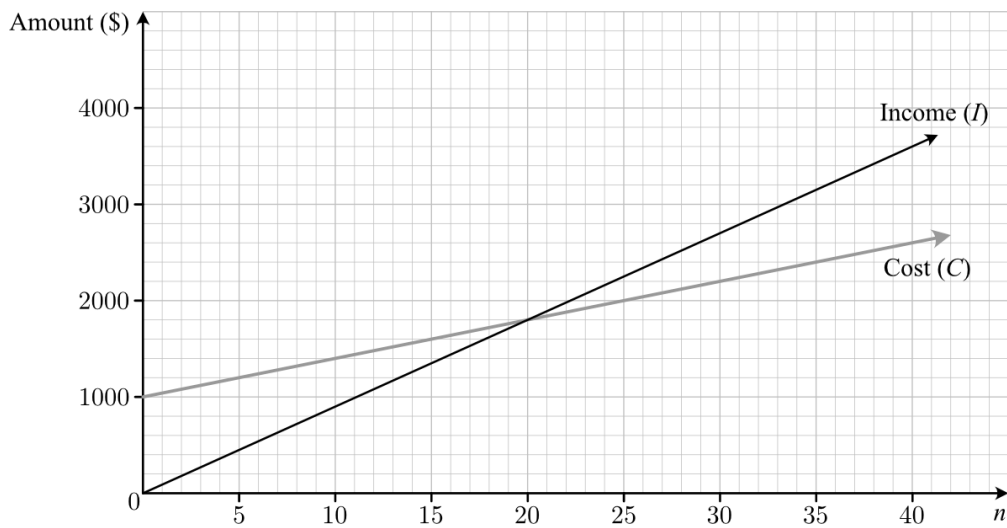
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- 37 Olivia plans to set up a furniture business to sell bedside tables. Below are the income (I) and cost (C) functions for her business.



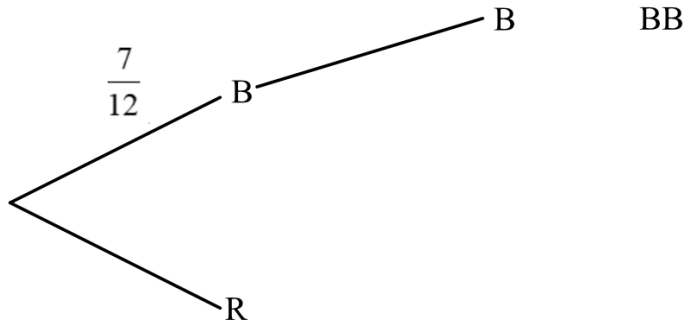
- (a) Write the cost function in the form $C = mn + c$ for the cost of making n tables. 2

- (b) For how much does Olivia plan to sell each bedside table? 1

- (c) If Olivia sells 35 bedside tables, how much profit or loss will she incur? 2

Jahnvi has a box containing 7 blue pens and 5 red pens. She selects a pen at random from the box and places it on a table. She then selects a second pen and places it on the table next to the first pen.

- | 1st pen | 2nd pen | Outcomes |
|---------|---------|----------|
| 1 | 1 | 11 |
| 1 | 2 | 12 |
| 1 | 3 | 13 |
| 1 | 4 | 14 |
| 1 | 5 | 15 |
| 1 | 6 | 16 |
| 2 | 1 | 21 |
| 2 | 2 | 22 |
| 2 | 3 | 23 |
| 2 | 4 | 24 |
| 2 | 5 | 25 |
| 2 | 6 | 26 |
| 3 | 1 | 31 |
| 3 | 2 | 32 |
| 3 | 3 | 33 |
| 3 | 4 | 34 |
| 3 | 5 | 35 |
| 3 | 6 | 36 |
| 4 | 1 | 41 |
| 4 | 2 | 42 |
| 4 | 3 | 43 |
| 4 | 4 | 44 |
| 4 | 5 | 45 |
| 4 | 6 | 46 |
| 5 | 1 | 51 |
| 5 | 2 | 52 |
| 5 | 3 | 53 |
| 5 | 4 | 54 |
| 5 | 5 | 55 |
| 5 | 6 | 56 |
| 6 | 1 | 61 |
| 6 | 2 | 62 |
| 6 | 3 | 63 |
| 6 | 4 | 64 |
| 6 | 5 | 65 |
| 6 | 6 | 66 |



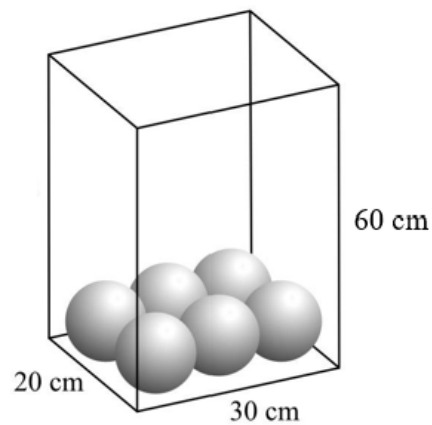
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39

Solid spherical balls of diameter 10 cm are stacked inside a box as shown below. The box is in the shape of a rectangular prism such that 6 balls will fit snugly in each layer.

4



The balls are stacked in the same manner as in the bottom layer until the box is full.

Calculate the percentage of the box that is empty space.
Give your answer correct to the nearest percentage.

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End of Section II

End of Examination

Section I

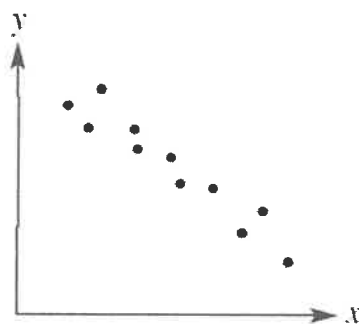
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- (B) Non-linear, positive, strong
- (C) Non-linear, negative, weak
- (D) Linear, positive, weak
- 2 Sugar is sold in 4 different-sized packs.

Which pack is the best buy?

- (A) 250 g pack for \$0.70
- (B) 500 g pack for \$1.30
- (C) 1 kg pack for \$2.30
- (D) 2 kg pack for \$4.80

Convert each option to 250g or equivalent.

Option A: 250g for \$0.70

Option B: $\frac{500\text{g}}{\div 2}$ for $\frac{\$1.30}{\div 2} = 250\text{g}$ for \$0.65

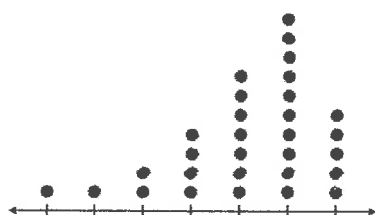
Option C: $\frac{1\text{kg}}{\div 4}$ for $\frac{\$2.30}{\div 4} = 250\text{g}$ for \$0.575

Option D: $\frac{2\text{kg}}{\div 8}$ for $\frac{\$4.80}{\div 8} = 250\text{g}$ for \$0.60

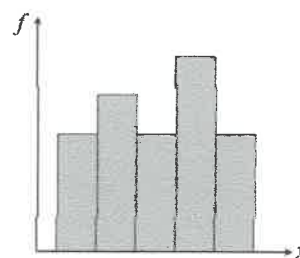
$\therefore$ Option C is the best buy

3 Which of the data sets below represents a distribution that is negatively skewed?

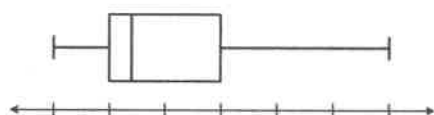
(A)



(B)



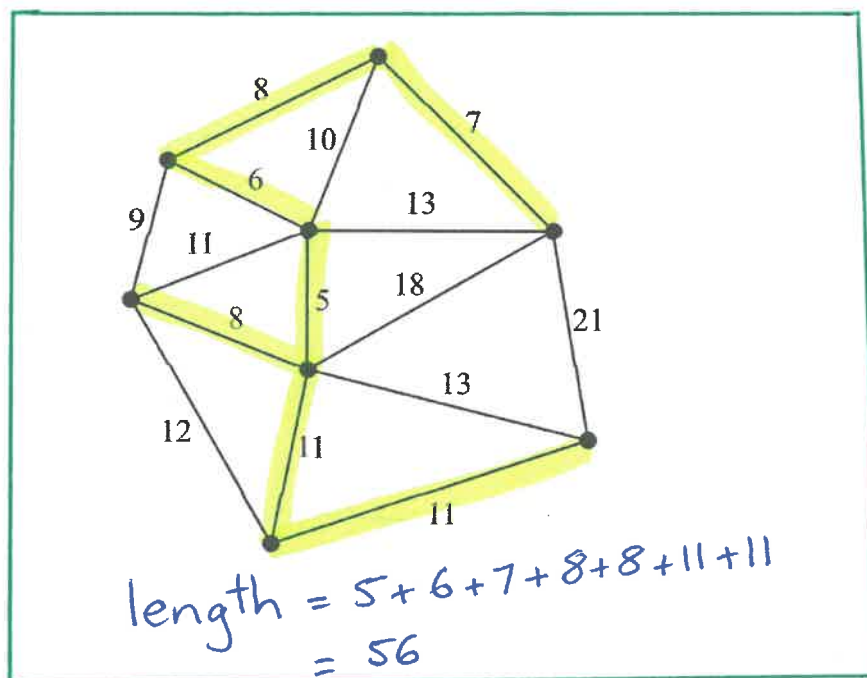
(C)



(D)

stem	leaf
14	6 9
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4 What is the length of the minimum spanning tree in the network below?



(A) 55

(B) 56

(C) 57

(D) 58

- 5 A farmer has 245 cows and 385 sheep.

What is the simplified ratio of sheep to cows?

(A) 3 : 1

(B) 7 : 11

(C) 11 : 7

(D) 175 : 275

$$\begin{aligned} \text{Sheep : Cows} \\ &= 385 : 245 \\ &\quad \div 35 \quad \div 35 \\ &= 11 : 7 \end{aligned}$$

- 6 Matthew weighs 85 kg and drinks 4 glasses of beer between 7 pm and 9:30 pm on a Saturday night. Each glass of beer is equivalent to 1.2 standard drinks. Matthews's blood alcohol content (BAC) can be calculated using the following formula:

$$BAC_{\text{male}} = \frac{10N - 7.5H}{5.5M}$$

where N = number of standard drinks
 H = number of hours drinking
 M = male's mass, in kilograms

What is Matthew's approximate BAC at 9:30 pm?

(A) 0.063

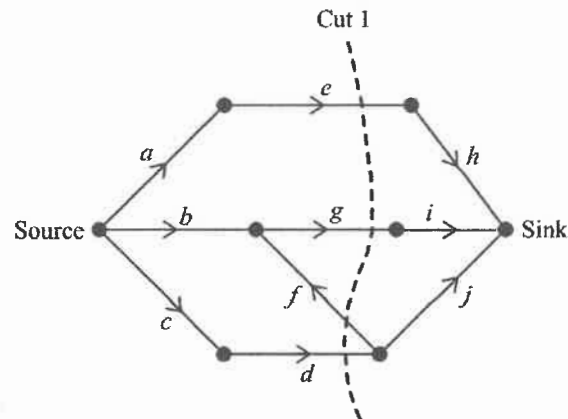
(B) 0.050

(C) 0.024

(D) 0.006

$$\begin{aligned} H &= 9:30 - 7 = 2.5 \text{ hours} \\ N &= 1.2 \times 4 = 4.8 \text{ standard drinks} \\ BAC_{\text{male}} &= \frac{10 \times 4.8 - 7.5 \times 2.5}{5.5 \times 85} \\ &= 0.0625... \\ &= 0.063 \text{ (to 3 d.p.)} \end{aligned}$$

- 7 Water pipes connect 8 locations. The flow network below shows the capacities of the pipes.



What is the capacity of cut 1?

- (A) $e + g + f$
 (B) $e + g - f + d$
 (C) $e + g + d$
 (D) $c + d$

edge f is ignored because
it flows from sink to source

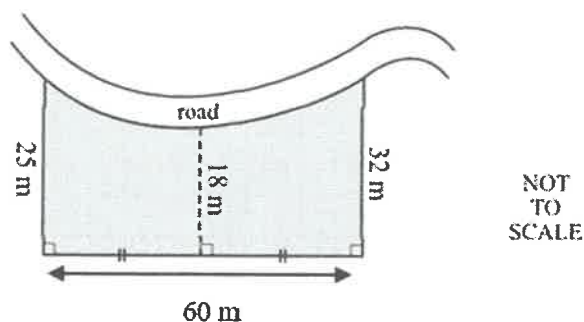
- 8 Last week, Eden earned \$403.20 when she worked 18 hours at a normal rate in her part-time job. This week she worked 12 hours at a normal rate and 3 hours at time-and-a-half.

How much did she earn this week?

- (A) \$268.80
 (B) \$336.00
 (C) \$369.60
 (D) \$403.20

$$\begin{aligned}\text{normal rate} &= \$403.20 \div 18 \\ &= \$22.40 \\ \text{earnings} &= 12 \times 22.40 + 3 \times 1.5 \times 22.40 \\ &= \$369.60\end{aligned}$$

- 9 The shaded region represents a block of land bounded on one side by a road.



What is the approximate area of the block of land using two applications of the Trapezoidal rule?

(A) 2790 m^2

(B) 1395 m^2

(C) 1710 m^2

(D) 1080 m^2

$$h = \frac{60}{2} = 30 \text{ m}$$

$$\begin{aligned} A &\approx \frac{30}{2} (32 + 18) + \frac{30}{2} (18 + 25) \\ &\approx 750 + 645 \\ &\approx 1395 \text{ m}^2 \end{aligned}$$

- 10 The length of a desert spoon is measured to be 13.6 cm long.

What is the percentage error of this measurement, correct to two decimal places?

(A) 0.60%

(B) 0.37%

(C) 0.74%

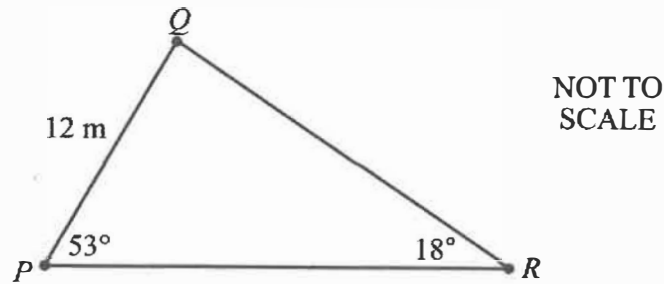
(D) 4.41%

$$\text{precision} = 0.1 \text{ cm}$$

$$\begin{aligned} \text{absolute error} &= \frac{1}{2} \times \text{precision} \\ &= 0.5 \times 0.1 \\ &= 0.05 \text{ cm} \end{aligned}$$

$$\begin{aligned} \% \text{ error} &= \frac{\text{absolute error}}{\text{measurement}} \times 100 \% \\ &= \frac{0.05}{13.6} \times 100 \% \\ &= 0.367... \% \\ &= 0.37 \% \text{ (to 2 d.p.)} \end{aligned}$$

- 11 What is the distance from Q to R in the diagram below, correct to the nearest metre?



- (A) 5 m
(B) 31 m
(C) 35 m
(D) 39 m

$$\begin{aligned}\frac{QR}{\sin 53^\circ} &= \frac{12}{\sin 18^\circ} \quad (\text{sine rule}) \\ QR &= \frac{12 \sin 53^\circ}{\sin 18^\circ} \\ &= 31.013... \\ &= 31 \text{ m (to nearest metre)}\end{aligned}$$

- 12 Ashfia's target heart rate when exercising is calculated using the following formula:

$$\text{THR} = I \times (\text{MHR} - \text{RHR}) + \text{RHR}$$

where I = exercise intensity
 MHR = maximum heart rate
 RHR = resting heart rate

Ashfia wants to undertake an exercise of 0.85 intensity and achieve a target heart rate of

165. If she has a resting heart rate of 80 beats per minute, what is her maximum heart rate?

- (A) 185
(B) 180
(C) 175
(D) 170

$$\begin{aligned}\text{THR} &= I \times (\text{MHR} - \text{RHR}) + \text{RHR} \\ 165 &= 0.85 \times (\text{MHR} - 80) + 80 \quad \leftarrow \text{subtract 80 from both sides} \\ 85 &= 0.85 \times (\text{MHR} - 80) \\ 100 &= \text{MHR} - 80 \quad \leftarrow \text{divide both sides by 0.85} \\ 180 &= \text{MHR} \quad \leftarrow \text{add 80 to both sides} \\ \therefore \text{Maximum heart rate is 180.}\end{aligned}$$

- 13 Eric achieved a z-score of 2.2 on his latest Geography test.

If the test scores were normally distributed with a mean of 64 and a standard deviation of 5, what was Eric's actual test mark?

(A) 58

(B) 65

(C) 72

(D) 75

$$\begin{aligned} Z &= \frac{x - \bar{x}}{\sigma} \\ 2.2 &= \frac{x - 64}{5} \\ 11 &= x - 64 \\ 75 &= x \\ x &= 75 \end{aligned}$$

- 14 Rosie is driving along the highway at 100 km/h. She notices a wombat on the road and applies the brakes 1.6 seconds after noticing the wombat. Her braking distance is 98 metres.

What is her approximate stopping distance?

(A) 48 m

(B) 57 m

(C) 63 m

(D) 142 m

$$\begin{aligned} S &= 100 \text{ km/h} \\ &= (100\,000 \div 3600) \text{ m/s} \\ &= 27.777... \text{ m/s} \end{aligned}$$

Reaction time distance:

$$\begin{aligned} D &= S \times T \\ &= 27.777... \times 1.6 \\ &= 44.444... \text{ m} \end{aligned}$$

$$\begin{aligned} \therefore \text{Stopping distance} &= \text{reaction distance} + \text{braking distance} \\ &= 44.444... + 98 \\ &= 142.44... = 142 \text{ m} \end{aligned}$$

- 15 Electricity prices have risen by 3.4% p.a.

If the average electricity bill in 2016 was \$523, what was the average electricity bill in 2024?

(A) \$537.75

(B) \$589.22

(C) \$673.67

(D) \$683.39

$$\begin{aligned} 2016 \rightarrow 2024 \text{ is } 8 \text{ years } \therefore n &= 8 \\ r &= 3.4\% = 0.034 \text{ as a decimal} \\ FV &= PV(1+r)^n \\ &= 523(1+0.034)^8 \\ &= 523(1.034)^8 \\ &= \$683.39 \end{aligned}$$

End of Section I

Section II

85 marks

Attempt all questions.

Allow about 2 hours and 10 minutes for this section.

Answer each question in the space provided.

Show all relevant mathematical reasoning and/or calculations

- 16 A set of data has a lower quartile of 26 and an upper quartile of 34.

3

What is the maximum possible range if there are no outliers in the data set?
(Use the definition of an outlier provided on your reference sheet.)

$$Q_1 = 26 \quad Q_3 = 34$$

$$\begin{aligned} \text{IQR} &= Q_3 - Q_1 \\ &= 34 - 26 \\ &= 8 \end{aligned}$$

$$\begin{aligned} \text{Outlier lower bound} &= Q_1 - 1.5 \times \text{IQR} \\ &= 26 - 1.5 \times 8 \\ &= 14 \end{aligned}$$

$$\begin{aligned} \text{Outlier upper bound} &= Q_3 + 1.5 \times \text{IQR} \\ &= 34 + 1.5 \times 8 \\ &= 46 \end{aligned}$$

✓ attempt
to
calculate
these bounds

$$\begin{aligned} \text{Maximum possible range} &= 46 - 14 \\ &= 32 \end{aligned}$$

17 Solve the following equations.

(a) $5b + 2 = 22 - 3b$

2

$$\begin{array}{r} 5b + 2 = 22 - 3b \\ +3b \quad +3b \end{array}$$

$$8b + 2 = 22$$

$$\begin{array}{r} -2 \quad -2 \end{array}$$

$$8b = 20$$

$$\begin{array}{r} \div 8 \quad \div 8 \end{array}$$

$$b = \frac{20}{8}$$

$$\therefore b = \frac{5}{2}$$

Must simplify $\frac{20}{8}$,
accept also $2\frac{1}{2}$
or 2.5

(b) $\frac{m-5}{3} + 7 = 9$

2

$$\begin{array}{r} \frac{m-5}{3} + 7 = 9 \\ -7 \quad -7 \end{array}$$

$$\frac{m-5}{3} = 2$$

$$\begin{array}{r} \times 3 \quad \times 3 \end{array}$$

$$m - 5 = 6$$

$$\begin{array}{r} +5 \quad +5 \end{array}$$

$$m = 11$$

18

Sophia purchased 1600 shares for \$3.25 and later sold them for \$4.80 per share. Sophia paid brokerage fees on the purchase and sale of the shares as shown in the table.

3

Brokerage fees	
Purchase of shares	2% of the purchase price
Sale of shares	3% of the sale price

Given that she did not receive any dividend, calculate the profit that Sophia earned from the shares.

$$\begin{aligned}\text{Purchase price} &= 1600 \times \$3.25 \\ &= \$5200\end{aligned}$$

$$\begin{aligned}\text{Total purchase cost} &= \text{purchase price} + \text{brokerage} \\ &= \$5200 + 0.02 \times 5200 \\ &= \$5304 \quad \checkmark\end{aligned}$$

$$\begin{aligned}\text{Sale price} &= 1600 \times \$4.80 \\ &= \$7680\end{aligned}$$

$$\begin{aligned}\text{Total income from selling} &= \text{Sale price} - \text{brokerage} \\ &= \$7680 - 0.03 \times 7680 \\ &= \$7449.60 \quad \checkmark\end{aligned}$$

$$\begin{aligned}\text{Profit} &= \$7449.60 - \$5304 \\ &= \$2145.60 \quad \checkmark\end{aligned}$$

- 19 Soha has a total of \$90 000 in an investment account earning interest at a rate of 0.7% per month. Each month, immediately after the interest has been paid, Soha withdraws \$1400 from the account.
The amount in the account immediately after the n th withdrawal can be determined using the recurrence relation

$$A_n = A_{n-1}(1.007) - 1400$$

where $n = 1, 2, 3, \dots$ and $A_0 = 90\,000$

- (a) Use the recurrence relation to find the amount of money in the account immediately after the third withdrawal.

2

$$A_0 = \$90\,000$$

$$A_1 = 90\,000(1.007) - 1400 \\ = \$89\,230$$

✓ Method

$$A_2 = 89\,230(1.007) - 1400 \\ = \$88\,454.61$$

$$A_3 = 88\,454.61(1.007) - 1400 \\ = \$87\,673.79227.. \\ = \$87\,673.79$$

✓

- (b) Calculate the amount of interest earned in the first three months.

2

$$\text{Interest} = \$87\,673.79 + (1400 \times 3) - 90\,000 \\ = \$1\,873.79$$

✓

✓

20 Amira had saved \$400 to use on fuel for a road trip during her holidays.

2

Her car has a fuel consumption of 6.7 L/100 km and she paid \$1.99 per litre for fuel throughout the trip.

How many kilometres was Amira able to travel using the money she had saved?
Answer correct to the nearest kilometre.

$$\text{Litres of fuel she can afford} = \$400 \div \$1.99 \\ = 201.0050251... \text{ L}$$

$$\begin{array}{rcl} 6.7 \text{ L} & \text{for} & 100 \text{ km} \\ \div 6.7 & & \div 6.7 \end{array}$$

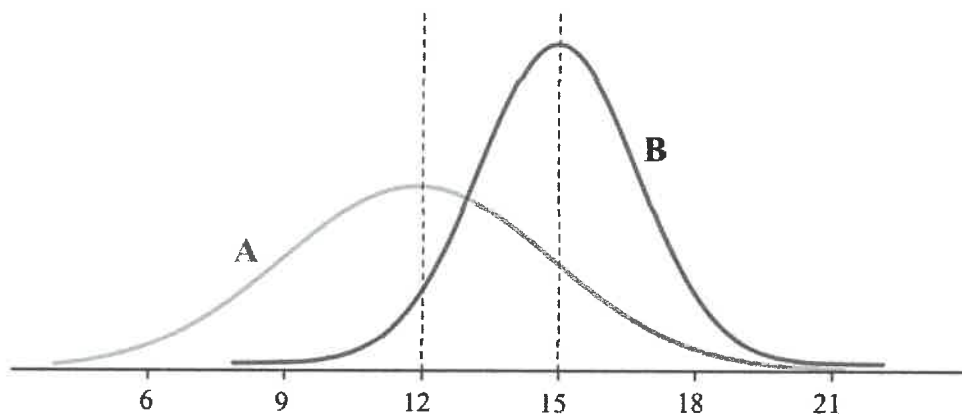
$$\begin{array}{rcl} 1 \text{ L} & \text{for} & 14.92537313... \text{ km} \\ \times 201.0050251... & & \times 201.0050251... \end{array}$$

$$201.0050251... \text{ for } 3000.075001 \text{ km}$$

$\therefore$ She can travel 3000 km (to nearest km)

21 The diagram below shows two different normal distribution curves A and B.

2

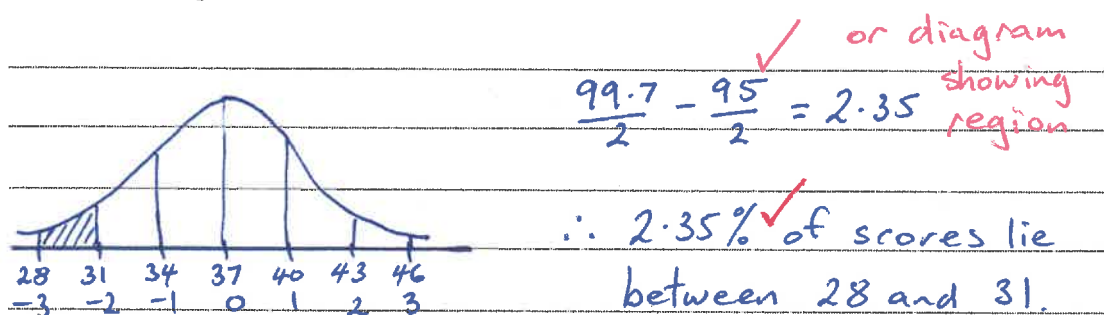


Compare the curves using the terms 'mean' and 'standard deviation'.

Curve A has a lower mean but higher standard deviation than curve B.

22 In a normally distributed set of scores, the mean is 37 and the standard deviation is 3. 2

What percentage of scores lie between 28 and 31?



Crystle contributes \$1200 per month at the start of each month into an investment which pays interest at 3.6 % per annum, compounded monthly.

- (a) Show that at the end of the second month, the future value of Crystle's investment will be \$2410.81. 2

$\$1200$ ↓ $\$1200$ → monthly $r = 3.6\% \text{ pa}$
 $= \frac{3.6}{12} \% \text{ per month}$
 $= 0.3\%$
 $= 0.003$
 At end of 2nd month $FV = 1200(1.003)^2 + 1200(1.003)^1$
 $= \$2410.8108$
 $= \$2410.81$ ✓

- (b) After 18 months, the future value of Crystle's investment will be \$22 226.19. 2

Alveena has a lump sum of \$21 600 which is equivalent to the total of Crystle's contributions. Alveena invests her lump sum into the same investment account paying 3.6% per annum, compounded monthly.

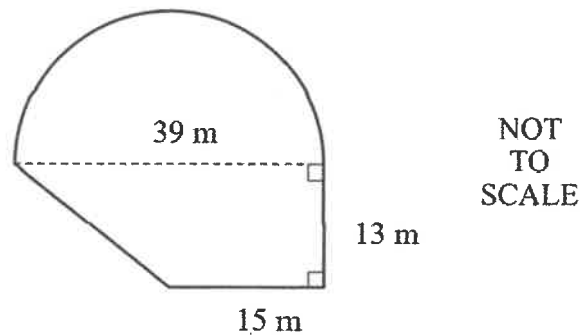
How much more than Crystle will Alveena have in her investment account after 18 months?

$P = \$21600$ $r = 0.003 \text{ per month}$ $n = 18 \text{ months}$
 Alveena's account: $FV = 21600(1 + 0.003)^{18}$
 $= \$22796.62$ ✓
 difference between FV for Crystle and Alveena
 $= 22796.62 - 22226.19$
 $= \$570.43$ ✓
 $\therefore$ Alveena will have \$570.43 more in her account after 18 months.

24 The composite shape below is made up of a semicircle and a trapezium.

3

Calculate the perimeter of the shape, correct to the nearest metre.



$$r = 39 \div 2 = 19.5 \text{ m}$$

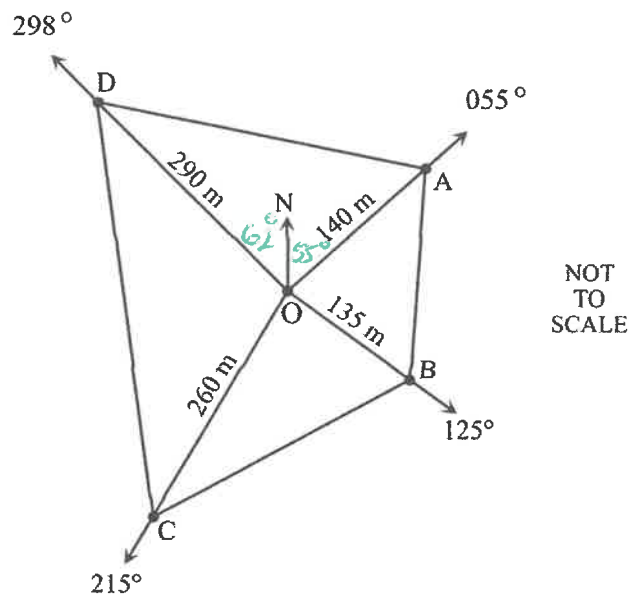
$$\begin{aligned} \text{arc length} &= \frac{1}{2} \times 2 \times \pi \times 19.5 \\ &= 19.5 \pi \text{ m} \quad (61.261\dots \text{m}) \end{aligned}$$

length of sloping side:

$$\begin{aligned} x^2 &= 24^2 + 13^2 \quad (\text{Pythagoras Theorem}) \\ x &= \sqrt{24^2 + 13^2} \\ &= \sqrt{745} \text{ m} \quad (27.29\dots \text{m}) \end{aligned}$$

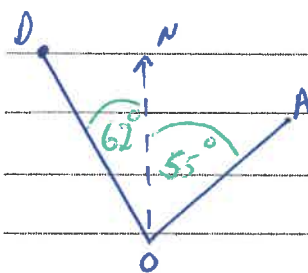
$$\begin{aligned} \text{Perimeter} &= 19.5 \pi + \sqrt{745} + 15 + 13 \\ &= 116.5557449\dots \\ &= 117 \text{ m} \quad (\text{to nearest metre}) \end{aligned}$$

- 25 A radial survey for the block of land ABCD, is shown in the diagram below.



- (a) Calculate the size of angle AOD.

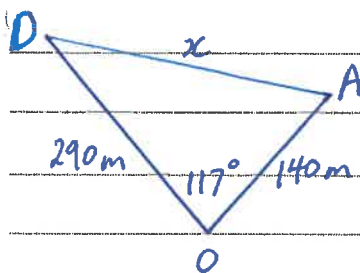
1



$$\begin{aligned}\angle AOD &= (360^\circ - 298^\circ) + 55^\circ \\ &= 62^\circ + 55^\circ \\ &= 117^\circ \quad \checkmark\end{aligned}$$

- (b) Calculate the distance along the boundary of the land from A to D, correct to the nearest metre.

2



Let x be the distance from A to D.

$$\begin{aligned}x^2 &= 290^2 + 140^2 - 2(290)(140)\cos 117^\circ \quad \checkmark \\ x^2 &= 140564 \cdot 0.286... \quad \text{cosine rule} \\ x &= \sqrt{140564 \cdot 0.286...} \\ x &= 374.918696... \\ x &= 375 \text{ m (to nearest m)} \quad \checkmark\end{aligned}$$

- 26 Prachi is buying her first car. She takes out a loan for \$17 000 and agrees to repay the loan in monthly repayments at 7.2% per annum for 5 years. 3

Use the present value of an annuity table to determine how much interest she will pay on the loan.

Table of present value interest factors						
N \ r	Interest rate per period					
	0.5%	0.6%	0.7%	0.8%	0.9%	1%
36	32.8710	32.2907	31.7247	31.1723	30.6334	30.1075
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

$$r = 7.2\% \text{ p.a.}$$

$$n = 5 \text{ years}$$

$$= \frac{7.2}{12}\% \text{ per month}$$

$$= 5 \times 12 \text{ months}$$

$$= 0.6\% \text{ per month}$$

$$= 60 \text{ months}$$

$$\text{table value} = 50.2621 \checkmark$$

$$PV = a \times \text{table value}$$

$$17000 = a \times 50.2621$$

$$\frac{17000}{50.2621} = a$$

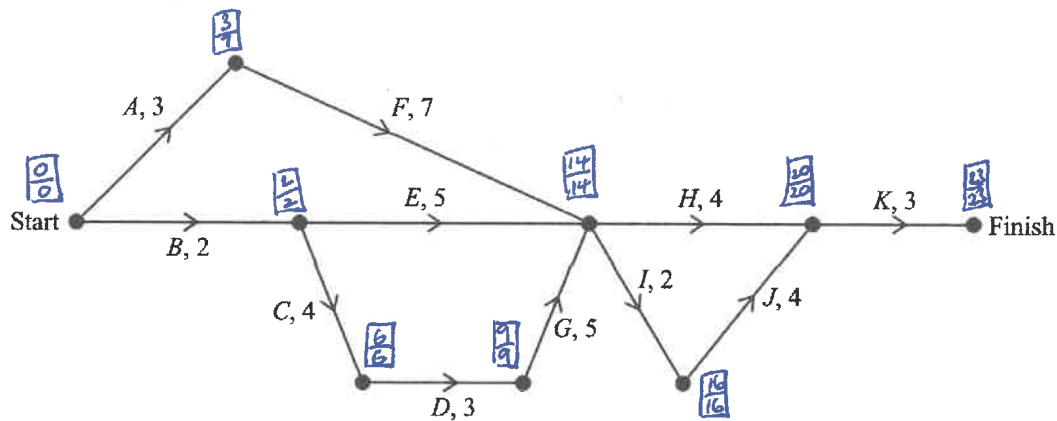
$$a = 338.227014...$$

$$= \$338.23 \checkmark$$

$$\begin{aligned} \text{Interest} &= (338.227014 \times 60) - 17000 \\ &= \$3293.62 \checkmark \end{aligned}$$

Accept \$3293.80

- 27 The network diagram shows tasks that must be completed to finish a project. Each edge weight represents the time taken to complete the task, in days.



- (a) What is the earliest start time (EST) of activity *H*? 2

14 days

✓ Evidence of calculating EST on diagram
✓ correct EST

- (b) What is minimum completion time for the project? 1

23 days

✓ answer

- (c) What is the critical path for the project? 2

B-C-D-G-I-J-K

✓ Backward scan or equivalent
✓ correct path

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

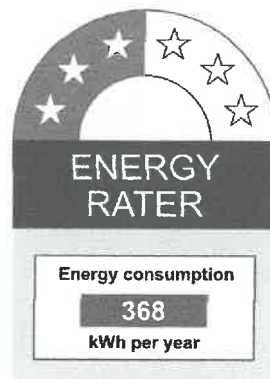
$\begin{matrix} 2 \\ 2 \end{matrix}$ E, 5 $\begin{matrix} 14 \\ 14 \end{matrix}$

float time = $LST_{next} - EST - \text{duration}$

$$= 14 - 2 - 5$$

$$= 7 \text{ days}$$

✓



The energy label assumes that a typical household would consume 368 kWh of energy per year using the vacuum cleaner.

How many hours and minutes of usage would this equate to each week?
Give your answer correct to the nearest minute. Assume 52 weeks per year.

$$\text{Assumed number of kWh per week} = \frac{368}{52} = 7.076... \text{ kWh} \quad \checkmark$$

$$\text{energy rating of vacuum} = 2500 \text{ W} \\ = 2.5 \text{ kW}$$

$$\text{Power consumption} = \text{power rating} \times \text{time}$$

$$7.076... = 2.5 \times t$$

$$t = \frac{7.076...}{2.5}$$

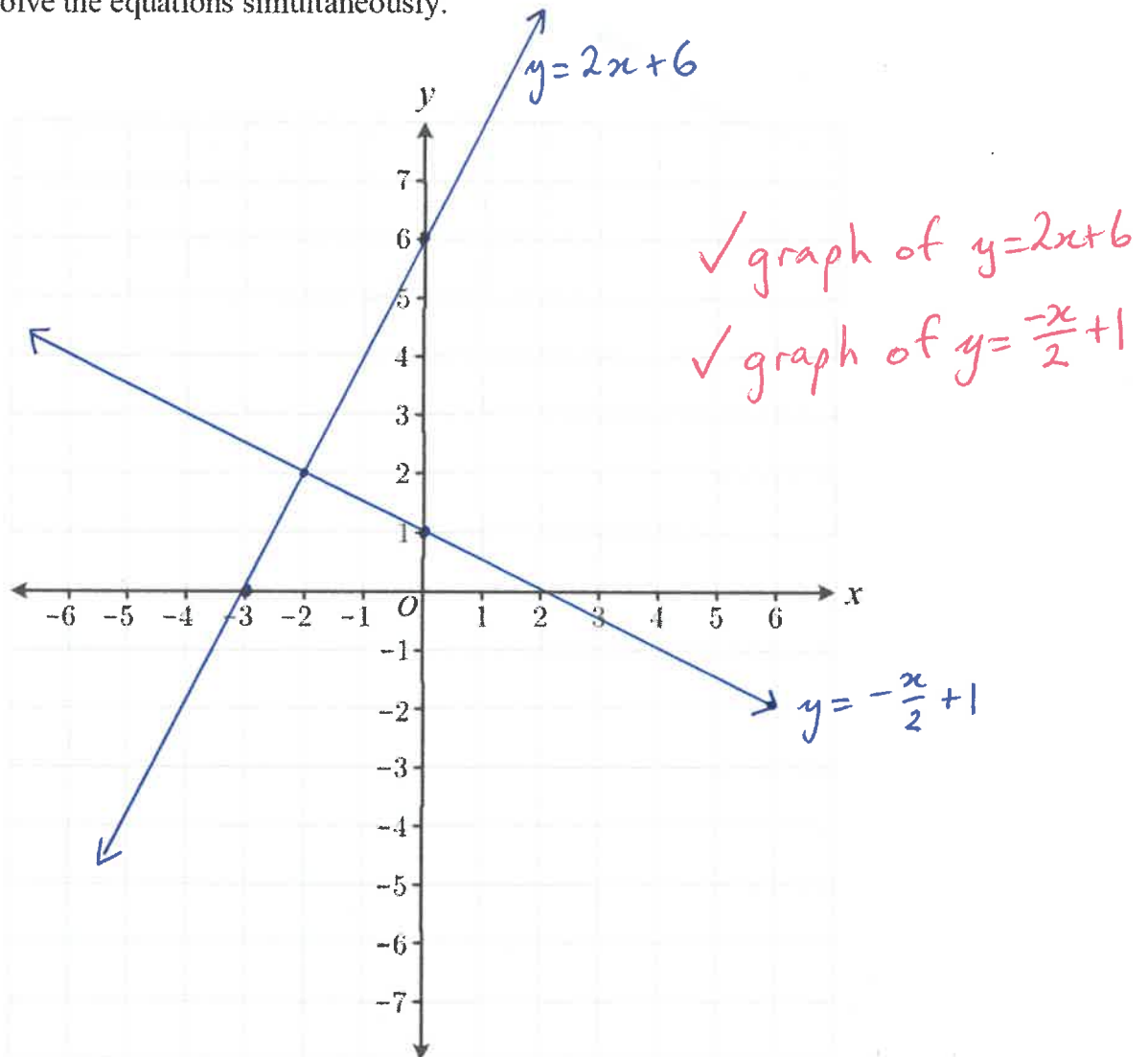
$$= 2.8307... \text{ h} \quad \checkmark$$

$$= 2 \text{ h } 49 \text{ min } 50.77 \text{ sec}$$

$$= 2 \text{ h } 50 \text{ min} \quad \checkmark \quad (\text{to nearest minute})$$

Must have correct
rounding

On the number plane below, graph the equations $y = -\frac{x}{2} + 1$ and $y = 2x + 6$, and hence, solve the equations simultaneously.



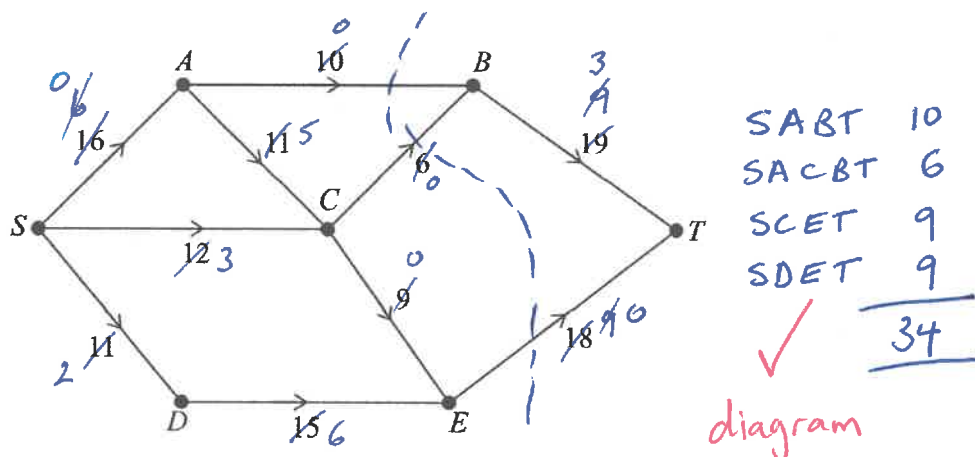
Graph $y = 2x + 6$ by finding the x and y intercepts.
 x intercept occurs when $y = 0$, $0 = 2x + 6$ ie $(-3, 0)$
 y intercept at $(0, 6)$ from equation
 $-6 = 2x$
 $-3 = x$
 $\therefore x = -3$

Graph $y = -\frac{x}{2} + 1$ by finding y -intercept $(0, 1)$
 from equation and using gradient $-\frac{1}{2}$ (go up one and two left from y -intercept)

Solution: $x = -2, y = 2$ (from graph)

✓ solution matches the point of intersection

- 30 The flow of water through a series of pipes is shown in the network below. The water flows from the source (S) to the sink (T) and the numbers on the edges show the maximum capacity of each pipe in litres per minute.



- (a) Find the maximum flow from S to T . 2

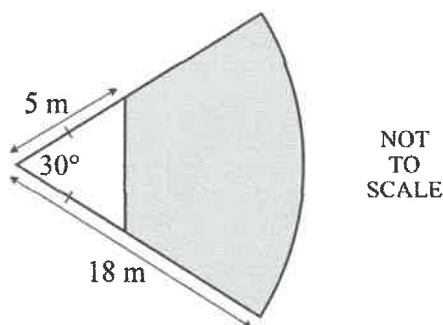
$$\begin{aligned} \text{Maximum flow} &= 10 + 6 + 9 + 9 \\ &= 34 \text{ L/min} \end{aligned}$$

✓ answer

- (b) By increasing the capacity of one edge in the network, the maximum flow could be increased by 3 litres per minute. 2

Identify the edge that could be increased. Justify your answer.

The minimum cut passes through AB, CB and ET so ✓
only changes to these edges will affect the minimum flow.
Only edge CB has the potential for increase by 3. ✓



$$\begin{aligned}\text{Area of sector} &= \frac{30}{360} \times \pi \times 18^2 \\ &= 27\pi \text{ m}^2 \quad \checkmark \quad (84.82... \text{ m}^2)\end{aligned}$$

$$\begin{aligned}\text{Area of triangle} &= \frac{1}{2} \times 5 \times 5 \times \sin 30^\circ \\ &= 6.25 \text{ m}^2 \quad \checkmark\end{aligned}$$

$$\begin{aligned}\text{Shaded area} &= 27\pi - 6.25 \\ &= 78.573... \\ &= 78.57 \text{ m}^2 \quad (\text{to 2 d.p.}) \quad \checkmark\end{aligned}$$

- 32 Cairo in Egypt is located at (30° N, 31° E).
Sydney, in Australia, is located at (33° S, 151° E).

3

Sophie lives in Sydney and needs to attend an online meeting with her business partners in Cairo starting at 9:00 am on Monday, local time in Cairo.

What time and day, in Sydney, does Sophie need to log on to the meeting? Ignore daylight saving.

$$\begin{aligned}\text{difference in longitude} &= 151^{\circ} - 31^{\circ} \\ &= 120^{\circ} \checkmark\end{aligned}$$

$$\begin{aligned}\text{time difference} &= \frac{120^{\circ}}{15^{\circ}} \quad (\text{since } 15^{\circ} = 1\text{ hour}) \\ &= 8 \text{ hours} \checkmark\end{aligned}$$

$$\begin{aligned}\text{local time in Sydney} &= 9 \text{ am Monday} + 8 \text{ hours} \\ \text{when meeting starts} & \\ &= 5 \text{ pm Monday} \checkmark\end{aligned}$$

- 33 Abbey spends \$4000 on a new photocopier for her business.

She uses the declining-balance method to calculate the depreciation of the photocopier. She claims this amount as a tax deduction each year. She can only claim the depreciation for that particular year.

- (a) If the rate of depreciation is 27% per annum, show that the depreciation she can claim in the second year is equal to \$788, rounded correct to the nearest dollar. 2

$$r = 27\% \text{ pa} = 0.27$$

$$\begin{array}{ll} \text{After 1 year:} & \text{After 2 years:} \\ S = V_0(1-r)^n & S = V_0(1-r)^n \\ = 4000(1-0.27)^1 & = 4000(1-0.27)^2 \\ = \$2920 & = \$2131.60 \\ \therefore \text{depreciation in 2nd year} = 2920 - 2131.60 & \\ = 788.40 & \\ = \$788 \text{ (to nearest dollar)} & \end{array}$$

- (b) Abbey earned \$130 000 for the last financial year. The depreciation for her photocopier in part (a) is the only tax deduction she claims. 3
Using the tax table below and ignoring the Medicare levy, calculate the amount of tax she needs to pay.

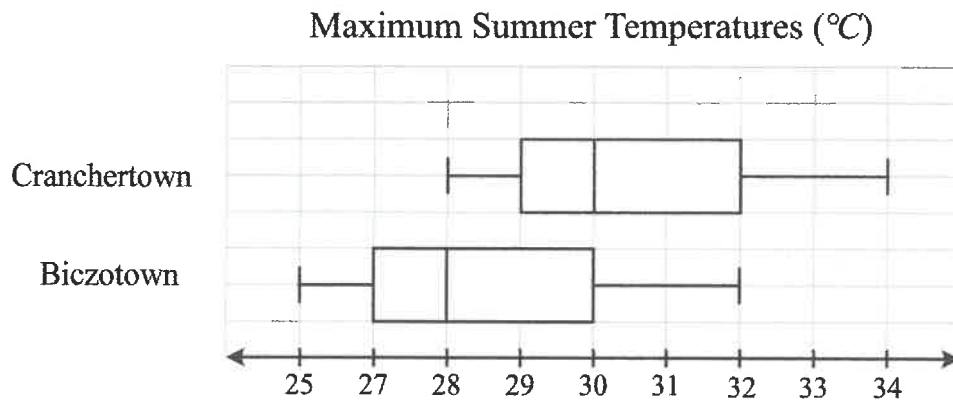
Income tax rates for Australian residents

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	\$3572 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

$$\begin{array}{l} \text{taxable income} = \text{gross income} - \text{deductions} \\ = \$130\,000 - \$788 \\ = \$129\,212 \checkmark \\ \text{tax} = 20\,797 + 0.37(129\,212 - 90\,000) \checkmark \\ = \$35\,305.44 \checkmark \end{array}$$

- 34 In one particular Australian summer, the summer months of December, January and February had a total of 90 days.

The box plots below display data on the maximum daily temperatures in Cranchertown and Biczotown during these summer months.



- (a) What is the median maximum summer temperature of Cranchertown?

1

30°C ✓ answer

- (b) What percentage of summer days in Cranchertown were warmer than Biczotown's warmest day?

1

25% ✓ answer

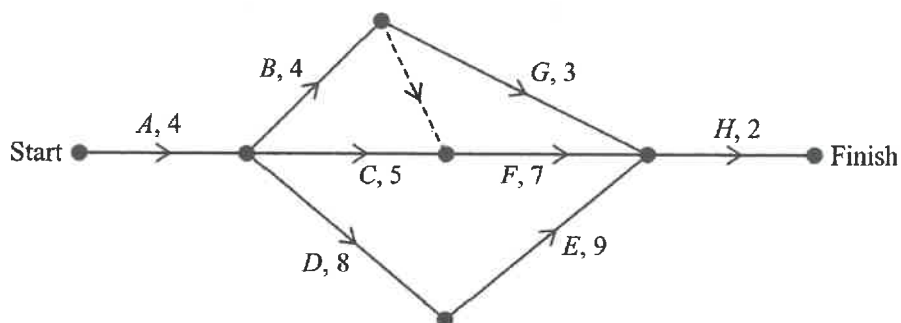
- (c) How many summer days in Biczotown were at least 28°C ?

2

28°C is the median for Biczotown

50% ✓ of temperatures are greater than 28°C

50% of 90 = 45 days ✓



Complete the activity table below for the network shown.

Activity	Duration	Immediate predecessor
A	4	—
B	4	A
C	5	A
D	8	A
E	9	D
F	7	B, C
G	3	B
H	2	E, F, G

1 mark

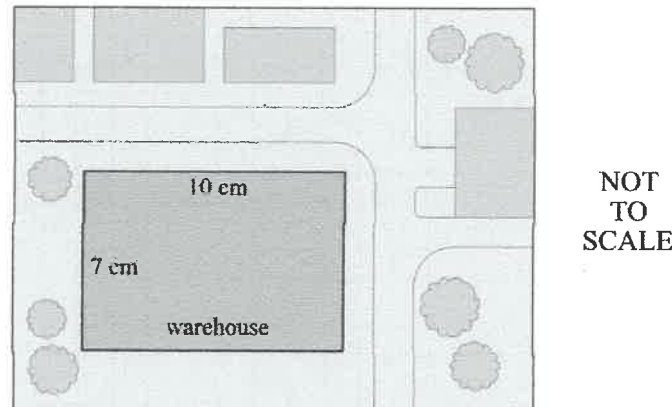
1 mark

1 mark for the activity and duration columns correct.

- 36 A company buys a new warehouse to improve their manufacturing capacity. They plan to save money by collecting rainwater from the entire area of the rectangular roof of the warehouse.

The diagram below shows a plan view of the warehouse and its location within its surroundings.

The dimensions of the warehouse on the diagram are 10 cm and 7 cm.



- (a) If 10 cm on the diagram represents 100 m, what would be the scale of the diagram? Express the scale as a ratio in simplest form. 1

$$10\text{cm} = 100\text{m}$$

$$\therefore 10\text{cm} = 10000\text{cm}$$

$$\therefore \text{Scale} = 10 : 10000$$

$$= 1 : 1000 \quad \checkmark \text{ answer}$$

- (b) If the company's goal is to collect 1200 kL of water from the roof, how much rain must fall? Answer in millimetres, correct to the nearest millimetre. 3

Actual roof measurements: 70 m and 100m

$$\text{Area of roof} = 70 \times 100 = 7000 \text{ m}^2 \quad \checkmark$$

$$V = 1200 \text{ kL} = 1200 \text{ m}^3$$

$$V = Ah$$

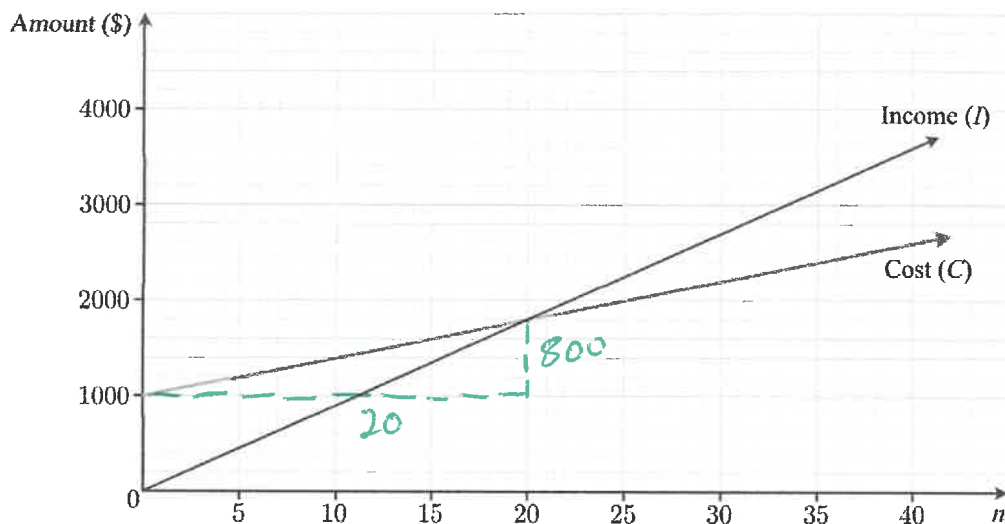
$$1200 = 7000 \times h \quad \checkmark$$

$$\frac{1200}{7000} = h$$

$$h = 0.171428... \text{ m}$$

$$= 171 \text{ mm} \quad \checkmark (\text{to nearest mm})$$

- 37 Olivia plans to set up a furniture business to sell bedside tables. Below are the income (I) and cost (C) functions for her business.



- (a) Write the cost function in the form $C = mn + c$ for the cost of making n tables. 2

$$m = \frac{\text{rise}}{\text{run}} = \frac{800}{20} = 40 \checkmark \quad c = 1000$$

$$\therefore C = 40n + 1000 \checkmark$$

- (b) For how much does Olivia plan to sell each bedside table? 1

$$\text{Gradient of Income graph} = \frac{\text{rise}}{\text{run}} = \frac{1800}{20} = 90$$

$$\therefore I = 90n$$

$$\therefore \text{price of each table} = \$90 \checkmark \text{ answer}$$

- (c) If Olivia sells 35 bedside tables, how much profit or loss will she incur? 2

$$C = 40 \times 35 + 1000 = \$2400 \checkmark \text{ substituting into equation or estimate from graph}$$

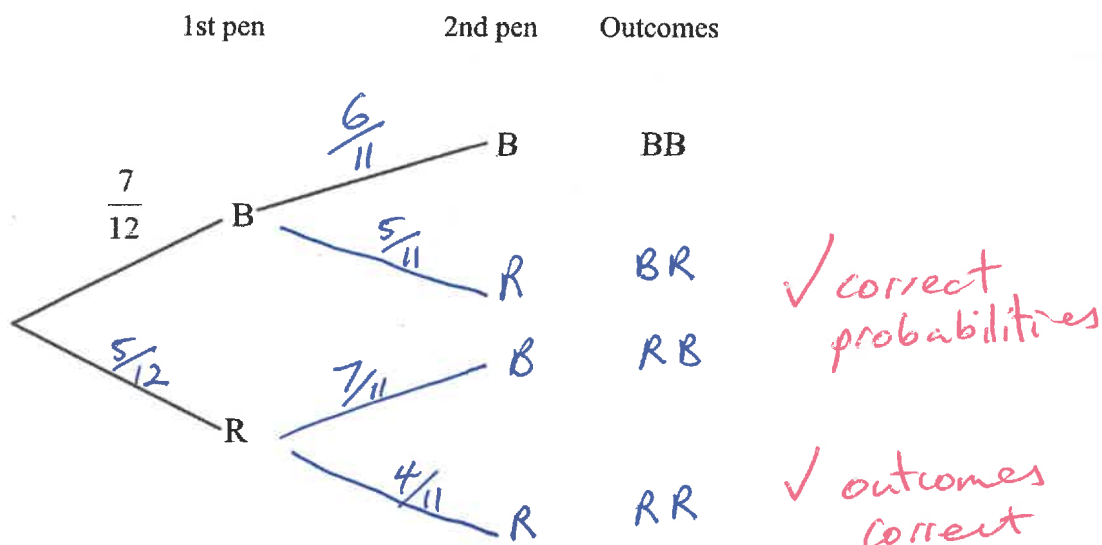
$$I = 90 \times 35 = \$3150$$

$$\text{Profit} = 3150 - 2400$$

$$= \$750 \checkmark$$

Jahnavi has a box containing 7 blue pens and 5 red pens. She selects a pen at random from the box and places it on a table. She then selects a second pen and places it on the table next to the first pen.

- (a) Complete the tree diagram below by drawing the missing branches, writing the probabilities on each branch and listing all possible outcomes. 2



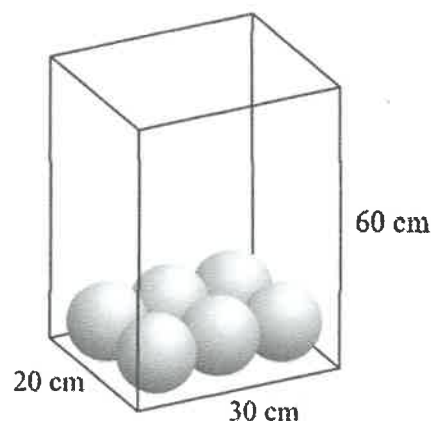
- (b) What is the probability that the pens on the table are both blue? 1

$$\begin{aligned}
 P(\text{both blue}) &= P(BB) \\
 &= \frac{7}{12} \times \frac{6}{11} \\
 &= \frac{7}{22} \quad \checkmark
 \end{aligned}$$

- (c) What is the probability that the pens on the table are different colours? 2

$$\begin{aligned}
 P(\text{different colours}) &= P(BR) + P(RB) \\
 &= \left(\frac{7}{12} \times \frac{5}{11}\right) + \left(\frac{5}{12} \times \frac{7}{11}\right) \quad \checkmark \\
 &= \frac{35}{66} \quad \checkmark
 \end{aligned}$$

Solid spherical balls of diameter 10 cm are stacked inside a box as shown below. The box is in the shape of a rectangular prism such that 6 balls will fit snugly in each layer.



The balls are stacked in the same manner as in the bottom layer until the box is full.

Calculate the percentage of the box that is empty space.

Give your answer correct to the nearest percentage.

Height of box is 60 cm and diameter of each ball is 10 cm.
 $\therefore$ 6 layers of balls will fit.

$$\begin{aligned} \text{number of balls} &= 6 \times 6 \\ &= 36 \end{aligned}$$

$$\begin{aligned} \text{Volume of balls} &= 36 \times \frac{4}{3} \times \pi \times 5^3 \\ &= 18849.55592... \\ &= 18850 \text{ cm}^3 \text{ (to nearest cm}^3\text{)} \end{aligned}$$

$$\begin{aligned} \text{Volume of box} &= 20 \times 30 \times 60 \\ &= 36000 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Volume of space} &= 36000 - 18850 \\ &= 17150 \text{ cm}^3 \end{aligned}$$

$$\% \text{ space} = \frac{17150}{36000} \times 100 \%$$

$$= 47.641... \%$$

$$= 48\% \text{ (to nearest \%)}$$

End of Section II

End of Examination