



NSW Education Standards Authority

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Centre Number

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Student Number

2024 HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 1

General Instructions

- Reading time – 10 minutes
- Working time – 2 hours
- Write using black pen
- Calculators approved by NESA 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
- Write your Centre Number and Student Number at the top of this page

Total marks:
80

Section I – 10 marks (pages 2–6)

- Attempt Questions 1–10
- Allow about 15 minutes for this section

Section II – 70 marks (pages 9–36)

- Attempt Questions 11–32
- Allow about 1 hour and 45 minutes for this section

Section I

10 marks

Attempt Questions 1–10

Allow about 15 minutes for this section

Use the multiple-choice answer sheet for Questions 1–10.

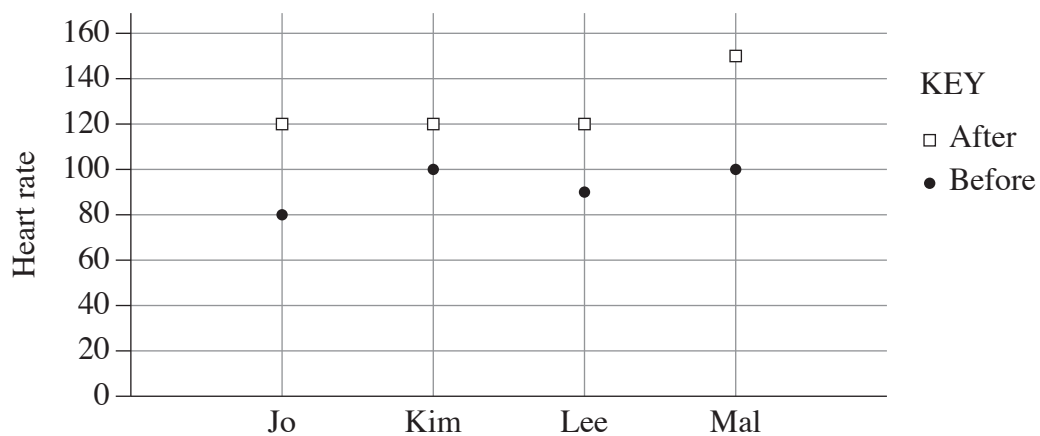
- 1 Mark buys one raffle ticket in a raffle with 1000 tickets.

Which of the following best describes the probability that Mark wins?

- A. Certain
- B. Even chance
- C. Unlikely
- D. Impossible

- 2 Four people completed the same fitness activity.

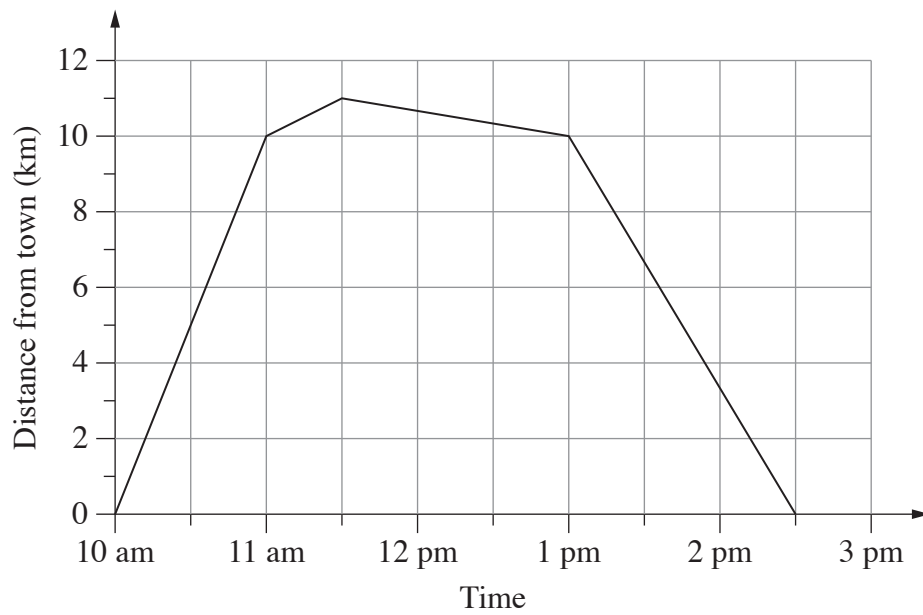
The graph shows the heart rate for each person before and after completing the activity.



Which person had the LEAST difference in heart rate?

- A. Jo
- B. Kim
- C. Lee
- D. Mal

- 3 The travel graph shows the distance of a runner from a town.



Between what times was the runner travelling at their greatest speed?

- A. 10 am and 11 am
 - B. 11 am and 11:30 am
 - C. 11:30 am and 1 pm
 - D. 1 pm and 2:30 pm
- 4 The cost of a plumbing job is \$500 plus 10% GST.

What is the total cost of the job, including GST?

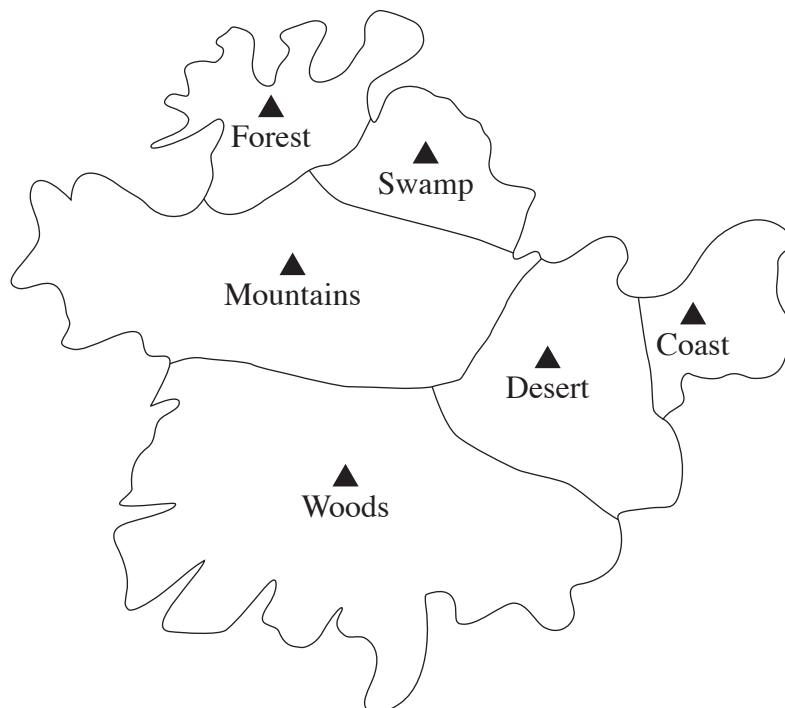
- A. \$45
- B. \$50
- C. \$545
- D. \$550

- 5 A car is valued at \$25 000 when new. Its value depreciates by 25% per annum.

Which of the following best describes the change in value of the car after one year?

- A. Decrease of \$1000
- B. Increase of \$1000
- C. Decrease of \$6250
- D. Increase of \$6250

- 6 The map shows regions within a country.

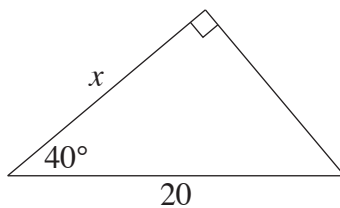


A network diagram is to be drawn to represent this map. Vertices will be used to indicate each region and edges will be used to represent a border shared between two regions.

How many edges will there be in the network diagram?

- A. 8
- B. 7
- C. 6
- D. 5

- 7 Consider the diagram shown.



Which of the following is the correct expression for the length of x ?

- A. $20 \cos 40^\circ$
 - B. $20 \sin 40^\circ$
 - C. $\frac{20}{\cos 40^\circ}$
 - D. $\frac{20}{\sin 40^\circ}$
- 8 Three years ago, the price of a uniform was \$180.

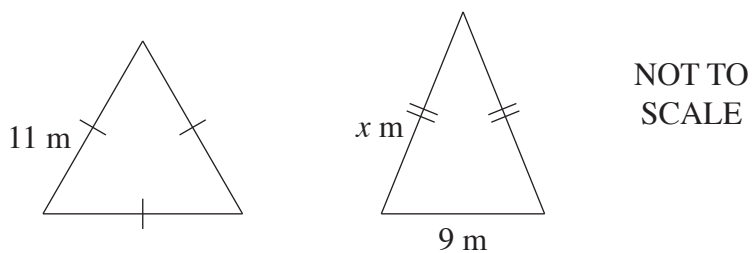
Due to inflation, the price increased annually by 2.5%.

What is the price of this uniform now?

- A. \$180.14
- B. \$181.35
- C. \$193.50
- D. \$193.84

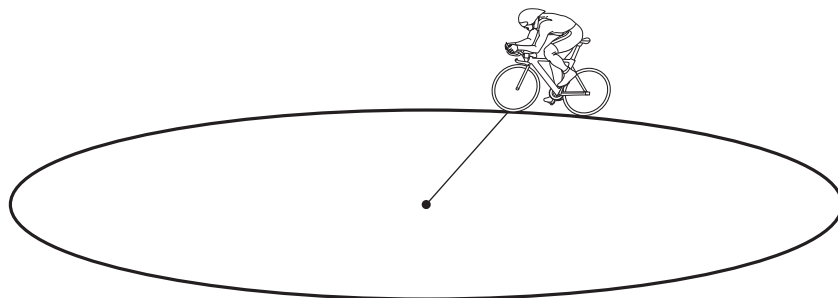
- 9 An equilateral triangle and an isosceles triangle are shown.

The triangles have the same perimeter.

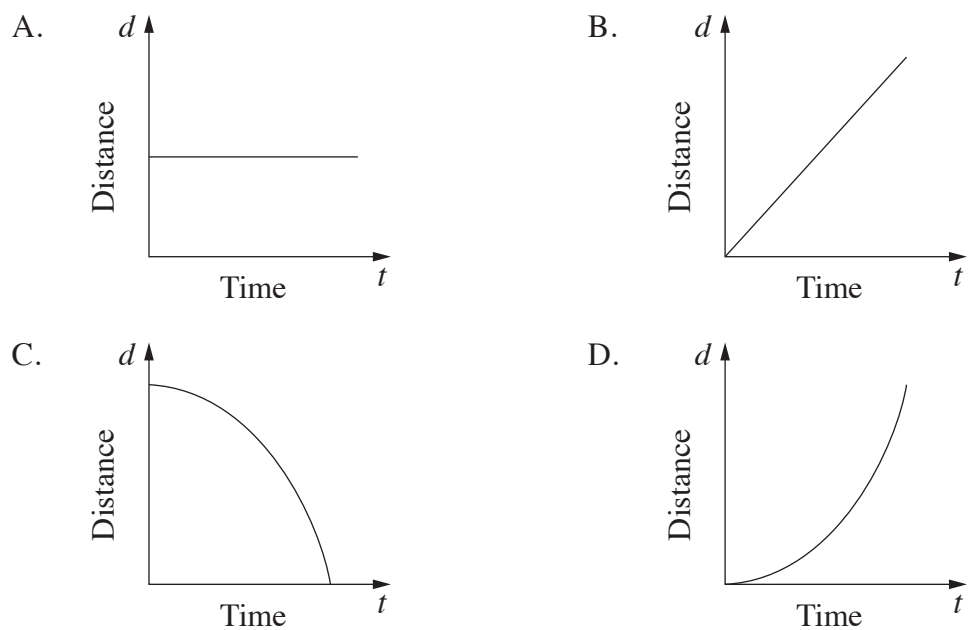


What is the value of x ?

- A. 8
B. 9
C. 11
D. 12
- 10 A cyclist rides a bicycle at a constant speed around a *circular* track.



Which of the graphs best illustrates the distance of the cyclist from the centre of the track as time varies?



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Centre Number

Mathematics Standard 1

Section II Answer Booklet

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Student Number

70 marks**Attempt Questions 11–32****Allow about 1 hour and 45 minutes for this section****Instructions**

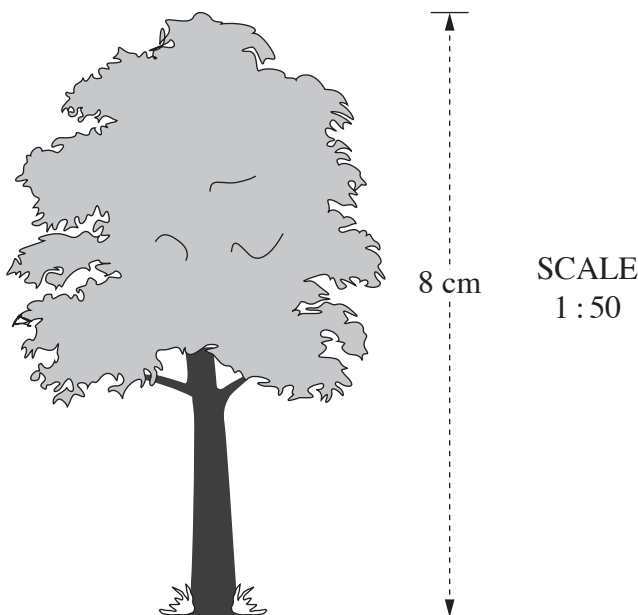
- Write your Centre Number and Student Number at the top of this page.
- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your responses should include relevant mathematical reasoning and/or calculations.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

Please turn over

Question 11 (2 marks)

A scale drawing of a tree is shown. The scale is 1 : 50.

2



What is the actual height of the tree, in metres?

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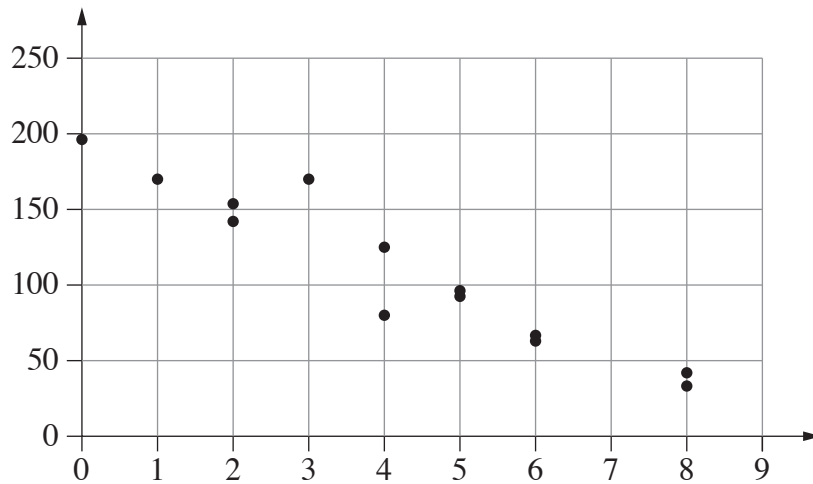
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Question 12 (2 marks)

The scatterplot shows a bivariate dataset.

2



Describe the bivariate dataset in terms of strength and direction.

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Please turn over

Question 13 (3 marks)

Consider the following dataset.

1, 1, 2, 3, 5, 7, 15

- (a) What is the interquartile range?

1

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- (b) By using the outlier formula, determine whether 15 is an outlier.

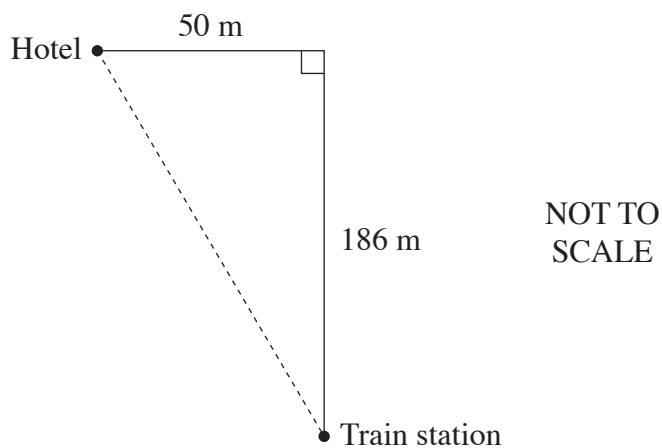
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Question 14 (4 marks)

A hotel is located 186 m north and 50 m west of a train station.



- (a) What is the straight line distance from the hotel to the train station? Round your answer to the nearest metre. 2

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- (b) What is the bearing of the hotel from the train station? Round your answer to the nearest degree. 2

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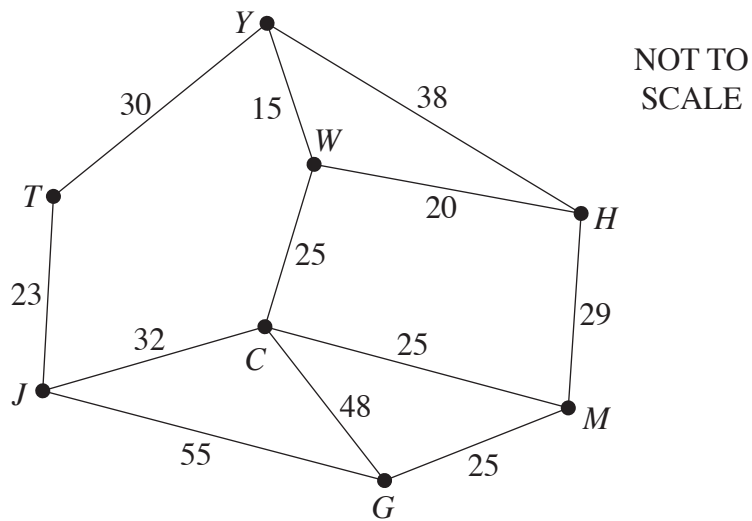
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Question 15 (4 marks)

A network of towns and the distances between them in kilometres is shown.



- (a) What is the shortest path from T to H ?

2

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- (b) A truck driver needs to travel from Y to G but knows that the road from C to G is closed.

2

What is the length of the shortest path the truck driver can take from Y to G after the road closure?

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Question 16 (2 marks)

The cost of electricity is 30.13 cents per kWh.

2

Calculate the cost of using a 650 W air conditioner for 6 hours.

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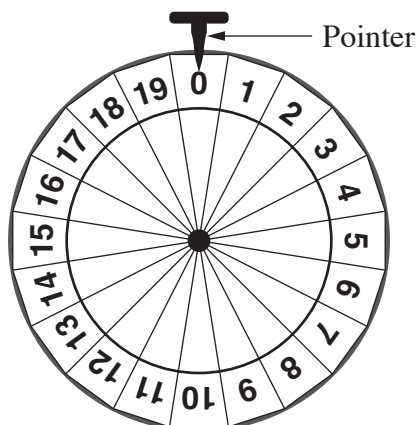
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Question 17 (3 marks)

A wheel is shown with the numbers 0 to 19 marked.

A game is played where the wheel is spun until it stops.

When the wheel stops, a pointer points to the winning number. Each number is equally likely to win.



- (a) List all the even numbers on the wheel that are greater than 7. 1

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- (b) What is the probability that the winning number is NOT an even number greater than 7? 2

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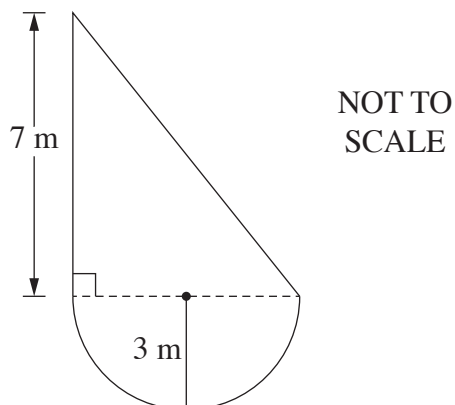
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Question 18 (3 marks)

A garden is made up of a right-angled triangle and a semicircle as shown.

3



What is the area of the garden, correct to the nearest square metre?

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Please turn over

Question 19 (2 marks)

The length (L) of a shark, in centimetres, can be modelled by the formula

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$$L = 7.3a + 38,$$

where a is the age of the shark, in years.

At what age should the shark reach a length of 156 cm, correct to the nearest year?

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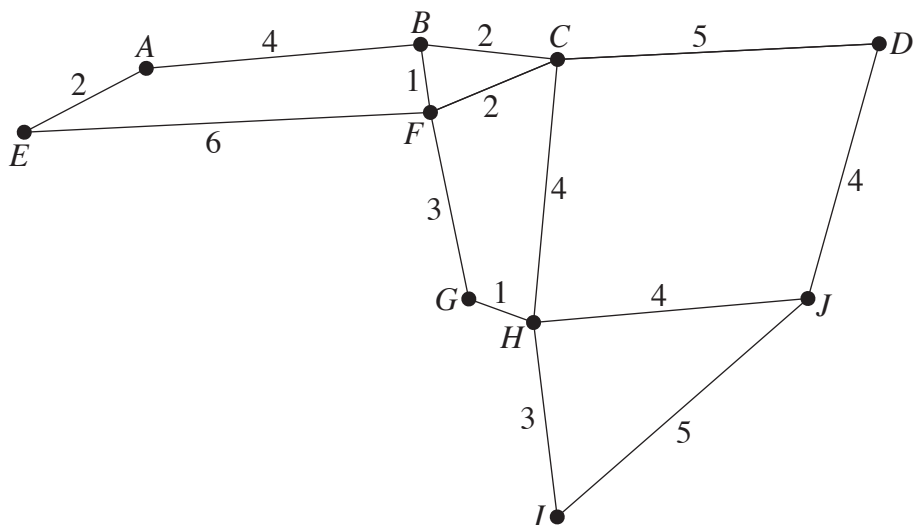
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Question 20 (3 marks)

The diagram shows a network with weighted edges.



- (a) Draw a minimum spanning tree for this network and determine its weight.

2

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B

C

D

E

F

G

H

J

I

Weight =

- (b) Is it possible to find another spanning tree with the same weight? Give a reason for your answer.

1

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Question 21 (2 marks)

Jan borrowed \$1500 at 6% per annum.

2

Calculate the simple interest for the first three months.

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Question 22 (2 marks)

The timetable shows an airline schedule in 24-hour time for a flight from Town A to Town B.

2

<i>Flight</i>	<i>Departure (local time Town A)</i>	<i>Arrival (local time Town B)</i>
Town A to Town B	1159	1336

When it is 10 am in Town A, the time in Town B is 9 am on the same day.

How long does the flight take to travel from Town A to Town B?

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Questions 11–22 are worth 32 marks in total

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Question 23 (7 marks)

Carrie is organising a fundraiser.

The cost of hiring the venue and the band is \$2500. The cost of providing meals is \$50 per person.

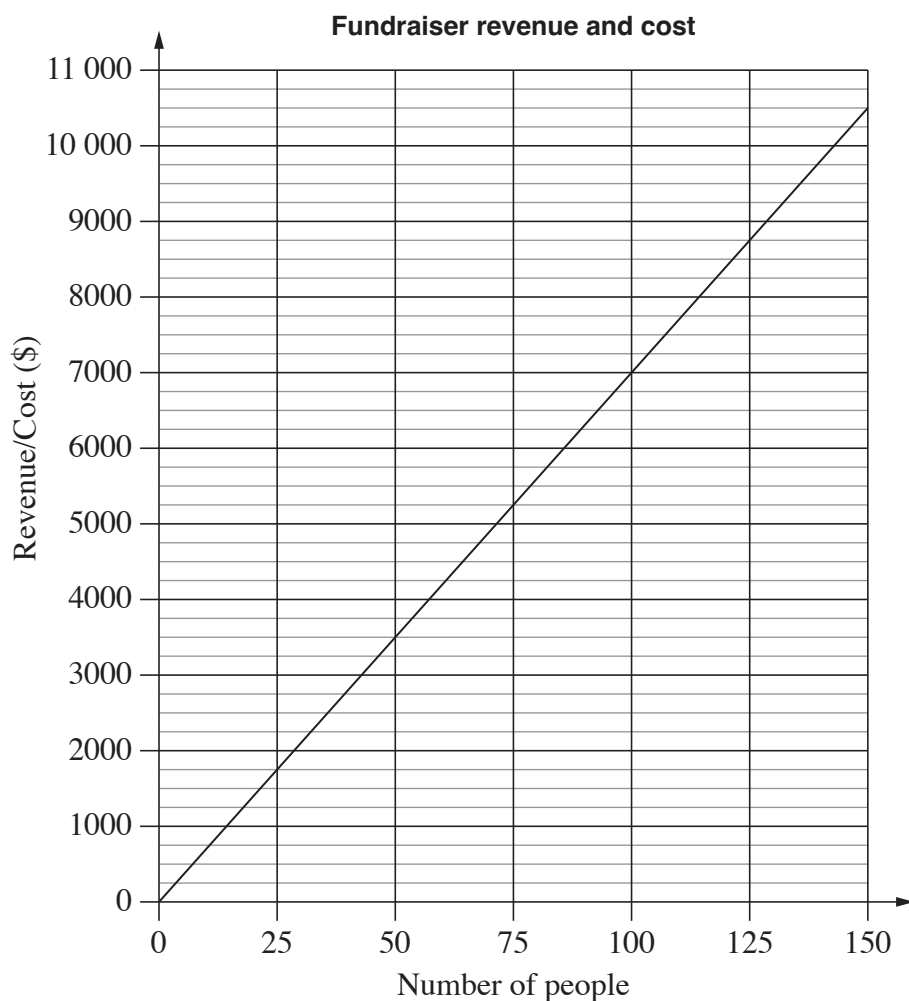
- (a) Complete the table of values to show the total cost of the fundraiser.

1

<i>Number of people</i>	0	25	50	75	100	125	150
<i>Cost</i>		3750	5000	6250	7500	8750	10 000

- (b) Carrie decides that tickets should be sold at \$70 per person. The graph shows the expected revenue at this ticket price. Using the information in part (a), plot the line that shows the cost of the fundraiser.

2



Question 23 continues on page 23

Question 23 (continued)

- (c) How many tickets need to be sold for the fundraiser to break even? **1**

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- (d) Carrie sold 300 tickets. How much profit did the fundraiser make? **3**

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End of Question 23

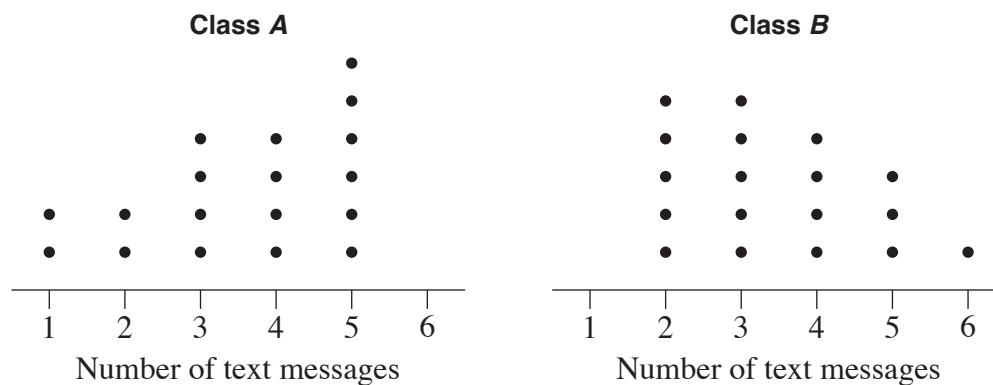
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Question 24 (3 marks)

Students in two classes, Class A and Class B, recorded the number of text messages they sent in a day. Each class has 18 students.

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The results are shown in the dot plots.



Compare the two datasets by examining the skewness, median and spread of the distributions.

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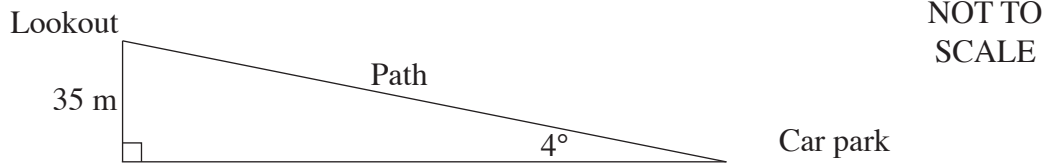
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Question 25 (2 marks)

In a national park, a straight path connects a lookout to a car park. The lookout is 35 m higher than the car park. The path is inclined at an angle of elevation of 4° , as shown.

2



What is the length of the path, correct to the nearest metre?

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Please turn over

Question 26 (3 marks)

Bobby has a credit card that has no interest-free period.

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Interest is charged at 0.07% per day, compounding daily, on the outstanding balance.

How much interest is Bobby charged on an outstanding balance of \$600 for 30 days?

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Question 27 (3 marks)

Zazu works a 38-hour week and is paid at an hourly rate of \$45. Any overtime hours worked are paid at time-and-a-half.

3

In a particular week, Zazu worked the regular 38 hours and some overtime hours. In that week Zazu earned \$2790.

How many hours of overtime did Zazu work in that week?

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Question 28 (3 marks)

Alex and Jun each invest \$1800 for 5 years.

3

- Alex's investment earns simple interest at a rate of 7.5% per annum.
- Jun's investment earns interest at a rate of 6.0% per annum, compounding quarterly.

By calculating the interest earned over the 5 years, determine who will have the greater amount.

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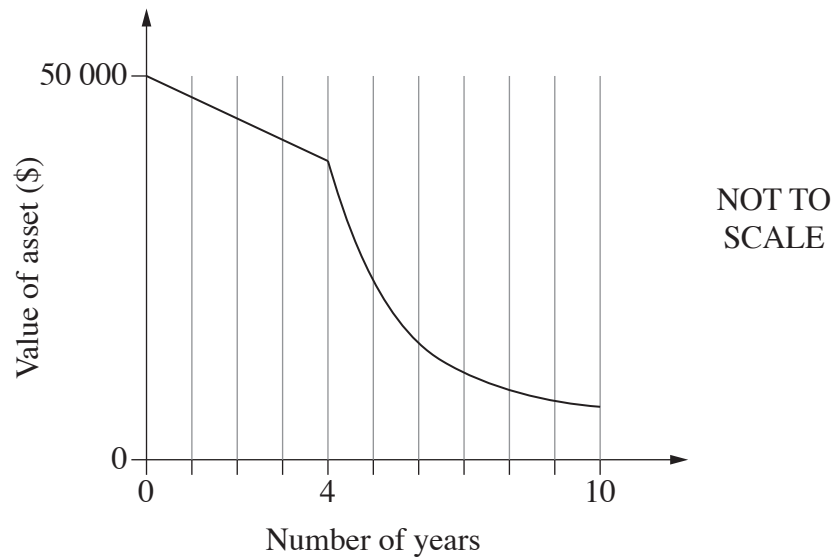


- [illegible]

Question 30 (4 marks)

The graph shows the decreasing value of an asset.

4



For the first 4 years, the value of the asset depreciated by \$1500 per year, using a straight-line method of depreciation.

After the end of the 4th year, the method of depreciation changed to the declining-balance method at the rate of 35% per annum.

What is the total depreciation at the end of 10 years?

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Question 31 (3 marks)

Wombats can run at a speed of 40 km/h over short distances.

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At this speed, how many seconds would it take a wombat to run 150 metres?

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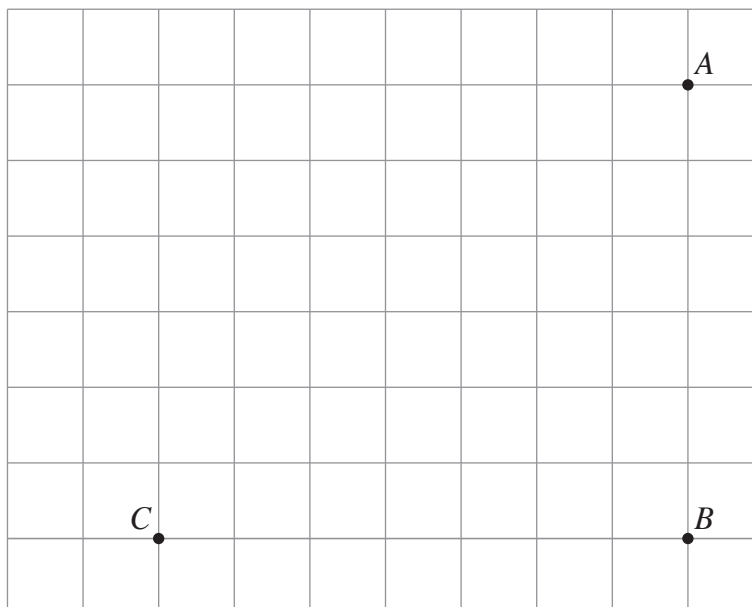
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Question 32 (5 marks)

A scale diagram is shown with locations A , B and C marked.

Jo takes 24 minutes to walk from A to B (in a straight line) when walking at 3 km per hour.



- (a) What is the scale used in the diagram?

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- (b) What is the distance from B to C , in kilometres?

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End of paper

– 32 –

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Mathematics Standard 1

Mathematics Standard 2

REFERENCE SHEET

Measurement

Limits of accuracy

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

$$\text{Upper bound} = \text{measurement} + \text{absolute error}$$

$$\text{Lower bound} = \text{measurement} - \text{absolute error}$$

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

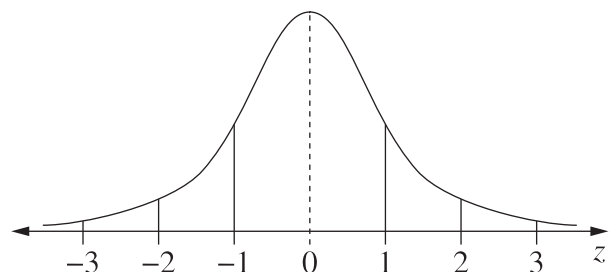
less than $Q_1 - 1.5 \times IQR$

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

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