A C E
EXAM
PAPER

Student name: _____

PAPER 2

YEAR 12
YEARLY
EXAMINATION

Mathematics Standard 1

General Instructions

- Working time - 120 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: 80

Section I – 10 marks

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

Section II – 70 marks

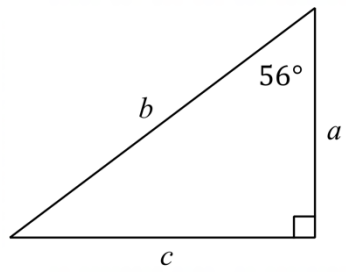
- Attempt all questions in Section II
- Allow about 1 hour and 45 minutes for this section

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.



Not to scale

What is the correct expression for tan56° in this triangle?

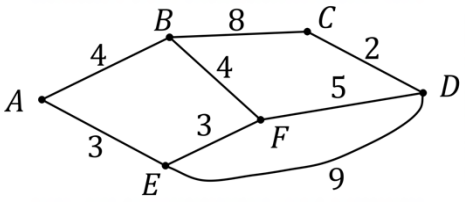
(A) $\frac{a}{b}$

(B) $\frac{c}{a}$

(C) $\frac{c}{b}$

(D) $\frac{a}{c}$

2. Prim's algorithm, beginning with vertex *A*, will be used to find the minimal spanning tree for the network below.



Which vertex will be added last?

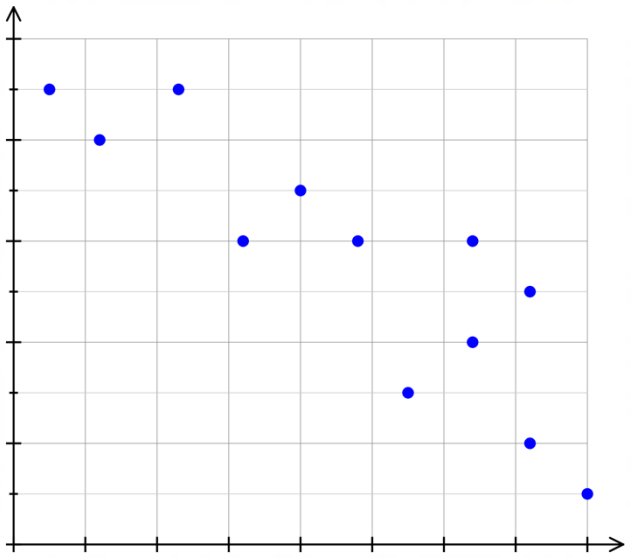
(A) *D*

(B) *C*

(C) *B*

(D) *F*

3.



What is the association between the variables in this scatterplot?

(A) Moderate negative

(B) Moderate positive

(C) Weak negative

(D) Weak Positive

4. The monthly repayments per $1000 on a bank home loan are shown in table below.

Term	8.00%	8.25%	8.50%
20 years	$8.36	$8.52	$8.68
25 years	$7.72	$7.88	$8.05

What is the monthly repayment for a loan of $320 000 at 8.25% p.a. interest rate for 25 years?

(A) $252.16

(B) $272.64

(C) $2521.60

(D) $2726.40

5. Millie's car uses 7.25 litres per 100 km. How many litres of petrol will her car use on a trip of 310 km from Bulahdelah to Wollongong?

(A) 2.339 L

(B) 233.9 L

(C) 22.475 L

(D) 2247.5 L

6. The amount of money in a fund is given by $A = 600 \times 1.1^t$ where A is the amount of money and t is the time in years. What is the initial amount of money invested in the fund?

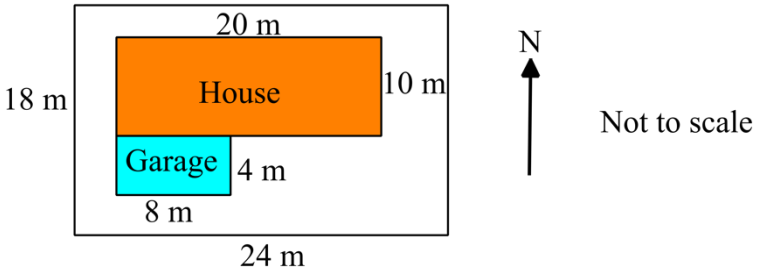
(A) \$600

(B) \$660

(C) \$1000

(D) \$1100

7. The diagram shows a site plan.



What area of land do the house and garage cover?

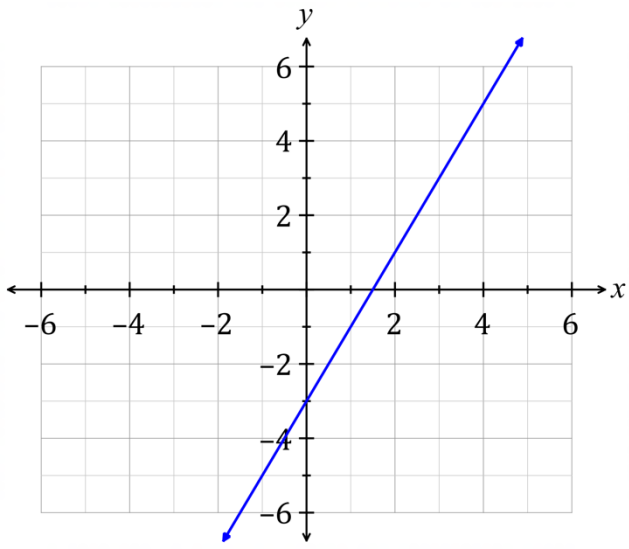
(A) 42 m²

(B) 52 m²

(C) 62 m²

(D) 232 m²

8.



The correct equation of line shown above is:

(A) $y = 2x - 3$

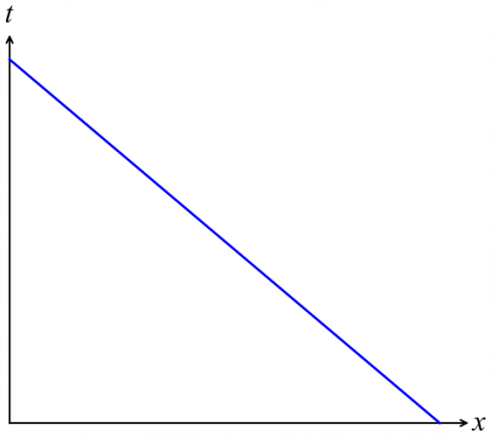
(B) $y = -2x - 3$

(C) $y = \frac{1}{2}x - 3$

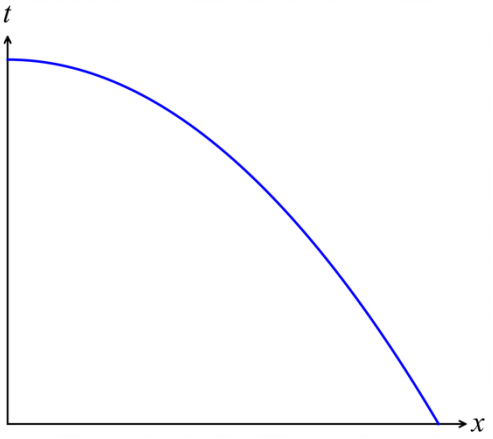
(D) $y = -\frac{1}{2}x - 3$

9. The time (t) taken to write a report and the number of people (x) writing the report is given by a reciprocal function . Which graph best represents this relationship?

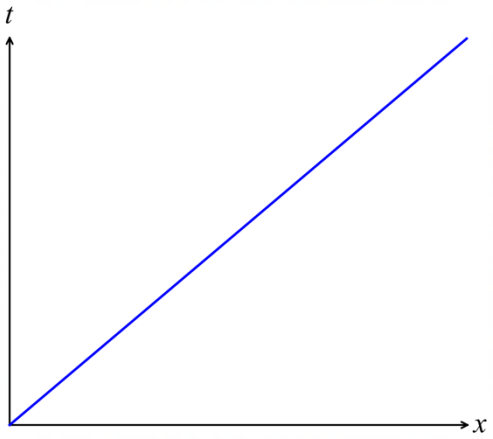
(A)



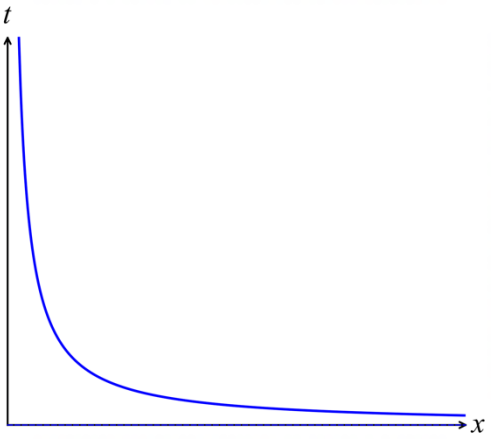
(B)



(C)



(D)



10. Stephanie invested $4,800 four years ago, and now has $5,952 ready to withdraw. What was the annual flat rate of interest Stephanie earned on her investment?

(A) 3.1%

(B) 6.0%

(C) 7.7%

(D) 19.2%

Section II

70 marks
Attempt all questions
Allow about 1 hour and 45 minutes for this section

Answer each question in the spaces provided.
Your responses should include relevant mathematical reasoning and/or calculations.

Question 11 (2 marks) **Marks**

A map has a scale of 1:400 000.

(a) Two towns are 2.5 cm apart on the map. **1**
What is the actual distance between the towns, in kilometres?

(b) The distance between two cities is 60 km. How far apart are the two cities on the map, in centimetres? **1**

Question 12 (2 marks)

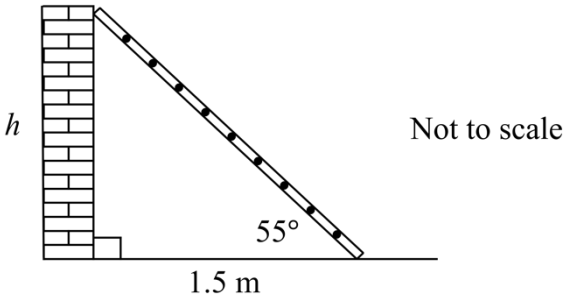
Kiara has 3000 shares. The current share price is $2.25 per share. Kiara is paid a dividend of $0.07 per share.

(a) What is the current value of her shares? **1**

(b) Calculate the dividend yield. Answer to the nearest whole number. **1**

Question 13 (3 marks) **Marks**

A ladder makes an angle of 55° with the ground and the foot of the ladder is 1.5 m from the base of the wall along the ground.

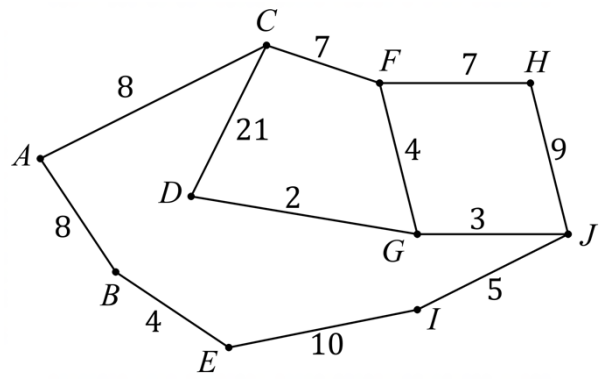


(a) How high does the ladder reach up the wall? Answer correct to two decimal places. **1**

(b) Calculate the length of the ladder. Answer correct to two decimal places. **1**

(c) The top of the ladder is moved 50 cm down the wall. What is the new angle the ladder makes with the ground? Answer to the nearest degree. **1**

Question 14 (3 marks)

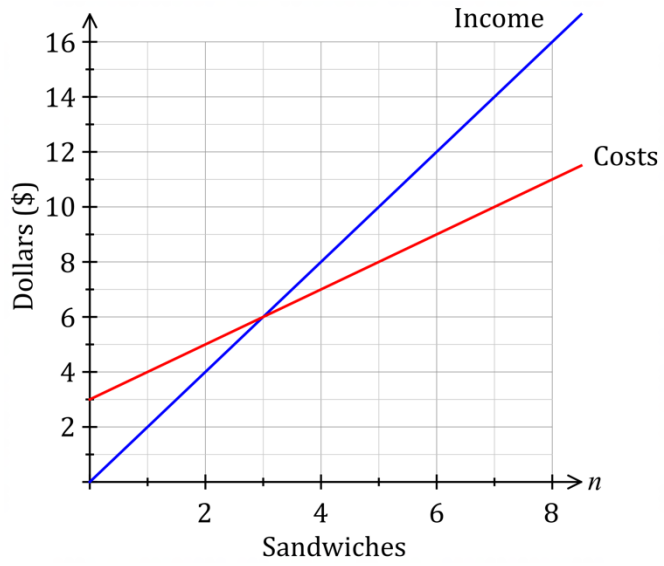


(a) List the vertices with an odd degree. **1**

(b) What is length of the shortest path from *A* to *J*? **2**

Question 15 (4 marks) **Marks**

The linear graphs below show the cost of making a sandwich and the income received from selling the sandwiches.



(a) Let the income received be $\$I$ and n the number of sandwiches sold. Write a formula for the income. **1**

(b) Let the costs of making a sandwich be $\$C$ and n the number of sandwiches sold. Write a formula for the costs. **1**

(c) What is the profit if 7 sandwiches are sold? **1**

(d) How many sandwiches are needed to be sold to break-even? **1**

Question 16 (2 marks) **Marks**

A building plan shows a house with a length of 20 m and a width of 16 m. What is the volume of rainfall collected by a water tank attached to the roof after 15 mm of rain? Answer correct to the nearest litre. **2**

Question 17 (3 marks)

Adam owns a credit card that has no annual fees and charges 15.7% p.a. simple interest on all purchases. The interest is charged from the day of purchase and includes the day of payment.

(a) Show that the daily interest rate is 0.0430%. **1**

(b) On the 30th of March, Adam bought an entertainment unit for $1240 using his credit card. Adam paid his credit card account on the 10th of April. What was the total amount Adam paid for the entertainment unit, including interest? Answer correct to the nearest cent. **2**

Question 18 (2 marks)

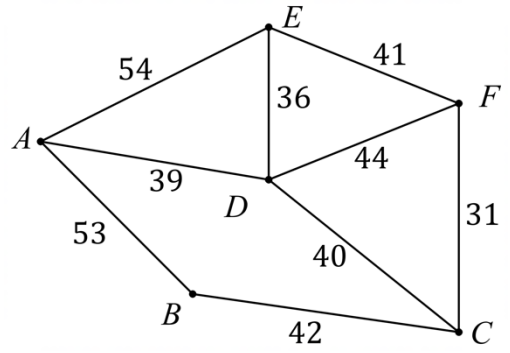
The ratio of boys to girls in a class is 6:7.
The number of girls increases from 14 to 15.

(a) What is the new ratio of boys to girls? **1**

(b) What is the new ratio of boys to the total number? **1**

Question 19 (3 marks) **Marks**

There are five towns (*B*,*C*,*D*,*E* and *F*) that need to be linked by pipelines to a natural gas supply (*A*). The existing road links and the distance (in km) between the towns is shown in the network diagram below.



(a) Draw a minimum spanning tree that will ensure that all the towns are connected to the network, but that also minimises the amount of pipelines required. **2**

(b) What is the minimum length of pipeline to supply all the towns? **1**

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Question 20 (2 marks)

Billie borrows $30,000 to buy a car and is charged 12% per annum simple interest. He pays off the loan in 5 years. How much interest does he pay? **2**

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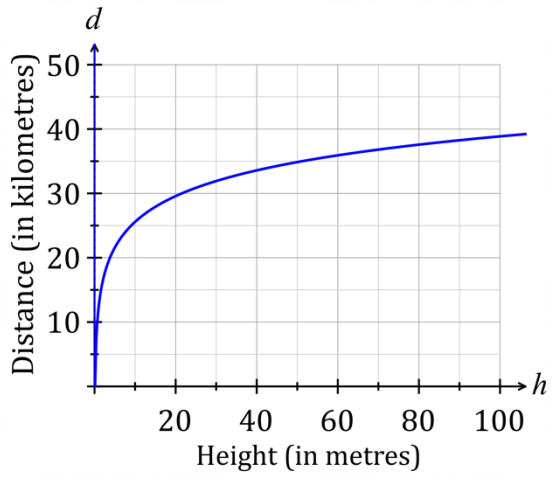
Question 21 (2 marks) **Marks**



The graph shows the distance (d) in kilometres to the horizon that can be seen from different heights (h) above sea level.

(a) What is the distance to the horizon, if the height above sea-level is 20 m? Answer correct to the nearest kilometre. **1**

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(b) Ian records a distance of 35 km to the horizon from his position at a lookout. What is the height above sea level? Answer correct to the nearest metre. **1**

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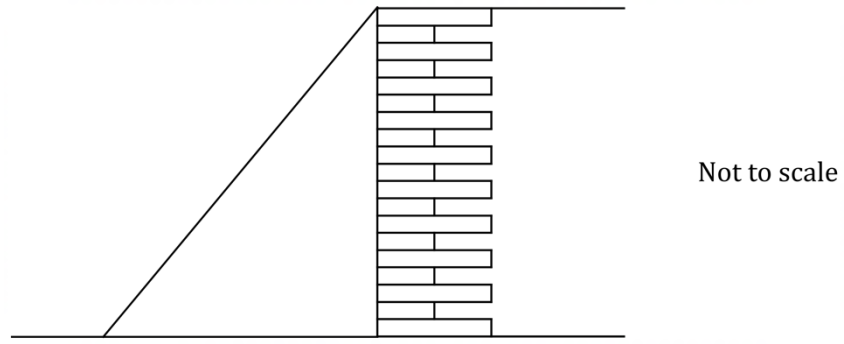
Question 22 (2 marks)

The angle of elevation to the top of a building from a car is 34˚. **2**



Not to scale

The approximate perpendicular height of the building is 30 metres. What is the distance, to nearest metre, from the car to the foot of the building?

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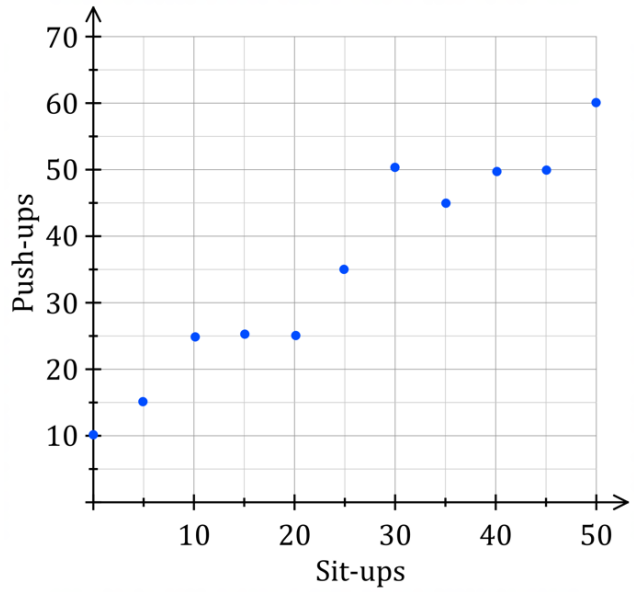
Question 23 (3 marks) **Marks**

The scatterplot shows the number of sit-ups (s) and the number of push-ups (p) performed by ten students during a fitness test.



(a) Draw a line of best fit on the scatterplot. Find the gradient of this line. **2**

(b) Alyssa was absent for the push-up test. Predict her push-up result if she scored 36 on the sit-up test. **1**

Question 24 (1 mark)

Cooper is a hospital patient who is given 1.5 litres of fluid over 8 hours. **1**
What is the required drip rate in mL/h?

Question 25 (3 marks) **Marks**

A table for $200 000 at 7.25% p.a. reducible interest is shown below.

Loan period in years	15	20	25	30
Monthly repayments	$1825.73	$1580.75	$1445.61	$1364.35

(a) Find the total amount that must be repaid if the loan is taken over 20 years. **1**

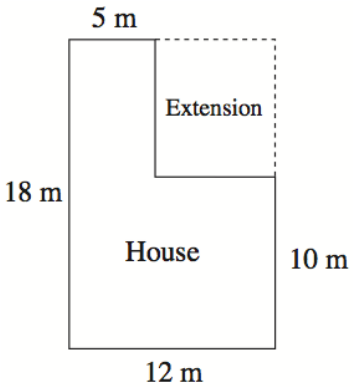
(b) How much extra is repaid if the loan is taken over 30 years rather 20 years? **2**

Question 26 (2 marks)

The diagram opposite shows the plan of an extension to a house. **2**

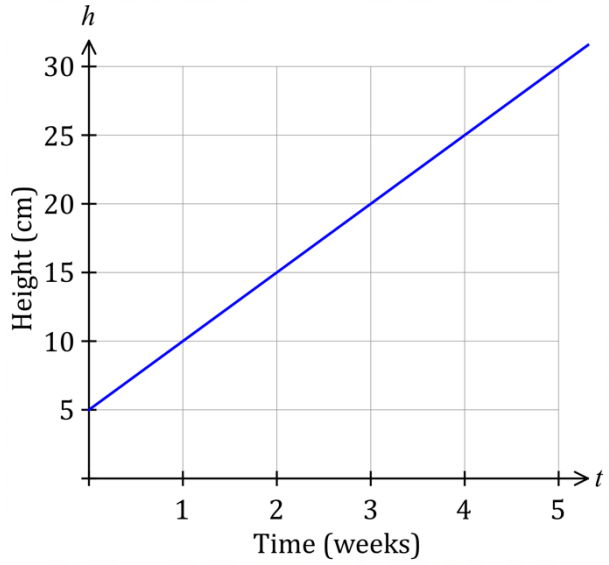
A timber extension will cost $480 per square metre and a brick extension will cost $570 per square metre.

What will be the cost of building a brick extension?



Question 27 (3 marks) **Marks**

Stefan drew a graph of the height of a flowering shrub over five weeks.



(a) When was the initial height of the shrub? **1**

(b) Calculate the gradient of the line. **1**

(c) What is the equation of this line? **1**

Question 28 (2 marks)

An estimate of a person's maximum heart rate (MHR) is given by the formula: **2**

$\text{MHR} = 220 - \text{AGE (years)}$ where MHR is measured in beats per minute and AGE is measured in years.

It is estimated that a healthy person should have a heart rate of 60% of their maximum rate when beginning to exercise. Holly is a healthy 17 years old girl. What is an estimate of her heart rate, in beats per minute, when she begins exercising?

Question 29 (4 marks) **Marks**

There are five motorways between five cities labelled A, B, C, D and E. The table below shows which cities are linked by the motorways and the length of each one in kilometres.

	A	B	C	D	E
A	–	–	–	22	46
B	–	–	43	19	–
C	–	43	–	7	–
D	22	19	7	–	–
E	46	–	–	–	–

(a) Represent the table shown above as a weighted network. **2**

(b) How would you travel from city E to city C? **1**

(c) What is the distance of the longest journey from city E to city C? **1**

Question 30 (3 marks) **Marks**

A truck is bought by a local council for $120 000. It depreciates at 16% p.a.

(a) Calculate the value of the truck after 3 years using the declining balance formula. Answer correct to 2 decimal places. **1**

(b) What is the percentage loss in value of the truck after 3 years? Answer correct to the nearest whole number. **2**

Question 31 (3 marks)

A bank offers a compound interest rate of 5% p.a.

(a) Aaron invested $10 000 for 4 years with the bank. What is the future value of his investment? **1**

(b) How much interest will Aaron receive on his investment? **1**

(c) How much money did Bonnie invest with the bank if she received a cheque for $8,389 at the end of 6 years? **1**

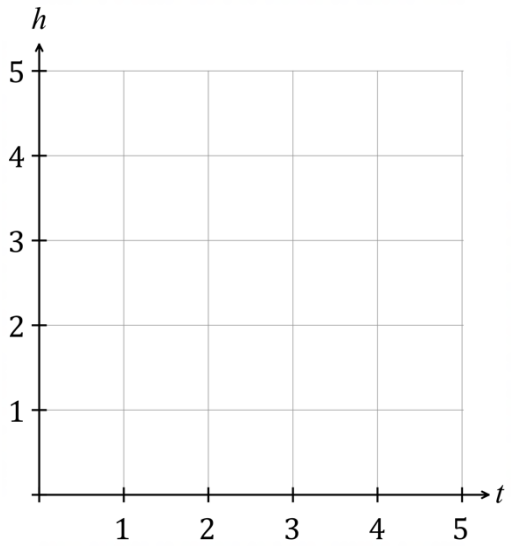
Question 32 (4 marks) **Marks**

Adam throws a ball and it takes 4 seconds to reach the ground. The height (in metres) it reaches is given by the formula: $h = 4t - t^2$

(a) Complete the following table of values. **1**

t	0	1	2	3	4
h					

(b) Draw the graph of $h = 4t - t^2$ using the number plane below. **1**



(c) What is the maximum height reached by the ball? **1**

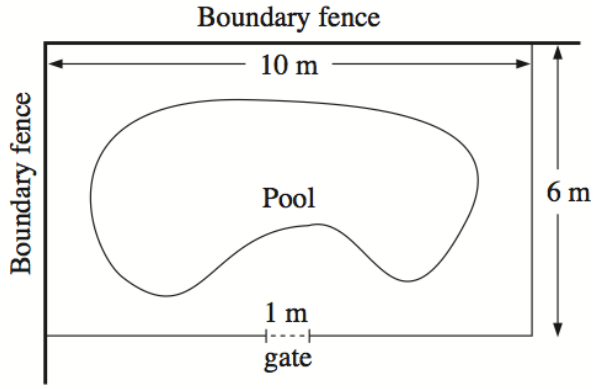
(d) When is the maximum height reached? **1**

Question 33 (1 mark) **Marks**

Elijah has high blood pressure of 180/132. A drug is expected to reduce blood pressure by 25%. What is his blood pressure after using this drug? **1**

Question 34 (2 marks)

A plan of a swimming pool is shown below. **2**



The boundary fences of this pool are already in place. Fencing costs \$73·50 per metre. The gate costs \$255. What is the cost of completing the pool enclosure.

Question 35 (1 mark)

What is the gradient of the line $y = -x + 2$? **1**

Question 36 (2 marks)

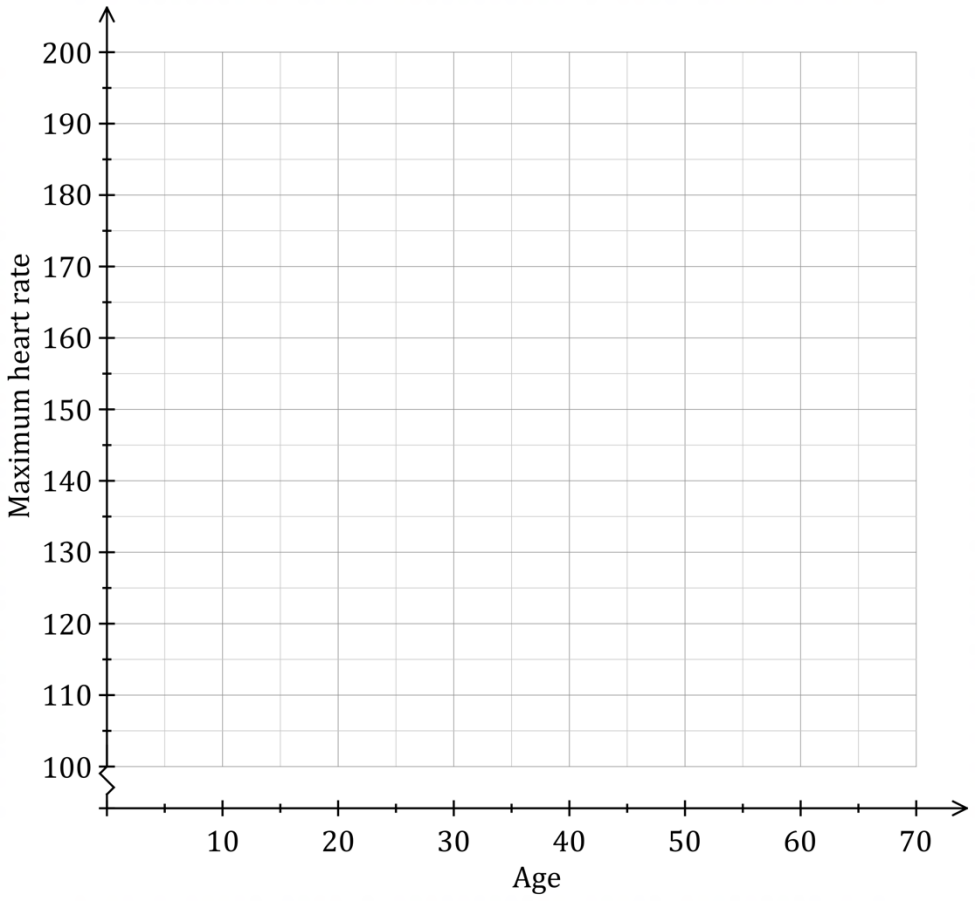
List four points that lies on the reciprocal function $y = \frac{4}{x}$ **2**

Question 37 (4 marks) **Marks**

The table shows the relationship between age and maximum heart rate (bpm).

Age	15	20	25	30	30	35	35	40	45	45	60	60	70
Max Heart rate	190	190	170	185	170	170	155	155	160	140	130	120	120

(a) Draw a scatterplot on the diagram below. **1**



(b) Construct a line of best fit on the scatterplot. **1**

(c) Estimate the maximum heart rate for person aged 50. Is this interpolation or extrapolation? **2**

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Question 38 (2 marks)

The bearing from A to B is 140°. What is the bearing of B from A? **2**

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End of paper

NSW Education Standards Authority

HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 1
Mathematics Standard 2

REFERENCE SHEET

Measurement

Precision

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

Upper bound = measurement + absolute error

Lower bound = measurement – absolute error

Length, area, surface area and volume

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

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

$$A = \frac{h}{2}\left(x + y\right)$$

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

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

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

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

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

Trigonometry

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

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

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

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

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

$$z = \frac{x - \bar{x}}{s}$$

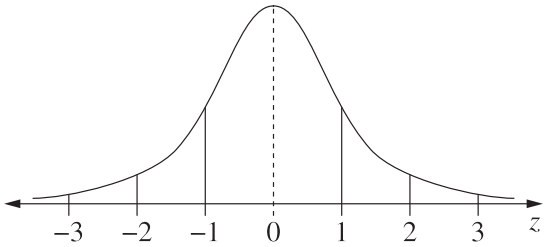
An outlier is a score

less than $Q_1 - 1.5 \times IQR$

or

more than $Q_3 + 1.5 \times IQR$

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