

**PAPER 1**

**YEAR 12**  
YEARLY  
EXAMINATION

# Mathematics Standard 1

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**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

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**Total marks:  
80**

**Section I – 10 marks**

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

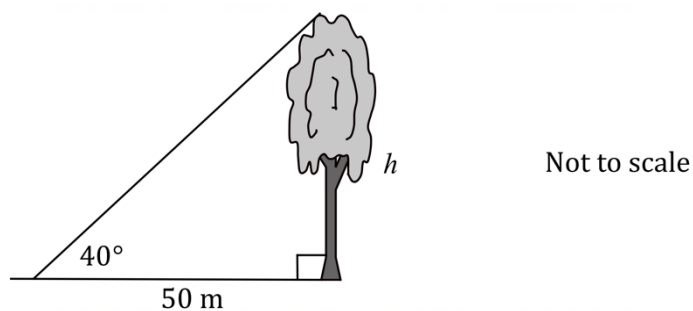
**Section II – 70 marks**

- 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.

Which of the following expressions would give the height ( $h$ ), of the tree in the diagram?

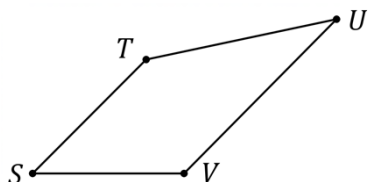
(A)  $50 \times \tan 40^\circ$

(B)  $\frac{50}{\tan 40^\circ}$

(C)  $50 \times \cos 40^\circ$

(D)  $\frac{50}{\cos 40^\circ}$

2.



Which of the following walks is a path in the above network diagram?

(A) S-T-S-V

(B) S-T-U-V

(C) S-T-V-S

(D) S-T-U-V-S

3. Ivy travels on a motorway at 100 km/h and it takes her 4 hours to get to her destination. Due to roadwork the motorway speed is reduced to 80 km/h. How long will it take Ivy to travel to her destination?

(A) 3 h

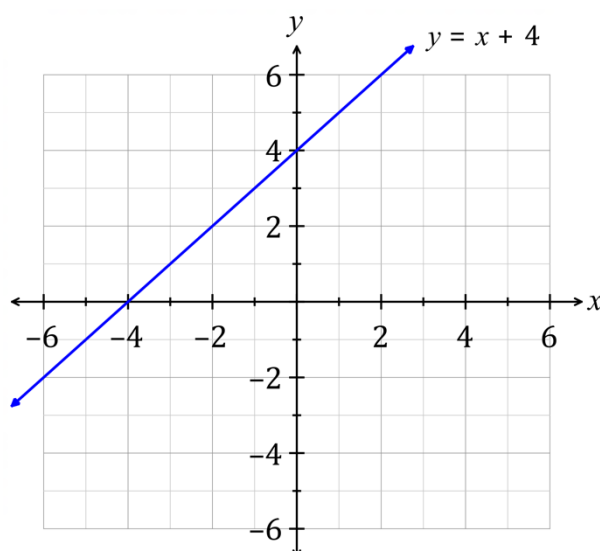
(B) 3.4 h

(C) 3.5 h

(D) 5 h

4. The scale on an aerial photograph is given as 1 mm = 180 m. If the length of land is 240 m, what is the map length between these points?
- (A) 1.33 mm  
(B) 2.67 mm  
(C) 3.20 mm  
(D) 60 mm
5. Michael invests \$3125 at 6% per annum compounding quarterly. How much will he have after 4 years? Answer to the nearest dollar.
- (A) \$3317  
(B) \$3945  
(C) \$3966  
(D) \$7939

6.



The graph of  $y = x + 4$  is shown above. Draw the graph of  $y = -x + 4$  on the number plane. What is the point of intersection of the lines  $y = x + 4$  and  $y = -x + 4$ ?

- (A) (0, 0)  
(B) (0, 4)  
(C) (4, 0)  
(D) (0, -4)
7. Andrew was driving at a speed of 70 km/h and has reaction time of 0.50 seconds. What is the stopping distance using the formula below?

$$d = \frac{5vt}{18} + \frac{v^2}{170}$$

- (A) 12 m  
(B) 24 m  
(C) 39 m  
(D) 44 m

8. The length of child's foot increases until they reach adulthood. What is the best description for the relationship between foot length and a child's age?
  - (A) Positive association
  - (B) Negative association
  - (C) Extrapolation
  - (D) Interpolation
  
9. Olive obtained a personal loan of \$30 000. She made a deposit of \$2200 and agreed to payments of \$820 per month for 4 years. What is the total amount paid for the loan?
  - (A) \$9360
  - (B) \$11 560
  - (C) \$39 360
  - (D) \$41 560
  
10. The number of people in a town is given by  $N = 1000(2.5^t)$  where  $N$  is the number of people and  $t$  is the time in years. What is the population after 2 years?
  - (A) 1581
  - (B) 2500
  - (C) 5000
  - (D) 6250

## 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**

Alice and Layla receive 72 text messages in the ratio 5:4. How many text messages does Layla receive?

**2**

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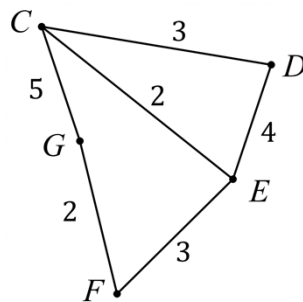
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### Question 12 (2 marks)

The network diagram below shows the possible paths (in km) for laying gas pipes between five locations.

**2**



What is the minimum length of pipes required to provide gas to all locations?

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**Question 13** (4 marks)

**Marks**

The petrol consumption ( $p$  litres per 100 km) and the speed of a car ( $s$  km/h) are modelled by the formula:

$$p = 0.01s^2 - s + 33$$

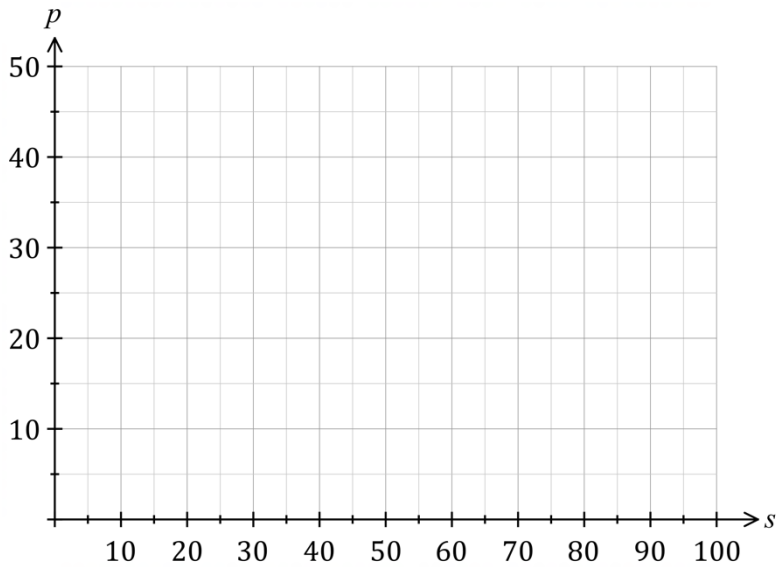
- (a) Complete the following table of values.

**1**

$s$	0	20	40	50	60	80	100
$p$							

- (b) Draw the graph of  $p = 0.01s^2 - s + 33$  using the number plane below.

**1**



- (c) A car was driven at 30 km/h for 40 km. How many litres of petrol did it use?

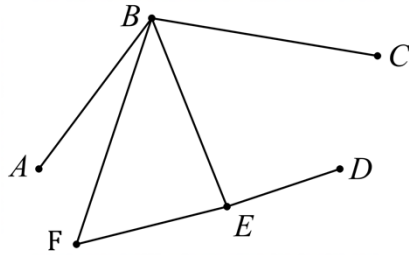
**1**

- (d) Why is the formula  $p = 0.01s^2 - s + 33$  not a good model if  $s = 0$ ?

**1**

**Question 14** (2 marks)

**Marks**



- (a) Complete the table of vertex degrees for the network diagram.

**1**

Vertex	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>
Degree						

- (b) Is there a path in the network that visits every edge exactly once? Give a reason for your answer.

**1**

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**Question 15** (3 marks)

Mitchell purchased a used car for \$16 000. It depreciated by 20% per annum and is expected to be used for 10 years.

- (a) What is the salvage value of the car after two years?

**1**

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- (b) How many years will it take for the salvage value of the car be less than \$4 000? Answer to the nearest whole year.

**2**

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**Question 16** (1 mark)

The volume of petrol in a tank decreases from 28 L by 2 L every second. What is the volume of petrol in the tank after 3 seconds?

**1**

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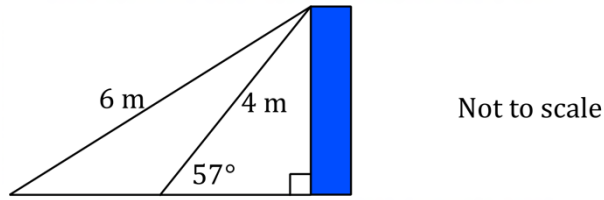
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**Question 17** (4 marks)

**Marks**

Two ladders are the same distance up the wall. The shorter ladder is 4 m long and makes an angle of  $57^\circ$  with the ground. The longer ladder is 6 m long.



- (a) Find the distance the ladders are up the wall. Answer correct to two decimal places. **2**

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- (b) Find the angle the longer ladder makes with the ground. Answer correct to the nearest degree. **2**

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**Question 18** (4 marks)

Edward borrows \$220 000 over 7 years at an interest rate of 9.5% p.a. reducible. He pays \$1910 per fortnight.

- (a) How much will Edward pay back altogether? **1**

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- (b) What is the interest paid for this loan? **1**

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- (c) What is the equivalent flat interest rate charged per annum on this loan? Answer correct to 1 decimal place. **2**

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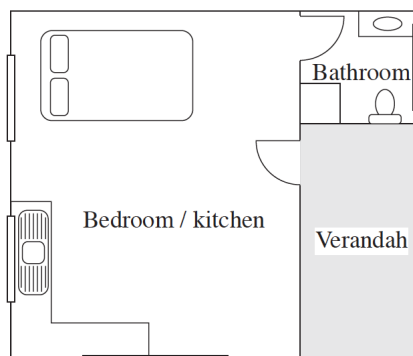
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**Question 19** (3 marks)**Marks**

A building plan for an extension is shown below. It uses a scale of 1:100.



(a) What is the symbol used for the door? **1**

(b) What are the dimensions of the verandah?  
Answer correct to one decimal place. **1**

(c) Calculate the area of the extension.  
Answer correct to the nearest square metre. **1**

**Question 20** (3 marks)

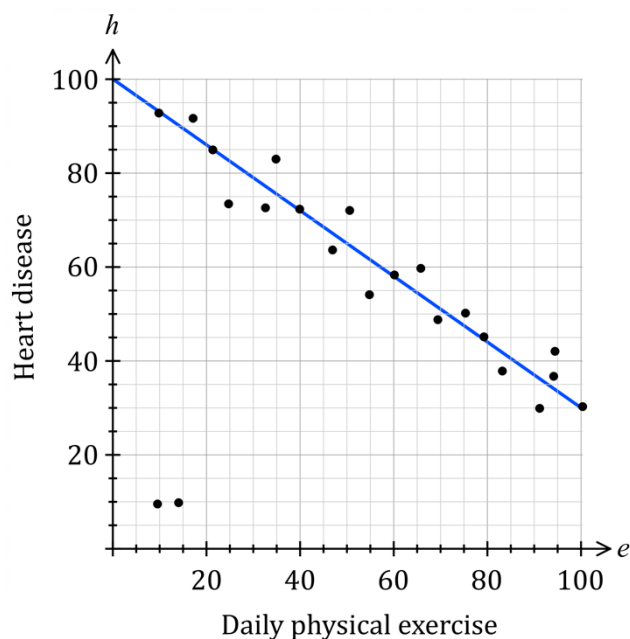
Audrey owns a credit card that has no annual fee and charges 16.3% p.a. interest on all purchases. The interest is charged on the date of purchase and the date of payment.

(a) Show that the daily interest rate is 0.04466%. **1**

(b) On the 27<sup>th</sup> of January, Audrey bought a TV for \$1029 using her credit card. Audrey paid her credit card account on the 7<sup>th</sup> of February. What was the total amount she paid for the TV, including interest? Answer correct to the nearest cent. **2**

**Question 21** (2 marks)**Marks**

The scatterplot shows daily physical exercise ( $e$ ) versus heart disease ( $h$ ).



- (a) Calculate the gradient of the line.

**1**

- (b) What is the equation of the line of best fit drawn?

**1****Question 22** (2 marks)

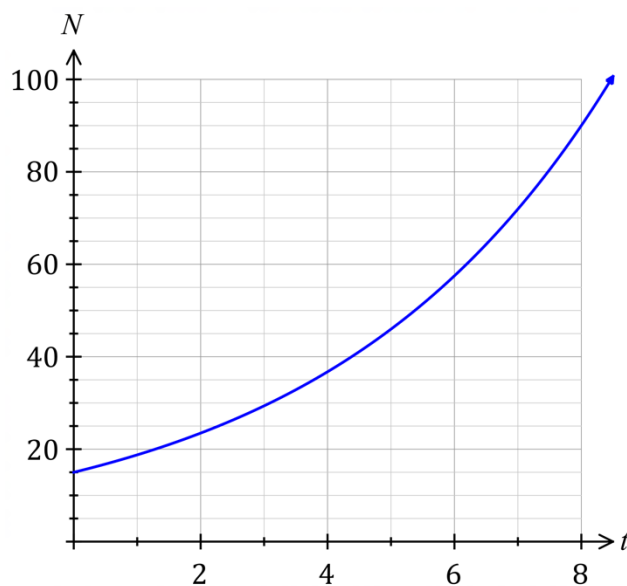
A plane is flying at a speed of 900 km/h.

**2**

How far will the plane travel from 10.15 am to 12.30 pm on the same day?

**Question 23** (3 marks)**Marks**

The graph below shows the exponential increase in bacteria where  $N$  is the number of bacteria in thousands after  $t$  hours.



- (a) What is the initial number of bacteria?

**1**


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- (b) Estimate the time taken for the number of bacteria to reach 45 000.

**1**


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- (c) Estimate the time taken for the number of bacteria to double its initial size.

**1**


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**Question 24** (2 marks)

Lucas bought a new car at the beginning of 2017 for \$30,000. At the end of 2017 the value of the car had depreciated by 30%. In 2018 the value of the car depreciated by 25% of the value it had at the end of 2017. What was the value of the car at the end of 2018?

**2**


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**Question 25** (3 marks)**Marks**

Items with a different mass ( $m$  in kg) are attached to a spring. The length of the spring ( $L$  in cm) is measured for each item. The results are shown below.

$m$	2	5	8	11	14	17
$L$	41.2	55.0	68.8	82.6	96.4	110.2

- (a) A linear model in the form  $L = km + 32$  describes this situation.  
What is the value of  $k$ ?

**1**


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- (b) What is the length of the spring when no item is attached?

**1**


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- (c) Calculate the mass of an item that will make the spring 78 cm long?

**1**


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**Question 26** (2 marks)**2**

	$W$	$X$	$Y$	$Z$
$W$	–	3	9	8
$X$	3	–	6	1
$Y$	9	6	–	2
$Z$	8	1	2	–

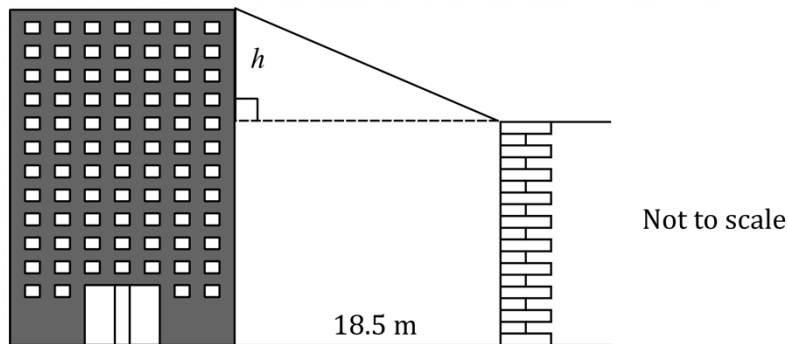
Represent the table shown above as a weighted network.

**Question 27** (2 marks)

**Marks**

The two buildings below are standing on level ground. The horizontal distance between the buildings is 18.5 metres and the angle of elevation between the buildings is  $32^\circ$ .

**2**



What the difference in height ( $h$ ) between the buildings? Answer correct to one decimal place.

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**Question 28** (4 marks)

- (a) Mia has a debit of \$12,590 on a credit card with a simple interest rate of 18% p.a. How much interest would she pay on this debit for two years?

**2**

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- (b) Mia transferred the debit to a new card with a simple interest rate of 21% p.a. The new card has a 0% balance transfer for 6 months. How much is saved after two years?

**2**

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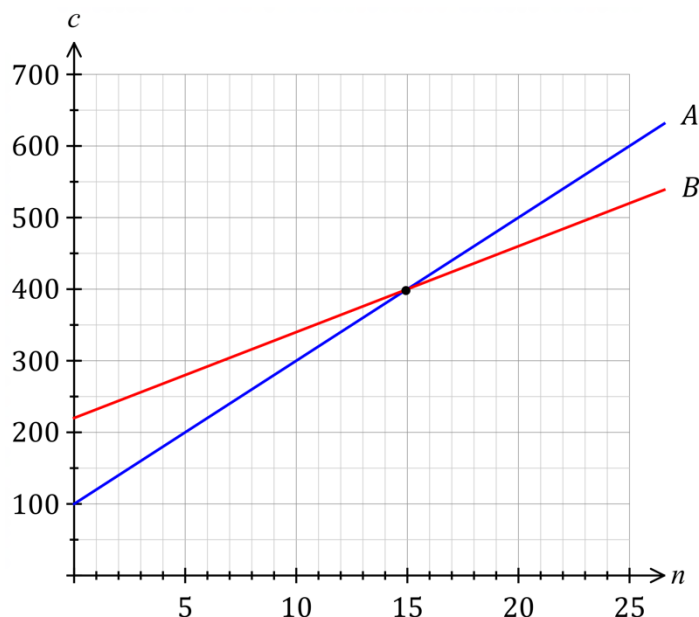
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**Question 29** (4 marks)**Marks**

The graph shows the cost charged by two different businesses to cater for a party. In each case the total cost (\$ $c$ ) depends on the number of people attending ( $n$ ).



- (a) For what number of people attending do the two businesses charge the same amount? **1**
- .....
- .....
- (b) If ten people attend the party, what business would you recommend? Justify your answer. **1**
- .....
- .....
- (c) If 25 people are to attend the party, what is the difference in the cost per person between the two businesses? **2**
- .....
- .....
- .....

**Question 30** (2 marks)

A scatterplot showing the profit made by a worker for different amounts of output. A line of best fit is drawn and its equation found to be  $P = 0.5n + 4.5$ , where  $P$  is the profit in dollars and  $n$  is the number of units produced. How much profit does the equation give for a worker producing one hundred million units? Do you think this an accurate prediction. Explain.

**2**

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**Question 31** (2 marks)

**Marks**

Fertiliser was added to a garden at a rate of  $100 \text{ g/m}^2$ . The fertiliser consists of nitrogen, phosphorus and potassium in the ratio of 7 : 6 : 12. How many grams of each element is that per square metre?

**2**

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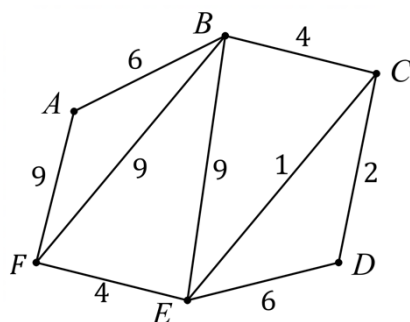
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**Question 32** (4 marks)



- (a) Find the length of the shortest path from  $A$  to  $E$ .

**2**

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- (b) Find a walk that visits every edge of the network only once, starting at  $C$ .

**2**

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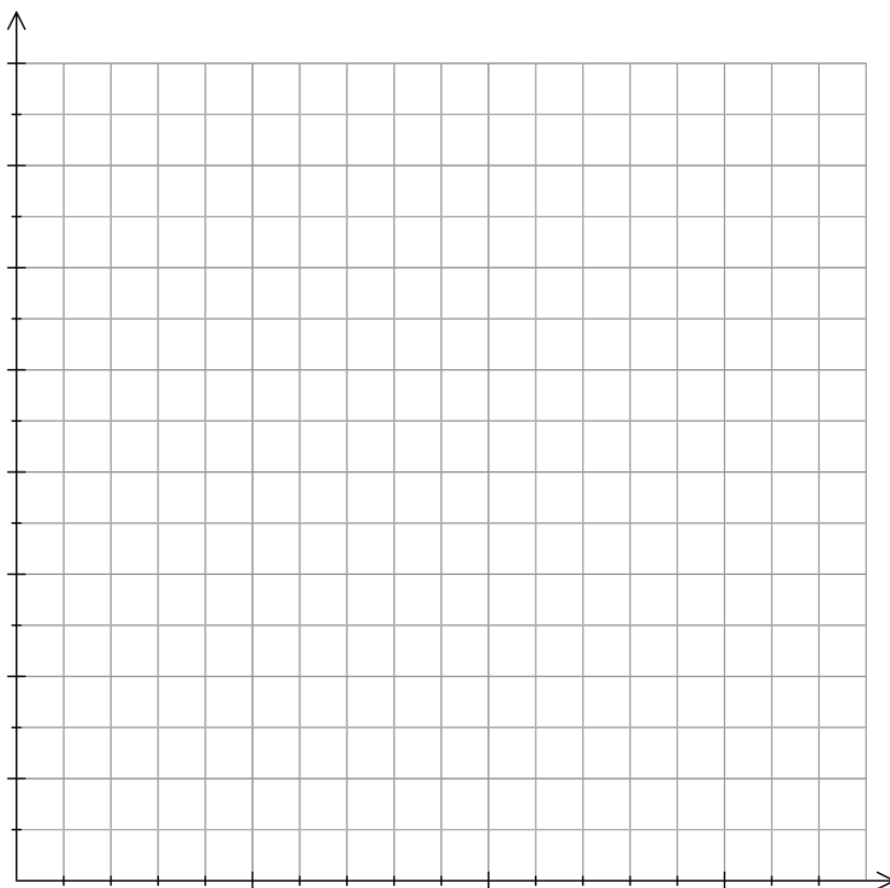
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**Question 33** (4 marks)**Marks**

The table below compares age (in years) and pulse rate (in beats per minute).

$a$	5	10	15	20	25	30
$p$	60	65	65	70	70	75

- (a) Draw a scatterplot using this data.

**2**

- (b) Draw a line of best fit on the scatterplot.

**1**

- (c) Use the line of best fit to estimate the pulse rate when a person's age is 28 years.

**1**


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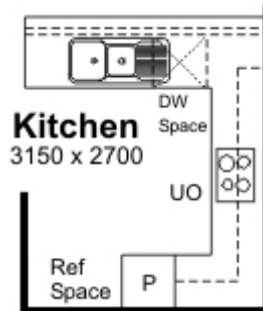
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**Question 34** (2 marks)

**Marks**

A section of a building plan is shown below.



- (a) What does 'DW' represent in this plan?

**1**

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- (b) What are dimensions of the kitchen?

**1**

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**Question 35** (2 marks)

A house was bought for \$940 000 and appreciated at the rate of 6% p.a. What will be the value of the house after 5 years? (Answer to the nearest dollar).

**2**

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**Question 36** (2 marks)

Ava, Bella and Claire share a lottery prize in the ratio 2:3:4. If Claire's share is \$6480, what is Bella's share?

**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 =  $\frac{1}{2} \times \text{precision}$

Upper bound = measurement + absolute error

Lower bound = measurement – absolute error

#### Length, area, surface area and volume

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

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

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

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

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

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

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

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

#### 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

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

#### Straight-line method of depreciation

$$S = V_0 - Dn$$

#### Declining-balance method of depreciation

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

### Statistical Analysis

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

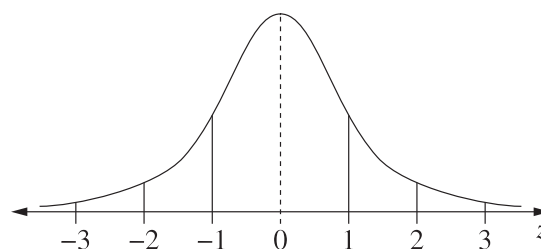
An outlier is a score

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  $3$