Student Number

Gosford High School

2022 **Trial HSC Examination**

Mathematics Standard 2

General Instructions

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

Total marks :

100

Section I – 15 marks (pages 2 – 10)

- Attempt Questions 1 – 15
- Allow about 25 minutes for this section

Section II – 85 marks (pages 11 – 37)

- Attempt Questions 16 – 40
- Allow about 2 hours and 5 minutes for this section

Section I

15 marks

Attempt Questions 1–15

Allow about 25 minutes for this section

Use the multiple-choice answer sheet for Questions 1 – 15

1 Which set of data is classified as categorical and nominal?

A. blue, red, black
B. size of coffee cups
C. heights of children in metres
D. number of students in each class

2 A train departs from Town A at 3.00 pm to travel to Town B. Its average speed for the journey is 90 km/h, and it arrives at 5.00 pm. A second train departs from Town A at 3.10 pm and arrives at Town B at 4.30 pm. What is the average speed of the second train?

A. 135 km/h
B. 150 km/h
C. 216 km/h
D. 240 km/h

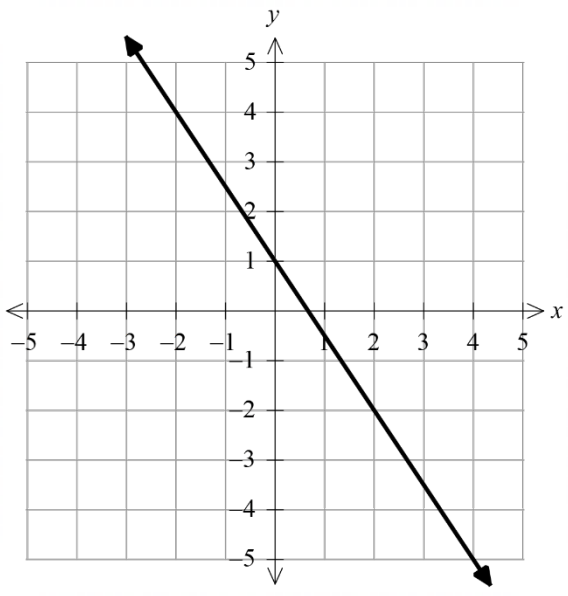
3 Chris purchased a laptop for $2 999.00 exactly 3 years ago.

He claims 15% depreciation per year using the declining balance method.

Calculate the current salvage value of the laptop.

A. $1 649.45
B. $1 841.76
C. $2 954.00
D. $2 988.88

4 Which of the following equations would represent the linear relationship shown below?



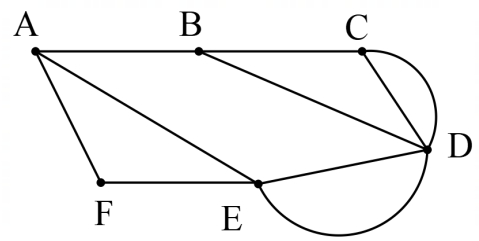
A. $y = x + 1$

B. $y = -x + 2$

C. $y = -\frac{3x}{2} + 1$

D. $y = \frac{3}{2}x + 1$

5 Consider the network diagram below. Which of the following statements is true?



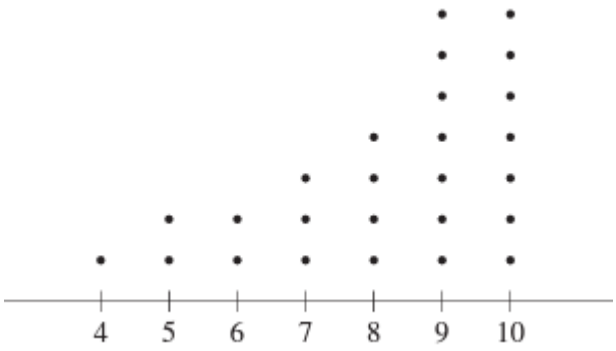
A. There are nine vertices in the network.

B. There are six edges in this network.

C. The vertex with the lowest degree is B.

D. The vertex with the highest degree is D.

6 A set of data is displayed in this dot plot.



Which of the following best describes this set of data?

A. Symmetrical

B. Positively skewed

C. Negatively skewed

D. Normally distributed

7 A cruise ship left Sydney (34°S, 151°E) to travel to the island of Desmos.

When the ship arrived in Desmos, it was 72° north and 124° west of Sydney.

What is the location of Desmos?

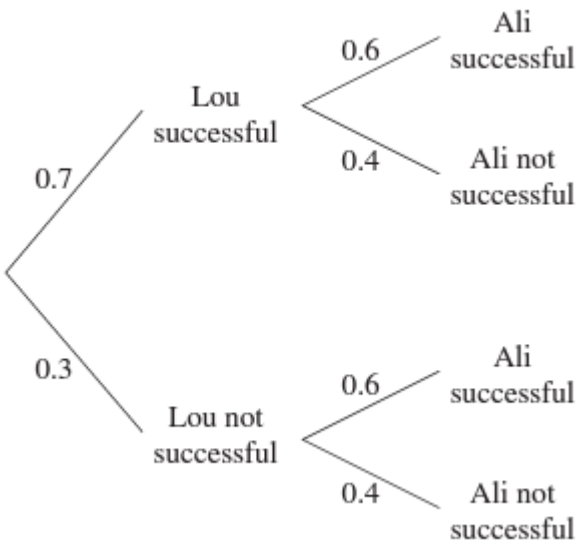
A. (38°N, 27°E)
B. (38°N, 95°E)
C. (106°N, 27°E)
D. (106°N, 95°E)

8 A bag of 12 apples is being sold for $4.59. The average weight of an apple in the bag is 75 grams.

What is the price of the apples when expressed as a rate in dollars per kilogram?

A. $3.83/kg
B. $5.10/kg
C. $6.12/kg
D. $7.34/kg

9 Lou and Ali are on a fitness program for one month. The probability that Lou will finish the program successfully is 0.7 while the probability that Ali will finish successfully is 0.6. The probability tree shows this information.



What is the probability that only one of them will be successful?

A. 0.18

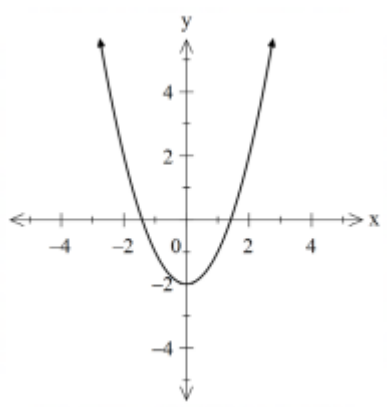
B. 0.28

C. 0.42

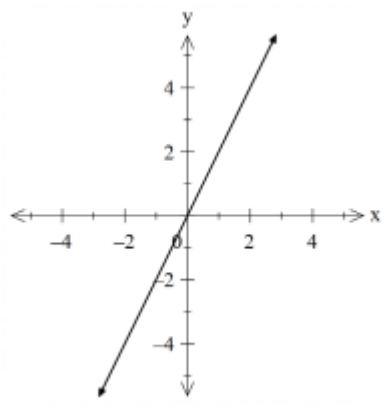
D. 0.46

10 Which of the following graphs best represents the equation $y = \frac{2}{x}$

A.

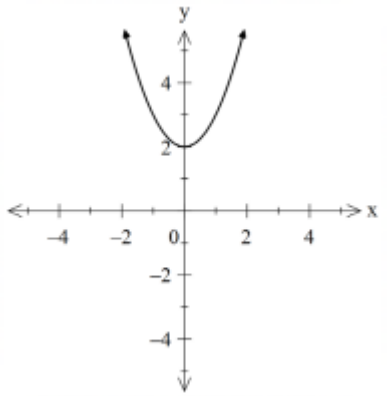


B.

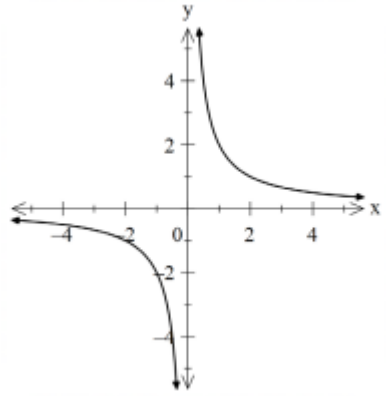


.

C.



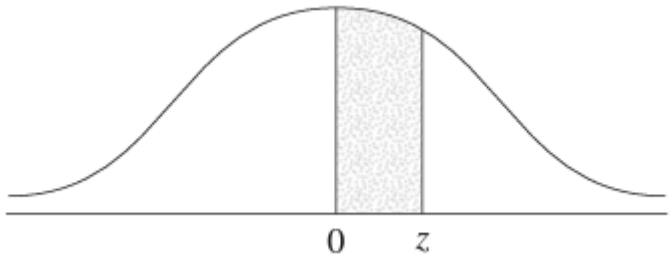
D.



11 A random variable is normally distributed with mean 0 and standard deviation 1. The table gives the probability that this random variable lies between 0 and z for different values of z.

z	0.1	0.2	0.3	0.4	0.5	0.6
Probability	0.0398	0.0793	0.1179	0.1554	0.1915	0.2257

The probability values given in the table for different values of z are represented by the shaded area in the following diagram.



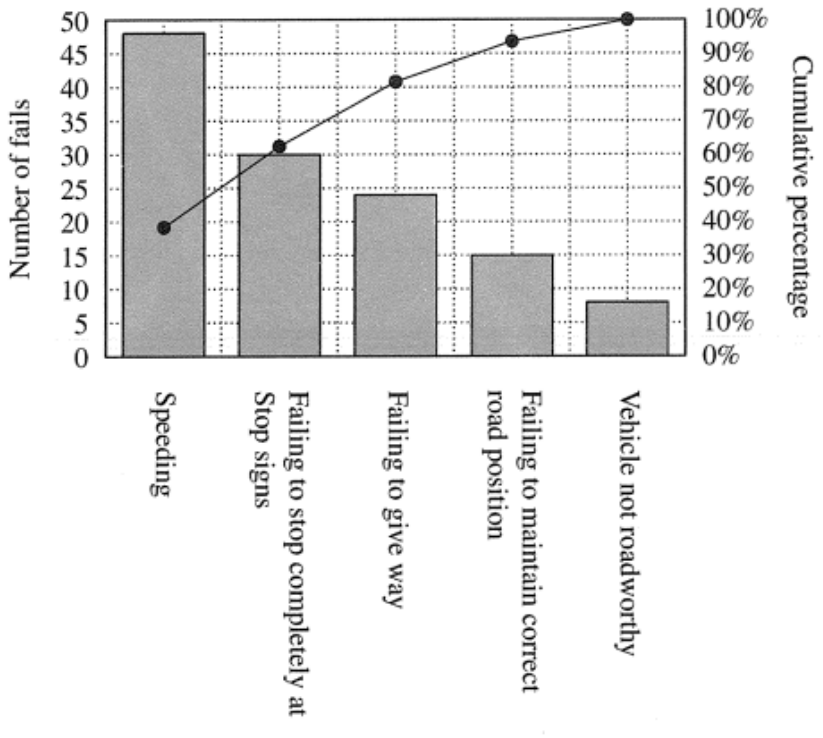
Using the table, what is the probability that a value from a random variable that is normally distributed with mean 0 and standard deviation 1 is greater than 0.4.

A. 0.1554
B. 0.2257
C. 0.3446
D. 0.8446

12 The variables, profit and amount spent on employee training have a correlation coefficient of r = 0.88. Given this information, we can say that:

A. Spending money to train employees reduces the profit.
B. Increased profits are highly linked to increased training of employees.
C. By spending money on training employees, a company has an 88% chance of increasing profits.
D. Profits are increased by 88% by training employees

13 The Pareto chart below show the reasons why learner drivers at a particular testing centre failed their driving test



Approximately what percentage of learner drivers failed because of failing to stop completely at stop signs?

A. 75%

B. 62%

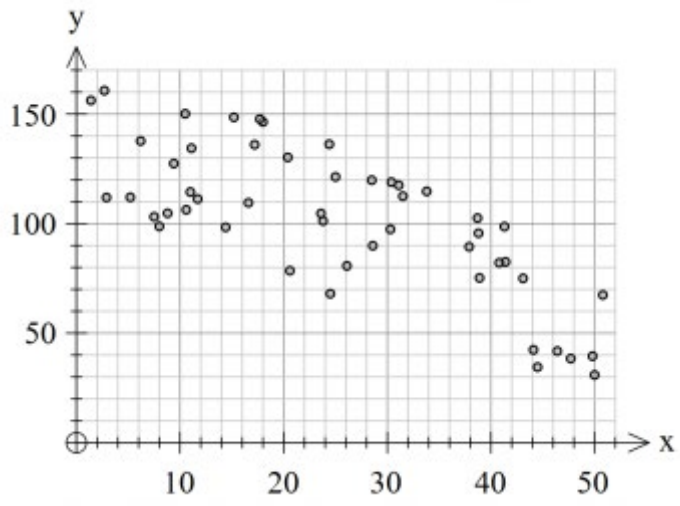
C. 40%

D. 24%

14 The weights of 4 parcels have a mode of 5kg, a median of 4.5kg and a mean of 4kg.
What is the weight of the lightest parcel?

A. 2 kg
B. 2.25 kg
C. 2.5 kg
D. 3.5 kg

15 Consider the data on the following scatterplot.



Which of the following would be the most reasonable choice for the line of best fit?

A. $y = 145 - 1.7x$
B. $y = 150 - 3.8x$
C. $y = 100 + 1.7x$
D. $y = 155 + 3.8x$

Gosford High School

2022 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 2

Section II Answer Booklet 1

Student Number

Section II

85 marks
Attempt Questions 16 – 40
Allow about 2 hours and 5 minutes for this section

Booklet 1 — Attempt Questions 16 – 32 (53 marks)
Booklet 2 — Attempt Questions 33 – 40 (32 marks)

Instructions

- Write your 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 on pages 26 - 27 of Booklet 1. If you use this space, clearly indicate which question you are answering.

Please turn over

Question 16 (2 marks) **2**

The Coordinated Universal Time (UTC) of Hawaii is -10 hours.

When it is 9 pm Wednesday in Hawaii, it is 12:30 pm Thursday in India.

What is the UTC of India?

……

……

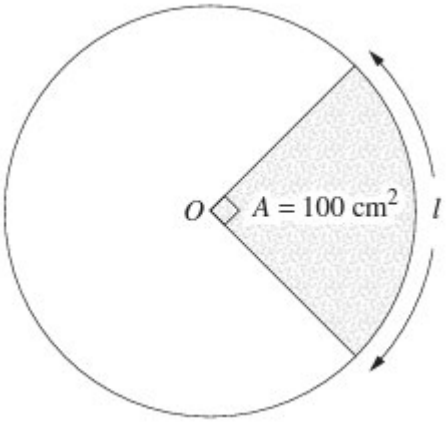
……

……

……

Question 17 (3 marks) **3**

In the circle, centre O, the area of the quadrant is 100 cm^2.



Calculate the length of *l*, correct to one decimal place.

……

……

……

……

……

Question 18 (5 marks)

A rectangular farm shed has a roof with dimensions of 20m by 12m. All the rain that falls onto this roof is diverted into a cylindrical water tank which has a radius of 1.6m. During a storm, 35 mm of rain falls onto the roof.

(a) Calculate the volume of water that fell onto the roof. Give your answer in m^3. **2**

……

……

……

……

(b) Calculate the number of litres of water that was diverted to the water tank. **1**

……

(c) Use your answer from part (a) to calculate the increase in the depth of water in the tank due to the rain that falls onto the roof during the storm. Give your answer to two decimal places. **2**

The volume of a cylinder is given by $V = \pi r^2 h$

……

……

……

……

……

……

……

Question 19 (6 marks)

Pragyat is a huge online influencer and works for the Kardashian family. He is completing his tax return. He has a gross salary of $210 560 from the company and an additional income from a modelling contract totalling $20 800. He is claiming $32 800 in allowable deductions.

(a) Calculate Pragyat's taxable income **1**

……

……

(b) Use the table below to calculate the tax payable. **2**

Taxable Income	Tax payable on this income
$\mathbf{0 - \$18,200}$	Nil
$\mathbf{\$18,201 - \$45,000}$	19 cents for each $1 over $18,200
$\mathbf{\$45,001 - \$120,000}$	$5,092 plus 32.5 cents for each dollar over $45,000
$120,001 – $180,000	$29,467 plus 37 cents for each $1 over $120,000
$180,001 and over	$51,667 plus 45 cents for each $1 over $180,000

……

……

……

……

……

(c) In addition of the above tax, Pragyat must also pay a Medicare levy of 2% of his taxable income. Calculate his Medicare levy. **1**

……

……

(d) Pragyat has already paid $61 450 as Pay As You Go (PAYG) tax. Calculate his tax return/debt to the Australian Tax Office (ATO). **2**

……

……

……

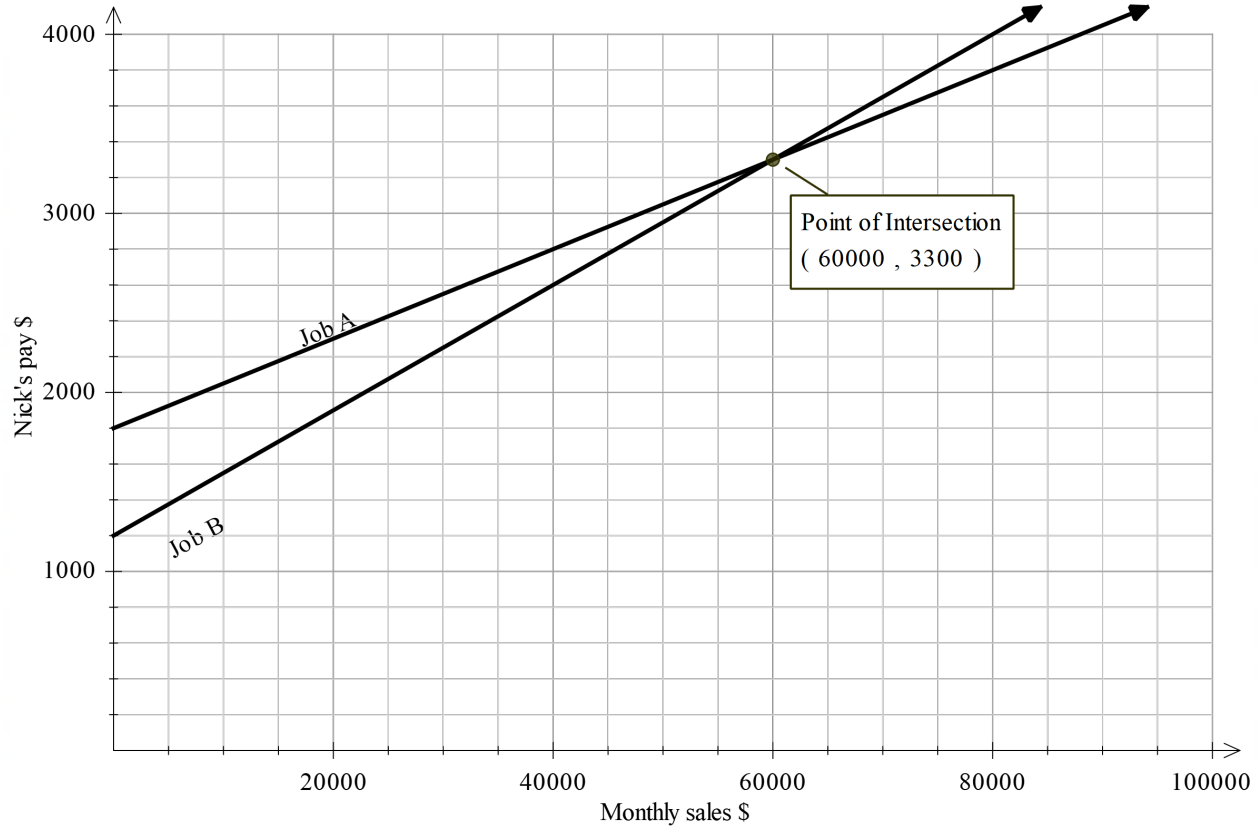
……

Question 20 (3 marks)

Jordan was offered two full-time sales positions. Both employers offered:

- a monthly retainer
- a commission on sales

The graph below shows the different pay rates for Job A and Job B.



(a) Explain how the graph tells us that Job A pays the highest retainer and state how much more this is than the retainer for Job B. **1**

……

……

……

……

(b) Calculate the percentage commission Jordan would receive if he selected Job B. **2**

……

……

……

……

Question 21 (3 marks)

The formula $C = \frac{5}{9}(F - 32)$ is used to convert temperatures between degrees Fahrenheit (F) and degrees Celsius (C). **3**

Convert $7°C$ to the equivalent temperature in Fahrenheit.

……

……

……

……

……

……

……

……

……

Question 22 (2 marks) **2**

On 20th July, Izabella purchased a Harry Styles concert ticket for $480 on her credit card. No other purchases were made using this card in July. Simple interest was charged at a rate of 19.74% p.a. There was no interest free period. The period for which interest was charged included the date of purchase and the date of payment.

What amount was paid when the account was paid in full on 31st July?

……

……

……

……

……

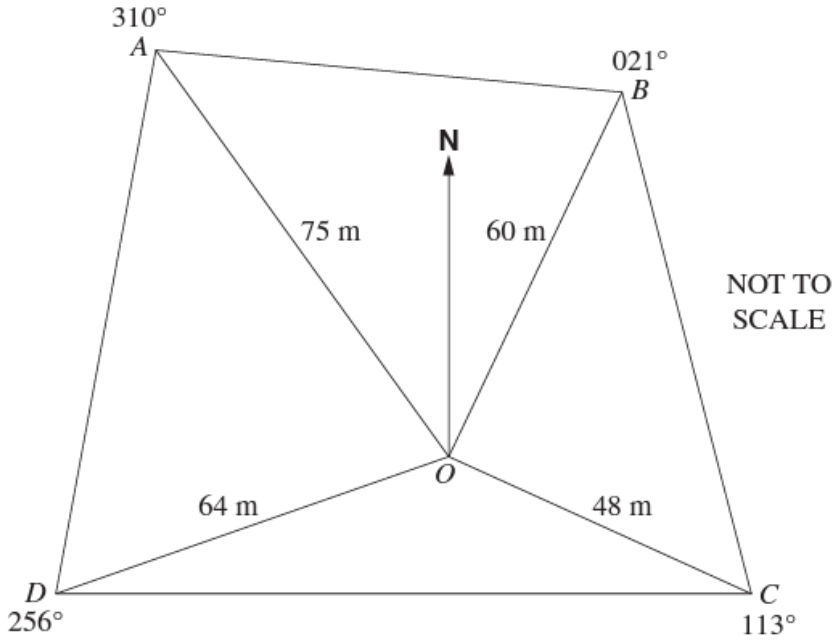
……

……

Question 23 (2 marks)

2

A compass radial survey of the field ABCD has been conducted from O.



Find the area of the section AOB, to the nearest square metre.

……

……

……

Question 24 (2 marks)

2

A 3400-watt air conditioner is used to cool a room. The air conditioner is used for a duration of 165 minutes. If electricity costs 35.82 cents per kilowatt-hour, calculate the cost of electricity to cool the room in this time. Give your answer to the nearest cent.

……

……

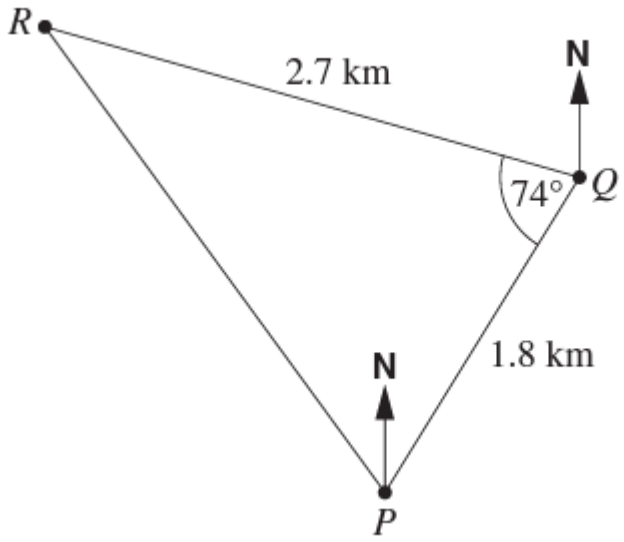
……

……

……

Question 25 (3 marks)

A yacht race follows the triangular course shown in the diagram. The course from P to Q is 1.8 km on a true bearing of 058°. At Q the course changes direction. The course from Q to R is 2.7 km and ∠PQR = 74°.



(a) What is the bearing of R from Q? **1**

……

……

(b) Use the cosine rule to determine the distance from R to P? Give your answer correct to one decimal place. **2**

……

……

……

……

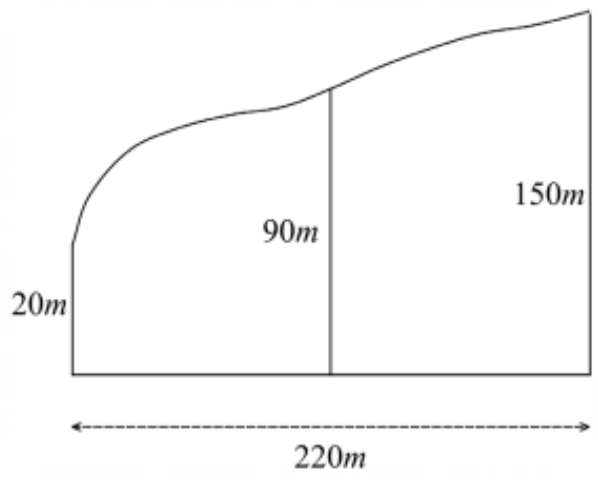
……

……

……

Question 26 (4 marks)

The diagram below shows a survey of the land Hanna will build her house on.



(a) Use two applications of the trapezoidal rule to estimate the area of the land to the nearest whole number. **2**

……

……

……

……

……

……

……

(b) Do you think your approximation in part (a) is higher, lower, or about equal to the actual area of this land? Provide reasons for your decision. **2**

……

……

……

……

……

Question 27 (3 marks)

In a small business, the seven employees earn the following wages per week:

$450, $735, $780, $885, $990, $1 020, $1 455

(a) Is the wage of $1 455 an outlier for this set of data? Justify your answer with calculations **2**

……

……

……

(b) Each employee will receive a $40 pay increase. **1**

What effect will this have on the standard deviation. Give a reason for your answer.

……

……

……

Question 28 (2 marks)

Charlotte owns 986 shares with a market value of $11.05 per share. The total dividend received for these shares is $640.90. **2**

Calculate the percentage dividend yield, correct to 1 decimal place.

……

……

……

……

……

……

……

……

Question 29 (5 marks)

Alex borrowed $19 000 to buy a diamond engagement ring. Interest on the loan was charged at 4.8% p.a. at the end of each month. He made a repayment of $436 at the end of every month. The table below sets out his monthly repayment schedule for the first four months of the loan.

Month	*Amount owing at start of month*	*Interest charged*	*Repayment*	*Amount owing at end of month*
1	*A*	$76.00	$436.00	$18 640.00
2	$18 640.00	*X*	$436.00	$18 278.56
3	$18 278.56	$73.11	$436.00	$17 915.67
4	$17 915.67	$71.66	$436.00	*B*

(a) Some values in the table are missing. Write down the values for A and B. **2**

……..

……..

(b) Calculate the value of X. **2**

……..

……..

……..

……..

.. ……

(c) Alex repaid this loan over four years. What is the total amount that Alex repaid? **1**

……..

……..

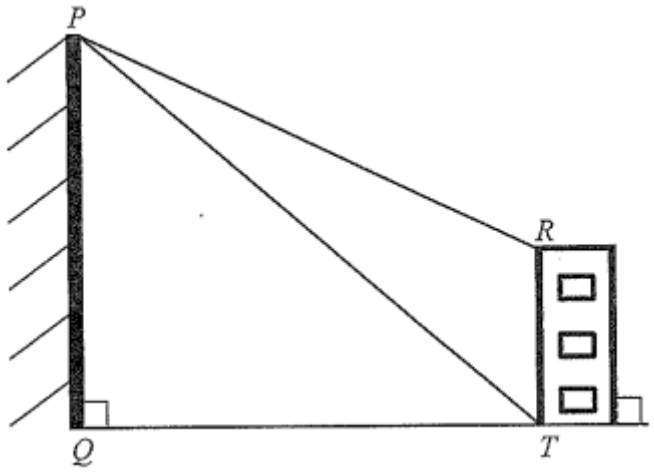
……..

……..

Question 30 (2 marks)

The diagram shows a vertical pole PQ and a building RT, both standing on level ground.

From the top of the pole the angle of depression of the top of the building is 29° and of the base of the building is 65°.



(a) Mark the given information on the diagram. **1**

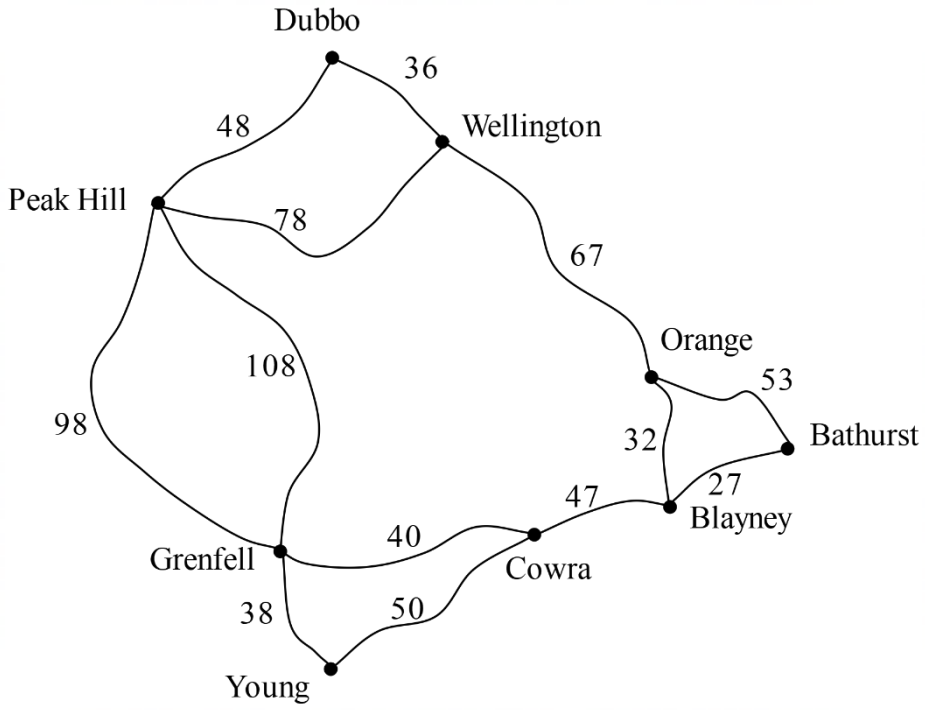
(b) Use this information to calculate the size of $\angle PRT$. **1**

…….

…….

Question 31 (4 marks)

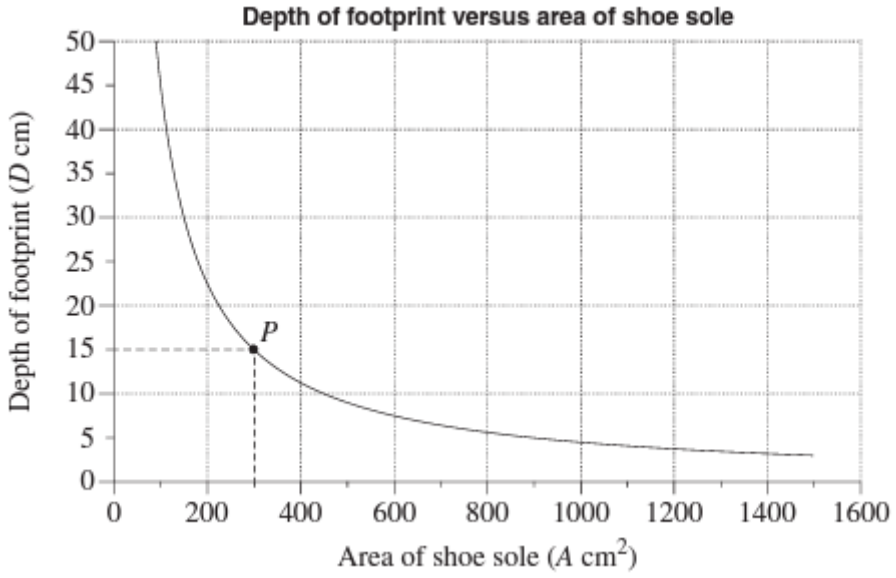
The network diagram shows the travel times in minutes along some of the roads connecting multiple different towns in New South Wales.



Draw a minimum spanning tree for this network and determine its length. **3**

Question 32 (3 marks)

When people walk in snow, the depth (D cm) of each footprint depends on both the area (A cm²) of the shoe sole and the weight of the person. The graph shows the relationship between the area of the shoe sole and the depth of the footprint in snow, for a group of people of the same weight.



(a) The graph is a hyperbola because D is inversely proportional to A. The point P lies on the hyperbola. Find the equation relating D and A. **2**

…….

…….

…….

…….

…….

(b) A man from this group walks in snow and the depth of his footprint is 5 cm. Use your equation from part (i) to calculate the area of his shoe sole. **1**

…….

…….

…….

Gosford High School

2022 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Student Number

Mathematics Standard 2

Section II Answer Booklet 2

Booklet 2 — Attempt Questions 33–40 (32 marks)

Instructions

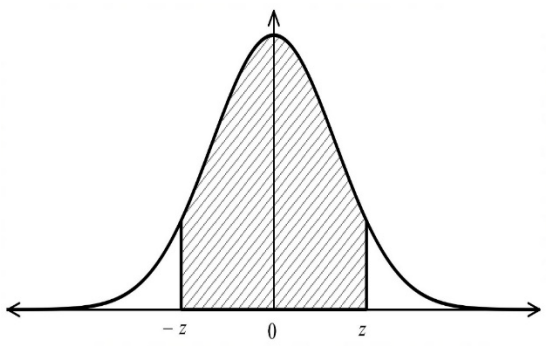
- Write your student number at the top of this page.
- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your responses should include relevant mathematical reasoning and/or calculations.
- Extra writing space is provided on pages 38 - 39. If you use this space, clearly indicate which question you are answering.

Please turn over

Question 33 (4 marks)

A random variable is normally distributed with mean 0 and standard deviation 1.
The table gives the probability that this random variable lies between -z and z for different values of z.

z	Probability
0.00	0.0000
0.25	0.1974
0.50	0.3829
0.75	0.5467
1.00	0.6827
1.25	0.7887
1.50	0.8664
1.75	0.9199
2.00	0.9545



The probability values given in the table for different values of z are represented by the shaded area in the diagram beside the table.

(a) Using the table, determine the probability that this random variable will lie between $z = -0.50$ and $z = 1.25$. **2**

……

……

……

……

(b) The arm span (in metres) for a group of 1200 residents of a town are normally distributed with a mean of 1.68 metres and a standard deviation of 0.24 metres. **2**

By first calculating the z-score, use the table above to determine how many of the residents will have an arm span greater than 1.5 metres.

……

……

……

……

……

……

Question 34 (4 marks)

Joe mixes petrol and oil in the ratio 40:1 to make fuel for his leaf blower.

(a) Joe pours 5 litres of petrol into an empty container to make fuel for his leaf blower. How much oil should he add to the petrol to ensure that the fuel is in the correct ratio? **1**

…….

…….

…….

(b) Joe has 4.1 litres of fuel left in his container after filling his leaf blower. He wishes to use this fuel in his lawnmower. However, his lawnmower requires the petrol and oil to be mixed in the ratio 25:1. How much oil should he add to the container so that the fuel is in the correct ratio for his lawnmower? **3**

…….

…….

…….

…….

…….

…….

…….

…….

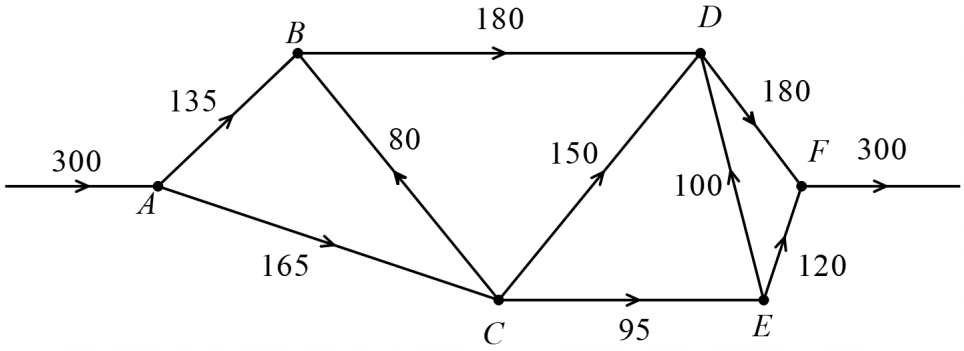
…….

…….

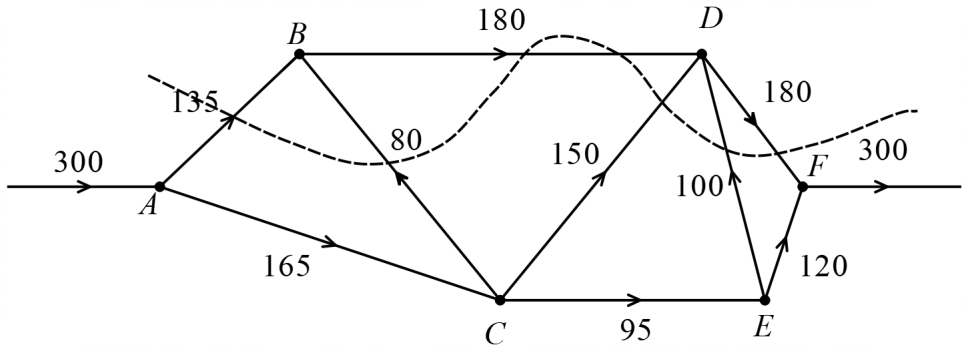
…….

Question 35 (3 marks)

The network diagram shows a series of water pipes and sprinklers in a section of an underground lawn watering system. The vertices *A, B, C, D, E* and *F* represent the sprinklers. The edges represent the underground water pipes which connect the sprinklers. The numbers on the edges represent the maximum capacity (in litres per hour) of the water pipes.



(a) In the diagram below, an invalid cut has been marked on the network. Explain why it is invalid. **1**



……

……

(b) Determine the maximum flow of the network. **2**

……

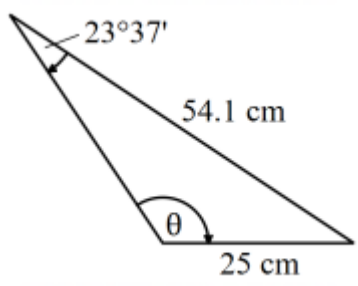
……

……

……

Question 36 (3 marks)

In the following triangle, θ is an obtuse angle.



Find the value of θ to the nearest minute.

……

……

……

……

……

……

……

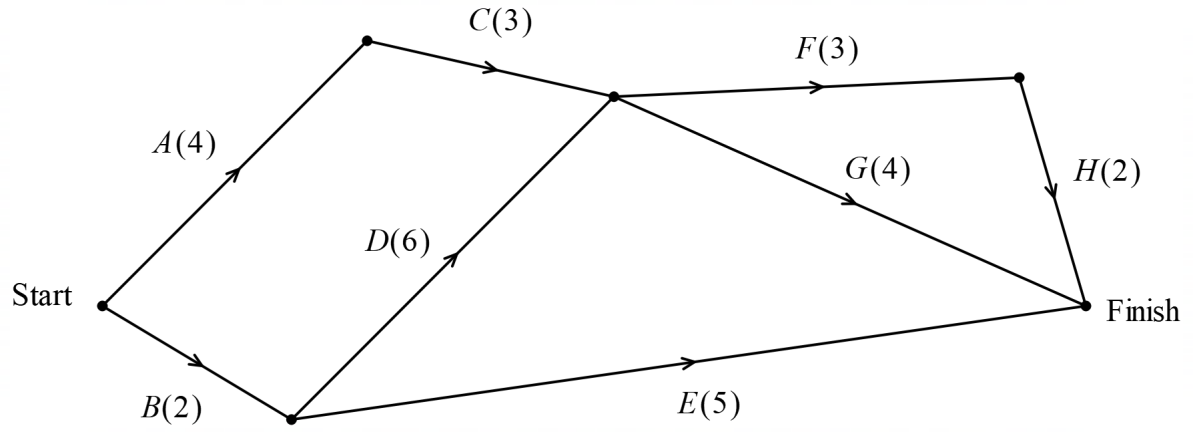
……

.

Question 37 (4 marks)

A team project requires completion of eight activities, $A - H$.

The directed network diagram shows the activities and their completion time, in hours.



(a) Complete the table below to show the immediate prerequisite(s) for activities E, F and G. **1**

Activity	Immediate prerequisite(s)
A	–
B	–
C	A
D	B
E	
F	
G	
H	F

(b) List the activities which make up the critical path for this project and state the minimum completion time. **2**

……

……

……

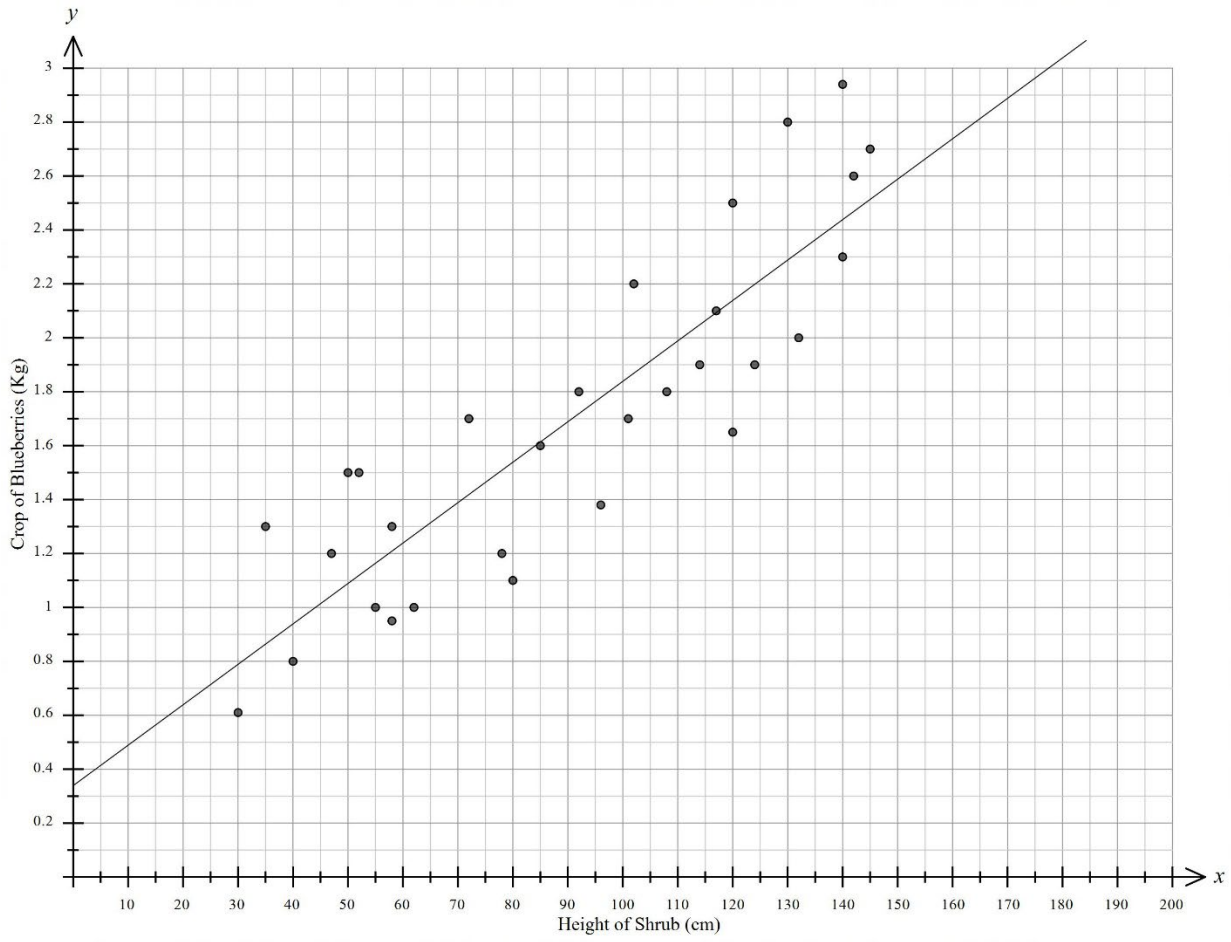
(c) The team are considering adding an additional activity (X) to the project. **1**

It would have a completion time of 2 hours, the earliest start time of 8 hours and a latest start time of 9 hours.

Add a directed edge to show activity X the diagram above.

Question 38 (4 marks)

A blueberry farmer records the crop size in kilograms from a range of blueberry shrubs on his trial patch. The data includes shrubs which have just begun to produce berries right through to fully mature plants.



Some statistical measures for the data in the Scatterplot are shown below.

Correlation Coefficient (r)= 0.874

Statistical Measure	Height of Shrub (x)	Crop Size (y)
Mean	90.83	1.70
Standard Deviation	35.42	0.61

Question 38 continues on the next page

Question 38 (continued)

(a) The gradient of the least-squares regression line can be found using the formula: **2**

$$\text{gradient} = r \times \frac{\text{standard deviation of y scores}}{\text{standard deviation of x scores}} = r\,\frac{\sigma_y}{\sigma_x}.$$

Given that the least-squares regression line crosses the vertical axis at 0.339, find the equation of the regression line and hence predict the crop (in kg) from a 100 cm high shrub.

……

……

……

……

……

……

(b) Use the statistical measures and the graph to justify the reliability of making predictions such as that in part (a) and determine the range of heights for which such predictions would continue to be reliable. **2**

……

……

……

……

Question 39 (5 marks)

A company stocks two different grades of timber.

Grade A sells for \$6 per square metre. Grade B sells for \$2 per square metre.

Patrick, a carpenter, purchases 30 m² of timber, including some of each grade. Total cost was \$84.

Let x represent the number of square metres of grade A timber purchased and y represent the number of square metres of grade B timber purchased.

Using the information above write down 2 equations for x and y and solve these simultaneous equations graphically on the number plane on the next page. Do *not* solve algebraically. From your graph determine how many square metres of each grade of timber was purchased.

…….

…….

…….

…….

…….

…….

…….

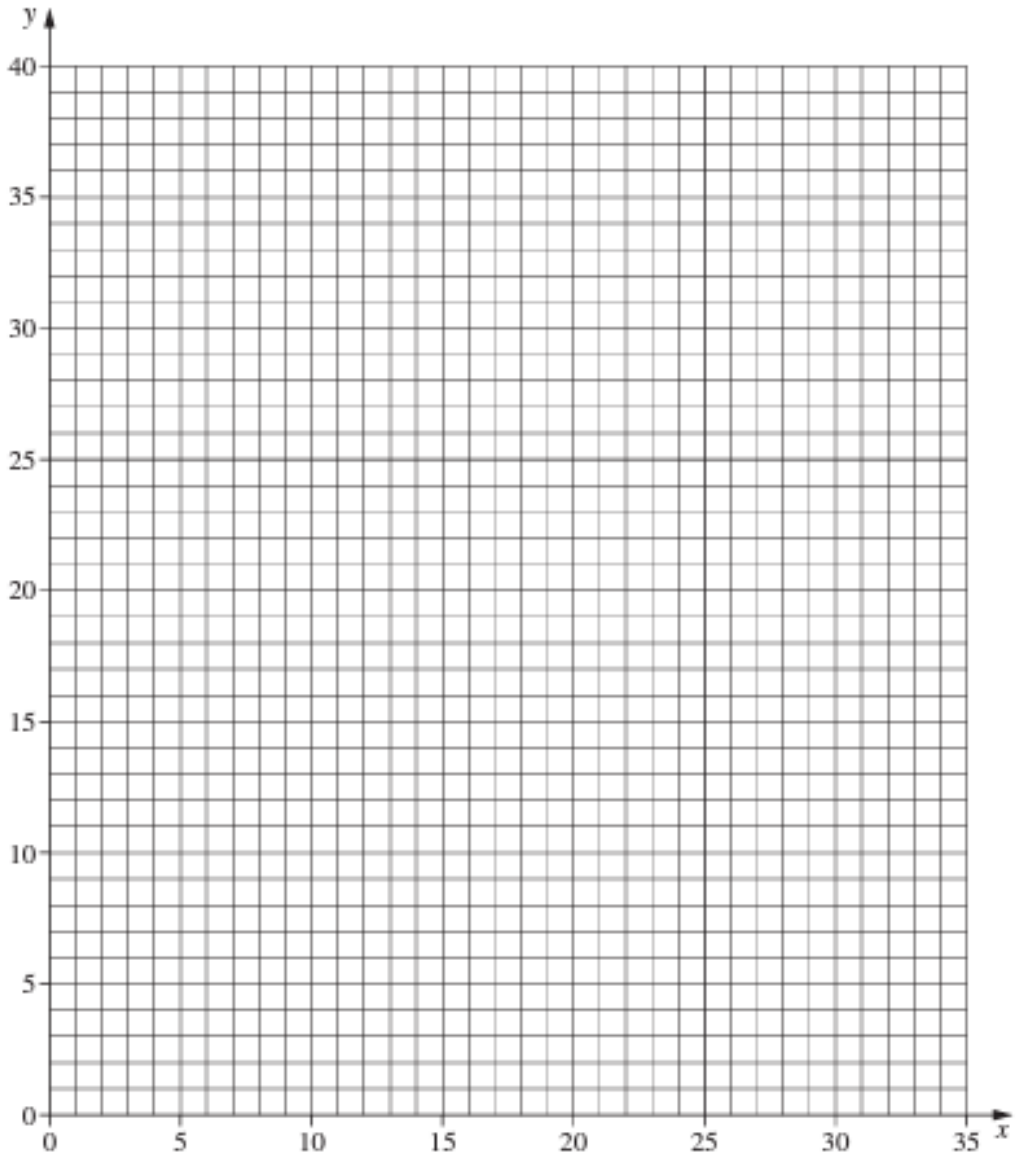
…….

…….

…….

…….

…….

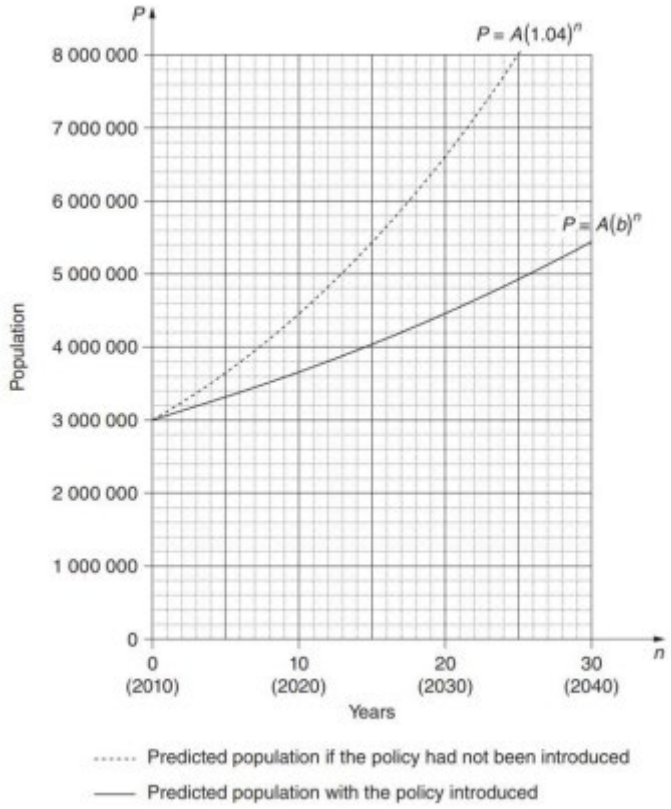


Number of square metres of grade A = ……

Number of square metres of grade B = ……

Question 40 (5 marks)

In 2010, the city of Thagoras used the equation $P = A(1.04)^n$ to predict its future population. The city introduced a new policy to slow its population growth and the new equation used was $P = A(b)^n$. In both equations, P is the predicted population and n is the number of years since 2010.



(a) In both equations, A is 3 000 000, what does A represent? **1**

…….

(b) Explain why 1.05 is not a suitable estimate for the value of b. **1**

…….

…….

(c) Find the predicted population in 2030 if the new policy had not been introduced. **1**

…….

…….

(d) Given that in the year 2030, the new policy predicts a population of 4 460 000, find the value of b to 2 decimal places. **2**

…….

…….

…….

End of Paper