XINMIN SECONDARY SCHOOL
新民中学
SEKOLAH MENENGAH XINMIN
Preliminary Examination 2024

CANDIDATE NAME	
CLASS	INDEX NUMBER

MATHEMATICS (SYLLABUS A) 4045/02

Paper 2 **1 August 2024**

Secondary 4 Normal (Academic) **2 hours**

Candidates answer on the Question Paper

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer **one** question.

The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is **70**.

The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

Errors	Qn No.	Errors	Qn No.
Accuracy		Simplification	
Brackets		Units	
Geometry		***Marks Awarded***	
Presentation		***Marks Penalised***	
		Total Marks for PRWC	

For Examiner's Use

70

Parent's/Guardian's Signature:

Mathematical Formulae

Compound Interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi rl$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

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

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Section A (62 marks)

Answer **all** the questions in this section.

1 The stem-and-leaf diagram shows the temperature, in °C, over 15 days in June in a city.

1	7	9	9							
2	0	3	3	3	4	4	5	7	8	8
3	0	2								

Key: 1 | 7 represents 17°C

(a) Find

(i) the range of the temperatures,

Answer …… °C [1]

(ii) the mean temperature, correct to 1 decimal place,

Answer …… °C [2]

(iii) the standard deviation of the temperatures.

Answer …… °C [1]

(b) Another day in June has a temperature of 22°C.

Given that this temperature value is to be included in the above diagram, would the mean temperature increase or decrease? Without the use of calculations, explain your answer.

Answer ……

……...

……... [1]

2 **(a)** Written as the product of its prime factors, $8316 = 2^2 \times 3^3 \times 7 \times 11$.

(i) Express 840 as the product of its prime factors.

Answer ..... [1]

(ii) Find the highest common factor of 8316 and 840.

Answer ..... [1]

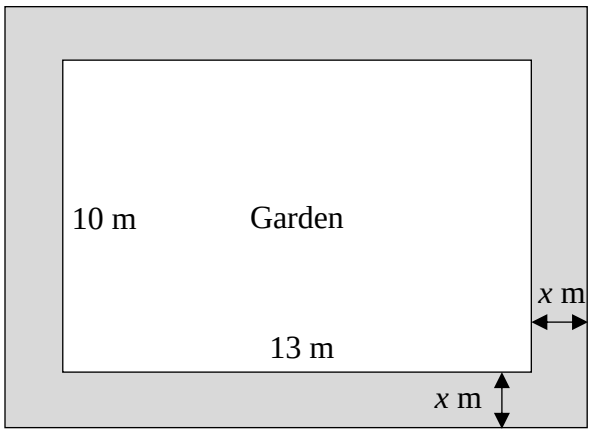
(iii) Find the smallest integer value of n such that $840n$ is a multiple of 8316.

Answer ..... [1]

(b) Rearrange $q = \dfrac{7p}{p-2}$ to make p the subject.

Answer p = ... [3]

3



The diagram shows a rectangular garden measuring 13 m by 10 m. The garden is surrounded by a path of uniform width of x m, shown shaded in the diagram. The total area of the path is 84 m^2.

(a) Write down an equation in x and show that it simplifies to $2x^2 + 23x - 42 = 0$.

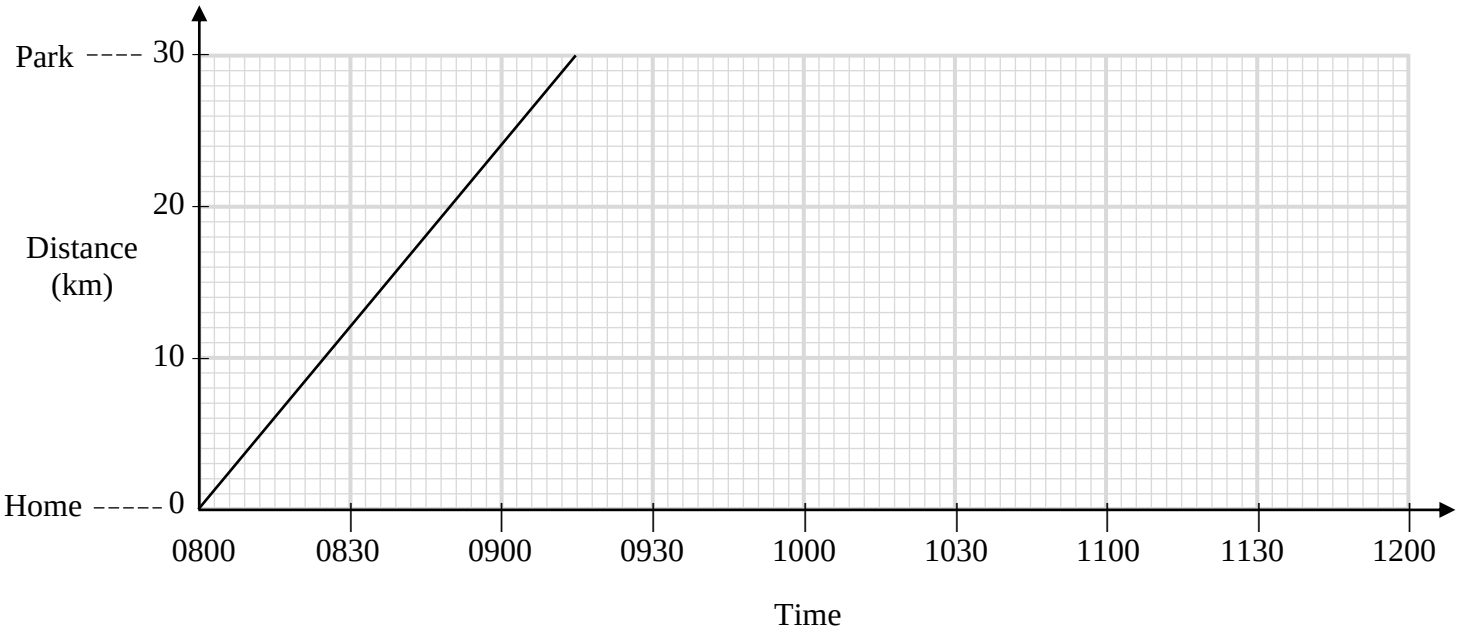
Answer

[2]

(b) Solve the equation $2x^2 + 23x - 42 = 0$ and find the width of the path.

Answer ..... m [2]

4 Min cycled from her home to a park. The distance-time graph shows her journey.



(a) Find the distance, in km, between Min's home and the park.

Answer …… km [1]

(b) Describe her motion between 0800 and 0915.

Answer …….

……... [1]

(c) Min took a rest in the park for 15 minutes before she cycled back home at a constant speed of 20 km/h.

On the same grid above, complete the graph to show Min's journey. [2]

5 **(a)** It is given that $6x = 7y$. The quantities y and z are in the ratio 9 : 2.

Write the ratio $x : y : z$ in its simplest form.

Answer …… : …… : …… [2]

(b) Simplify $\left(\frac{2}{a^6}\right)^{-3}$, leaving your answer in positive index form.

Answer …… [2]

(c) $\left(1.4\times10^{x}\right)\div\left(2.5\times10^{y}\right)=k\times10^{n}$, where $1\le k<10$.

(i) Find the value of k.

Answer k = …… [1]

(ii) Write an expression for n in terms of x and y.

Answer n = …… [1]

6 **(a)** Nadia invested some money for five years at 1.2% simple interest per year.
At the end of five years, it was worth $22260.

How much did she invest?

Answer $ ……. [3]

(b)

OFFER A	**OFFER B**
Deposit: 15% of the cash price Instalments: $110 per month over 1 year	Deposit: One-fifth of the cash price Instalments: $60 per month over 2 years

The cash price of a vacuum cleaner is $1299.
Jovan wants to buy the vacuum cleaner with either Offer A or Offer B.

Which offer should he choose? Explain your answer.

Answer Jovan should choose Offer …… because ……

…… [3]

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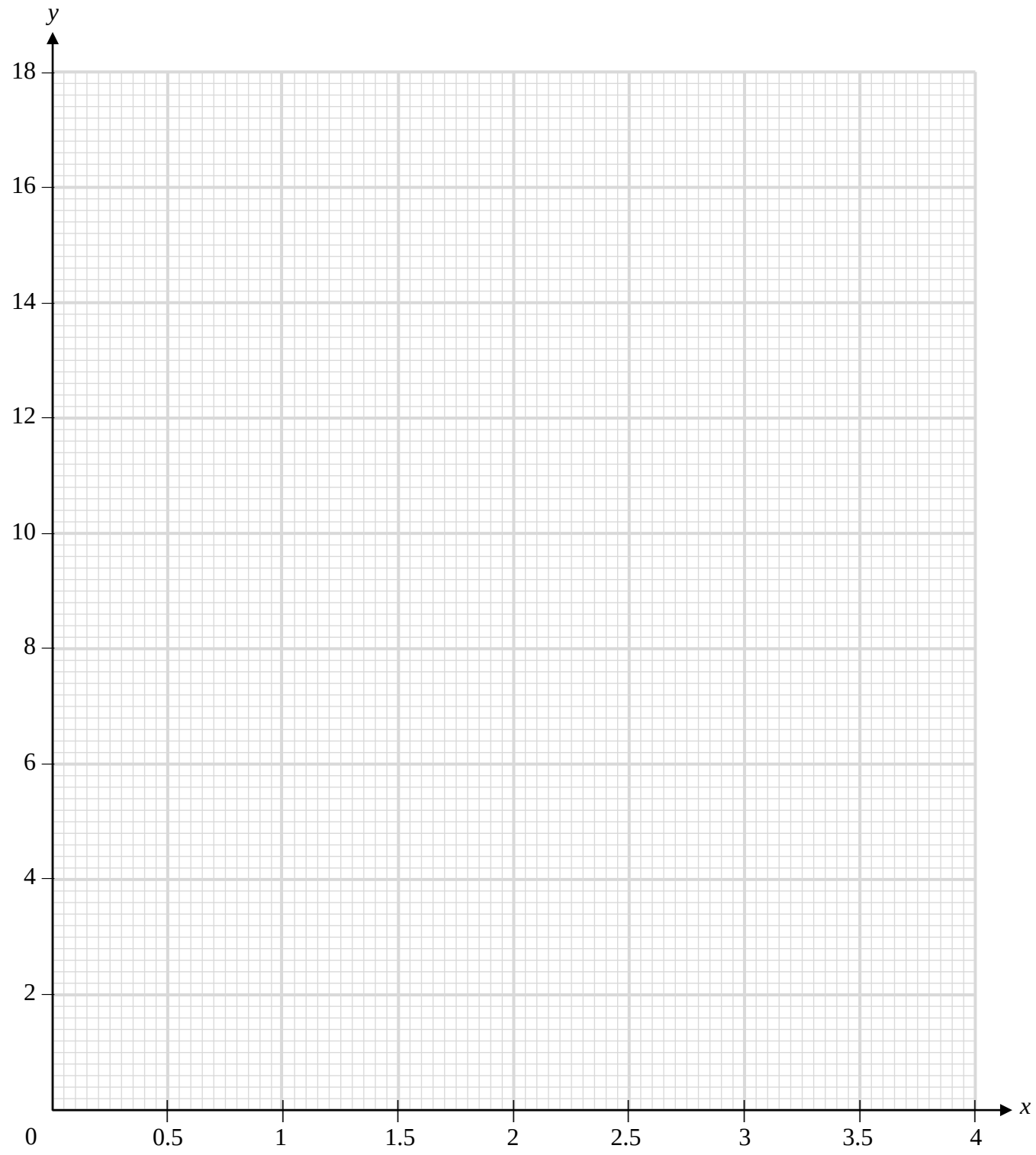
7 **(a)** Complete the table of values for $y = x^2 + \frac{2}{x}$.

x	0.5	1	1.5	2	2.5	3	3.5	4
y	4.25	3	3.58	5	7.05	9.67	12.82	

[1]

(b) Draw the graph of $y = x^2 + \frac{2}{x}$ for $0.5 \le x \le 4$. [2]



(c) Use your graph to find the values of x when $y = 3.8$.

Answer $x =$ …… or $x =$ …… [2]

(d) By drawing a suitable tangent, find the gradient of the curve when $x = 2$.

Answer …… [2]

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8 **(a)** x is inversely proportional to the cube root of y.

Given that $x = 3$ when $y = 8$, find the value of x when $y = 64$.

Answer $x =$ …… [2]

(b) Write $\frac{5}{x-3} + \frac{1}{x^2-9}$ as a single fraction in its simplest form.

Answer …… [3]

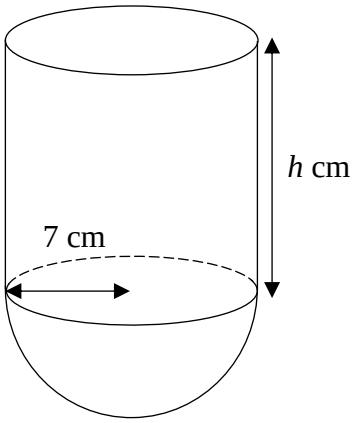
(c) Solve these simultaneous equations.

$$2x - 5y = 12$$
$$3x - 2y = 7$$

Answer $x =$ ……

$y =$ …… [3]

9



The diagram shows a closed solid made from a cylinder and a hemisphere.

The cylinder and the hemisphere have a common radius of 7 cm. The height of the cylinder is h cm and the total surface area of the solid is 371π cm^3.

(a) Show that the exact value of h is 16 cm.

Answer

[4]

(b) Find the volume of the solid.

Answer …… cm^3 [3]

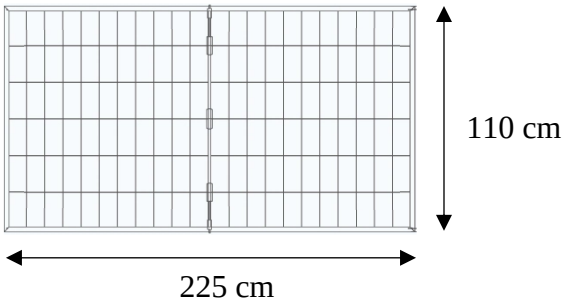
(c) The solid is made of ash wood. The density of ash wood is 0.67 g/cm^3.

Find the mass of the solid.

Answer …….. g [1]

10 These are some information given by a company about the solar panels they produce.

Solar Panel



Dimensions of each panel: 225 cm by 110 cm (one size)
Power generated: 0.3 kW

The amount of electricity generated by each solar panel per day, in kilowatt-hour (kWh), can be found with information on the power generated in kilowatt (kW) and the number of peak sun hours per day.

It is calculated using this formula:

amount of electricity (kWh) = power (kW) × number of peak sun hours per day (h)

The number of peak sun hours per day in Singapore is 5 hours. It is assumed that a month has 31 days and that the number of peak sun hours per day is constant each day.

(a) Show that each solar panel can produce 46.5 kWh of electricity in a month.

Answer

[2]

The table shows the estimated average monthly electricity consumption for households living in the different types of housing in Singapore.

Type of Housing	**Estimated average monthly electricity consumption (kWh)**
HDB 4-Room Flat	342
HDB 5-Room Flat	399
Terrace	821
Bungalow	2146

The Ng family lives in a terrace. Mr Ng wants to install some solar panels on their roof to generate at least 70% of their monthly electricity consumption.

(b) Calculate an estimate of the minimum amount of electricity that must be generated by the solar panels per month to meet Mr Ng's target.

Answer ……. kWh [2]

(c) Mr Ng plans to purchase solar panels from this company. He has a rectangular space on his roof, where it is suitable to install the solar panels.

Given that his roof has a dimension of 7 m by 5 m, would Mr Ng be able to meet his target?

Justify your answer with calculations.

Answer …….

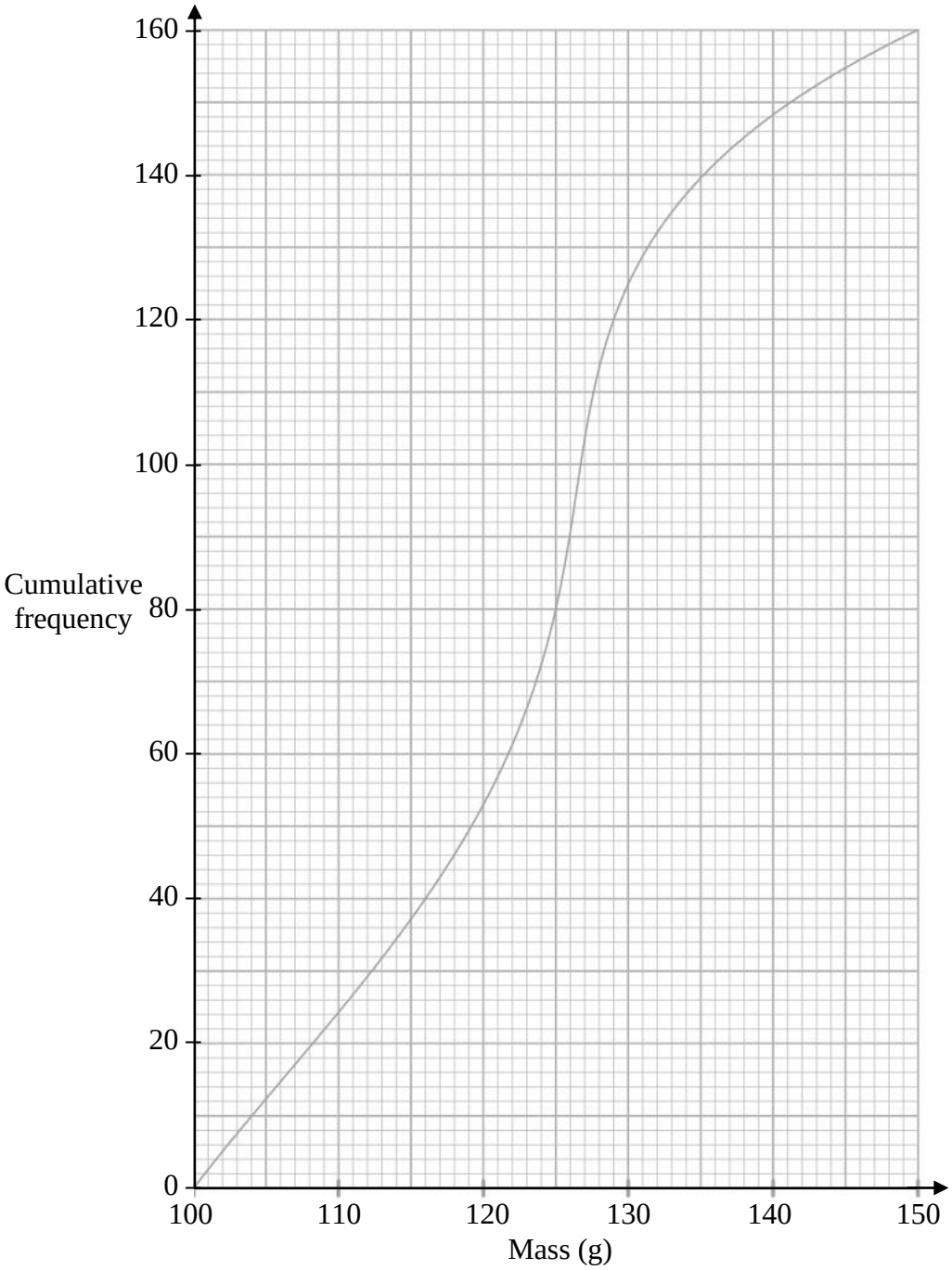
……...

……... [4]

Section B (8 marks)

Answer **one** question from this section. Each question carries 8 marks.

11 The masses of 160 potatoes planted using fertiliser *A* were recorded. The cumulative frequency diagram shows the distribution of the masses in grams.



(a) Use the diagram to estimate

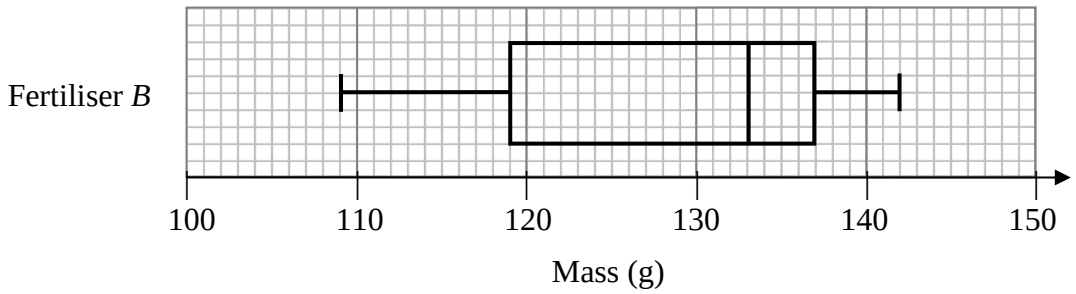
(i) the median,

Answer ..... g [1]

(ii) the interquartile range.

Answer ..... g [2]

(b) The box-and-whisker plots show the masses of 160 potatoes of the same variety planted using fertiliser *B*.



For the potatoes planted using fertiliser *B*, find

(i) the median,

Answer …… g [1]

(ii) the interquartile range.

Answer …… g [1]

(c) Which fertiliser produces potatoes that have a more consistent mass?
Give a reason for your answer.

Answer Fertiliser …… because ……

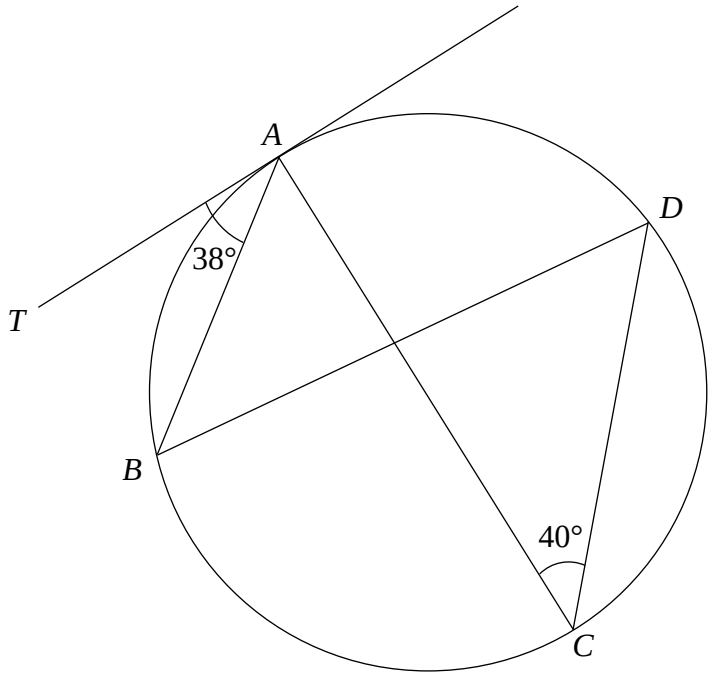
…… [1]

(d) Two potatoes planted using **fertiliser *A*** are chosen at random.

Find the probability that both potatoes have a mass of at least 146 g.

Answer …… [2]

12 (a)



A, *B*, *C* and *D* are points on a circle with *AC* as a diameter. *TA* is a tangent to the circle. Angle *TAB* = 38° and angle *ACD* = 40°.

Find the following angles, giving a reason for each.

(i) Angle *BAC*

Answer Angle *BAC* = …… because ……..

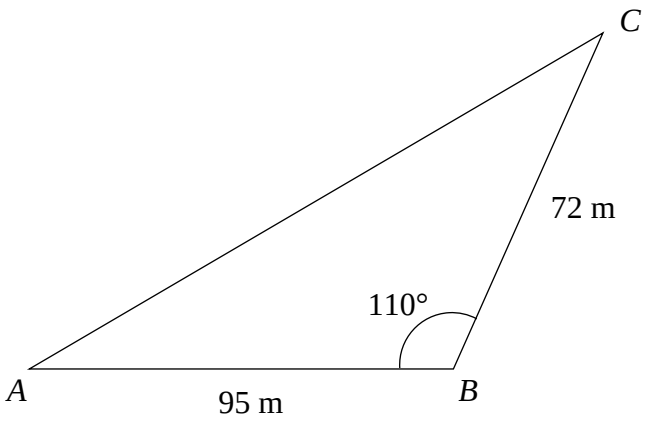
…….. [2]

(ii) Angle *ABD*

Answer Angle *ABD* = …… because ……..

…….. [2]

(b)



The diagram shows a triangular park *ABC* on horizontal ground.

AB = 95 m, *BC* = 72 m and angle *ABC* = 110°.

(i) Show that *AC* = 137.43 m, correct to 2 decimal places.

Answer

[2]

(ii) At *C*, there is a vertical lamp post of height 7.5 m. Calculate the angle of depression of *A* from the top of the lamp post.

Answer …… ° [2]

END OF PAPER

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Answer Key

1ai	15°C
1aii	24.1°C
1aiii	4.16°C
1b	The new mean temperature would decrease because 22°C is lower than the mean temperature of the initial set of 15 days.
1a	$2^3 \times 3 \times 5 \times 7$; 84 ; 99
2b	$p = \dfrac{2q}{q-7}$
3a	$(10 + 2x)(13 + 2x) - (10 \times 13) = 84$
3b	1.60 m
4a	30 km
4b	24 km/h
5a	21 : 18 : 4
5b	$\dfrac{a^{18}}{8}$
5c	$k = 5.6$; $n = x - y - 1$
6a	$21000
6b	*A* total- $1514.85 ; *B* total- $1699.80 Jovan should get Offer *A* because the total cost is cheaper
7a	16.5
7c	$x = 0.575$ or $x = 1.65$
7d	3.5 [accept 3.3 to 3.7]
8a	$x = \dfrac{6}{\sqrt[3]{y}}$; 1.5
8b	$\dfrac{5x+16}{(x+3)(x-3)}$
8c	$x = 1$ and $y = -2$
9a	$\left(\frac{1}{2} \times 4\pi \times 7^2\right) + (2\pi \times 7 \times h) + (\pi \times 7^2) = 371\pi$
9b	3180 cm^3
9c	2130 g
10b	574.7 kWh
10c	max no. of solar panels that can be installed = 12 Mr Ng would not be able to meet his target because he has to install at least 13 solar panels but he can only install 12 solar panels on his roof.
11a	125 g ; 13 g
11b	133 g ; 18 g
11c	Fertiliser *A* because the potatoes planted using fertiliser *A* has a smaller interquartile range.
11d	$\dfrac{1}{2120}$
12ai	52° ; (tangent $\perp$ radius)
12aii	40° ; ($\angle$s in the same segment)
12bi	$AC^2 = 95^2 + 72^2 - 2(95 \times 72 \times \cos 110°)$
12bii	3.1°