GREENRIDGE SECONDARY SCHOOL
2024 PRELIMINARY EXAMINATION
SECONDARY 4 EXPRESS / 5 NORMAL (ACADEMIC)

CANDIDATE NAME					
CLASS		-		INDEX NUMBER	

MATHEMATICS **4052/02**

Paper 2 23 August 2024

Setter: Mrs Li Geok Eng 2 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: Nil

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
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.

Answer **all** questions.
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 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, unless the question requires the answer in terms of π.

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

The total of the marks for this paper is 90.

For Examiner's Use	
Total	90

[Turn over

This paper consists of **23** printed pages, including this cover page.

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Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone = πrl

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

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

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

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

Arc length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ 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

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

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

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Answer **all** the questions.

1 **(a)** Simplify $\frac{5a^3}{6b} \div \frac{2ab}{4a^2b}$.

Answer ……...…… [1]

(b) Solve $\frac{x}{8} = \frac{50}{x}$.

Answer x = …… or …….. [2]

(c) Simplify $\frac{4v^2 - 1}{2pv + p - 10v - 5}$.

Answer ……...…… [3]

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(d) Solve $2x^2 = 3(3x-1)$.
Give your solutions correct to two decimal places.

Answer

Answer x = …… or …… [4]

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2 **(a)** Hamid borrowed a sum of money for 3 years at an interest rate of 3.5% per annum simple interest to pay for his car.

If the total interest Hamid paid on the loan was $10 374, find the sum of money that he borrowed.

Answer $ ……..…… [2]

(b) The table shows information collected by Hamid about his driving in 2023.

Total distance driven in 2023	16 992 km
Average price paid for petrol	$2.72 per litre
Average petrol consumption of his car	6.7 litres per 100 km

Calculate the total amount Hamid paid for petrol in 2023.

Answer $ ……..…… [2]

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(c) At the start of 2020, Hamid bought his car at a cash price of $120 500.
Each year the value of the car decreases by 5% of its value at the start of the year.
At the end of 2023, Hamid decided to sell his car.

(i) Explain why the percentage reduction at the end of three years is **not** 15% of $120 500.

……...

……... [1]

(ii) Calculate the value of his car at the end of 2023. Give your answer correct to the nearest dollar.

Answer $ ……..…… [3]

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3 **(a)** $\xi = \{x : x \text{ is an integer, } 2 \le x \le 14\}$
$A = \{x : x \text{ is a prime number}\}$
$B = \{x : x \text{ is a multiple of 3}\}$

(i) List the elements in $(A \cup B)'$.

Answer ……...…… [1]

(ii) List the elements in $A \cap B$.

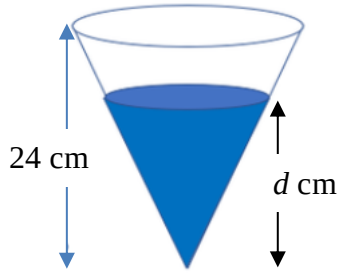
Answer ……...…… [1]

(iii) Given that $C \subset A$, $\text{n}(C) = 3$ and $B \cap C = \varnothing$, list the elements of a possible set C.

Answer ……...…… [1]

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3 (b) (i) The diagram shows a cone P of height 24 cm.



The volume of the liquid in the cone is half the volume of the cone.
Calculate the depth, d cm, of the liquid.

Answer ……..…….…… cm [2]

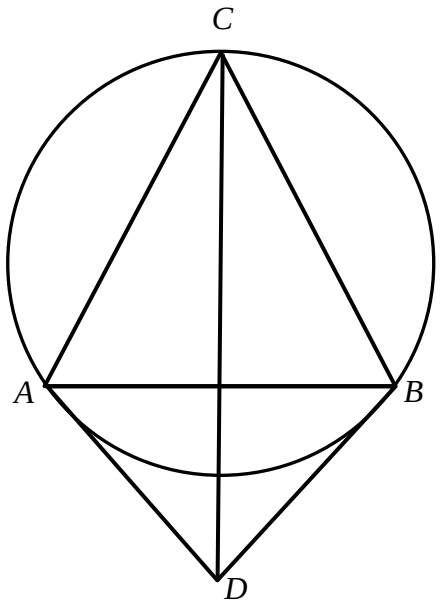
(ii) The volume of cone P is v cm^3.
Cone T has radius which is double that of the cone P and its height is one-third that of the cone P.

Express the volume of cone T in terms of v.

Answer ……..…… cm^3 [2]

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(c)



A, *B* and *C* are points on the circumference of a circle.
Angle *CAB* = angle *CBA*.
DA and *DB* are tangents to the circle from the point *D*.

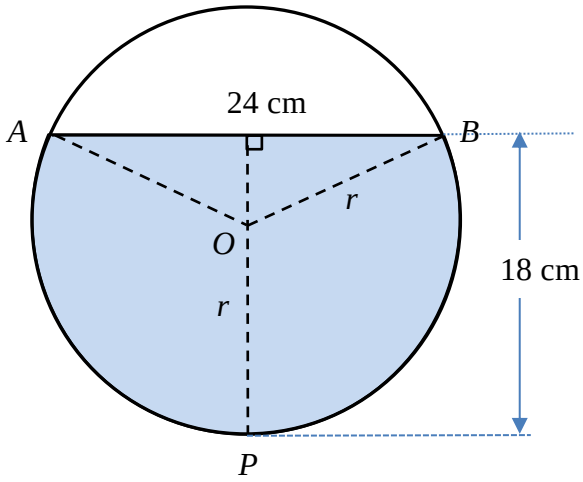
Prove that triangle *ACD* and triangle *BCD* are congruent.

Answer

[3]

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4



The diagram shows the cross section of a cylinder, centre *O*, radius *r*, lying on its side.
The cylinder contains water to a depth of 18 cm.
The width, *AB*, of the surface of the water is 24 cm.

(a) Use algebraic method to show that $r = 13$ cm.

Answer

[2]

(b) Show that angle *AOB* is 134.76° correct to 2 decimal places.

Answer

[2]

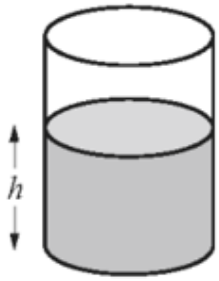
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(c) Hence calculate the area of the shaded segment.

Answer ……..…… cm^2 [4]

(d) The length of the cylinder is 40 cm.
The cylinder is turned so that it stands on one of its circular ends.
In this position, the depth of the water is *h* cm.

Find the value of *h*.



Answer *h* = ……..…… [2]

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5 **(a)** A is the point $(2,3)$ and B is the point $(3,-5)$.

(i) Find the equation of the line AB.

Answer ……...…… [2]

(ii) Find the length of AB.

Answer ……...…… [2]

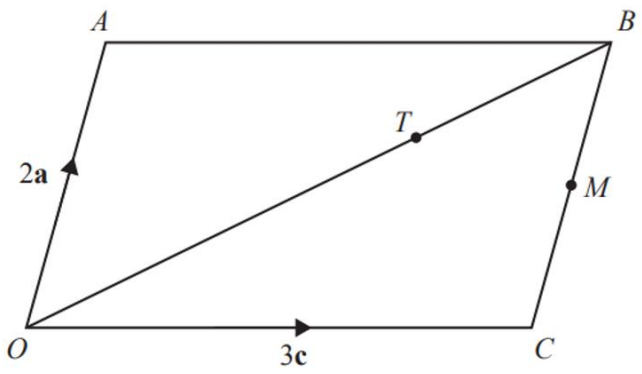
(iii) $\overrightarrow{BC} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$.

Find the coordinates of point C.

Answer C (……. , ……) [2]

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(b)



OABC is a parallelogram.
$\overrightarrow{OA} = 2\mathbf{a}$ and $\overrightarrow{OC} = 3\mathbf{c}$.
M is the midpoint of *BC*.
T is the point on *OB* such that $OT : TB = 2 : 1$.

(i) Find $\overrightarrow{OB}$ in terms of **a** and **c**.

Answer $\overrightarrow{OB}$ = …… [1]

(ii) Find $\overrightarrow{OT}$ in terms of **a** and **c**.

Answer $\overrightarrow{OT}$ = …… [1]

(iii) Determine if the points *A*, *T* and *M* lie on a straight line.

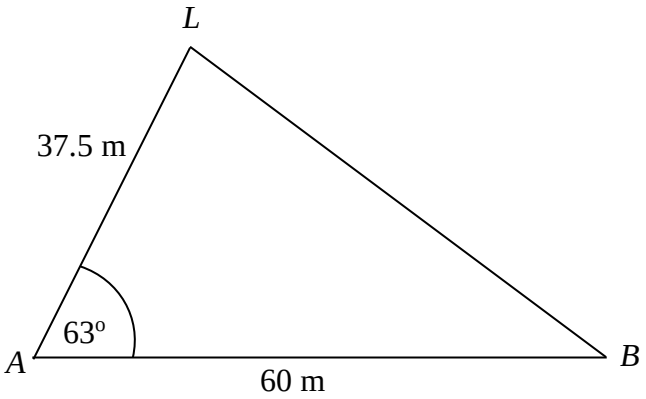
Answer

……..

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…….. [3]

6



The diagram shows three points, *A*, *B* and *L* on a horizontal field.
AL = 37.5 m, *AB* = 60 m and angle *LAB* = 63°.

(a) Calculate *LB*.

Answer ……...…… m [3]

(b) Calculate angle *LBA*.

Answer ……..... [2]

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(c) T is top of a vertical tree at L.
The angle of elevation of the top of the tree seen from A is 10^o.
Find the height of the tree.

Answer ……..…… m [2]

(d) A bird is hovering at a height of 3 m above the field. It spots a prey on the ground at angle of depression of 60^o. Calculate the distance that the bird must fly to catch its prey.

Answer ……..…… m [2]

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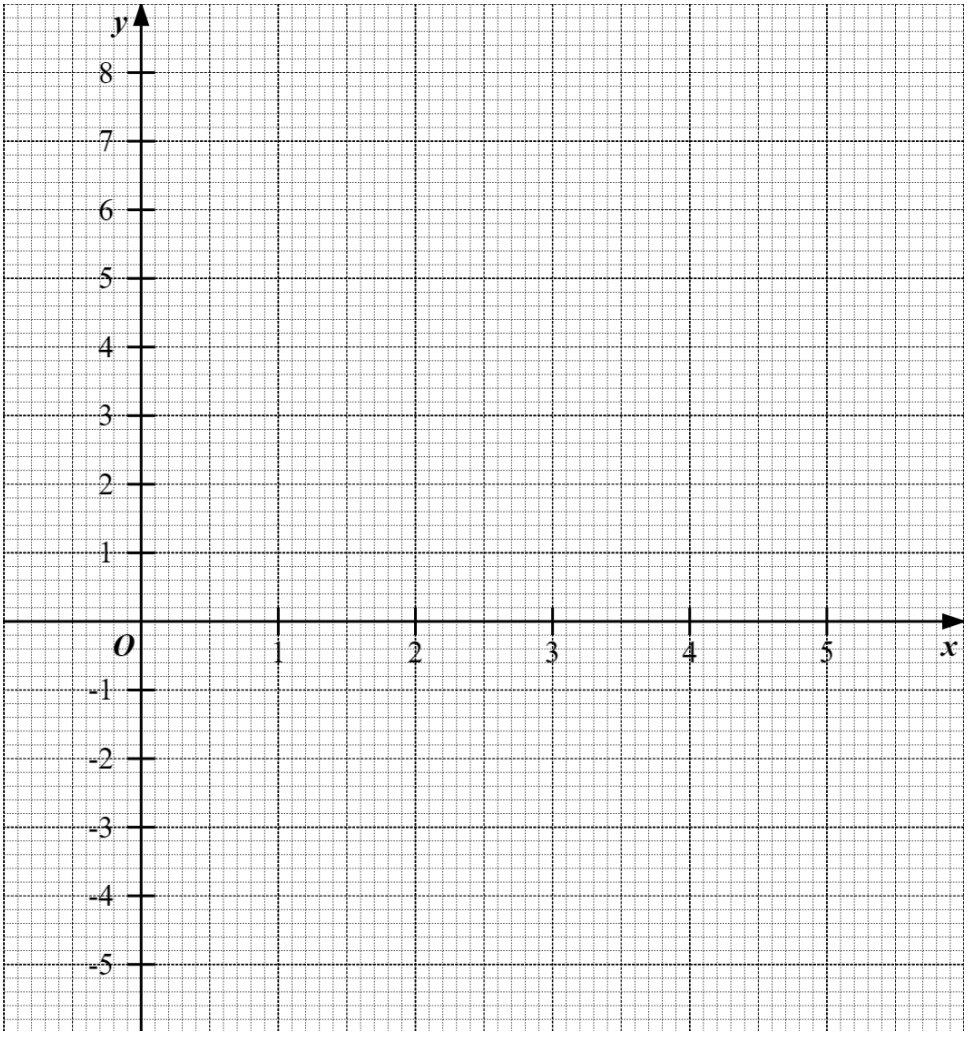
7 **(a)** Complete the table of values for $y = 2x + \frac{9}{x} - 11$.

Values are given to 1 decimal place where appropriate.

x	0.5	1	1.5	2	2.5	3	4	5
y	8	0	–2	–2.5	–2.4	–2	–0.8	

[1]

(b) On the grid, draw the graph of $y = 2x + \frac{9}{x} - 11$ for $0 \leq x \leq 5$.



[3]

(c) By drawing a tangent, find the gradient of the curve at $(1.5, -2)$.

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Answer ……..... [2]

(d) **(i)** On the same axes, draw the graph of the straight line $2y = 12 - 3x$. [1]

(ii) Write down the x-coordinates of the points where the graphs meet.

Answer x = …….. or …… [2]

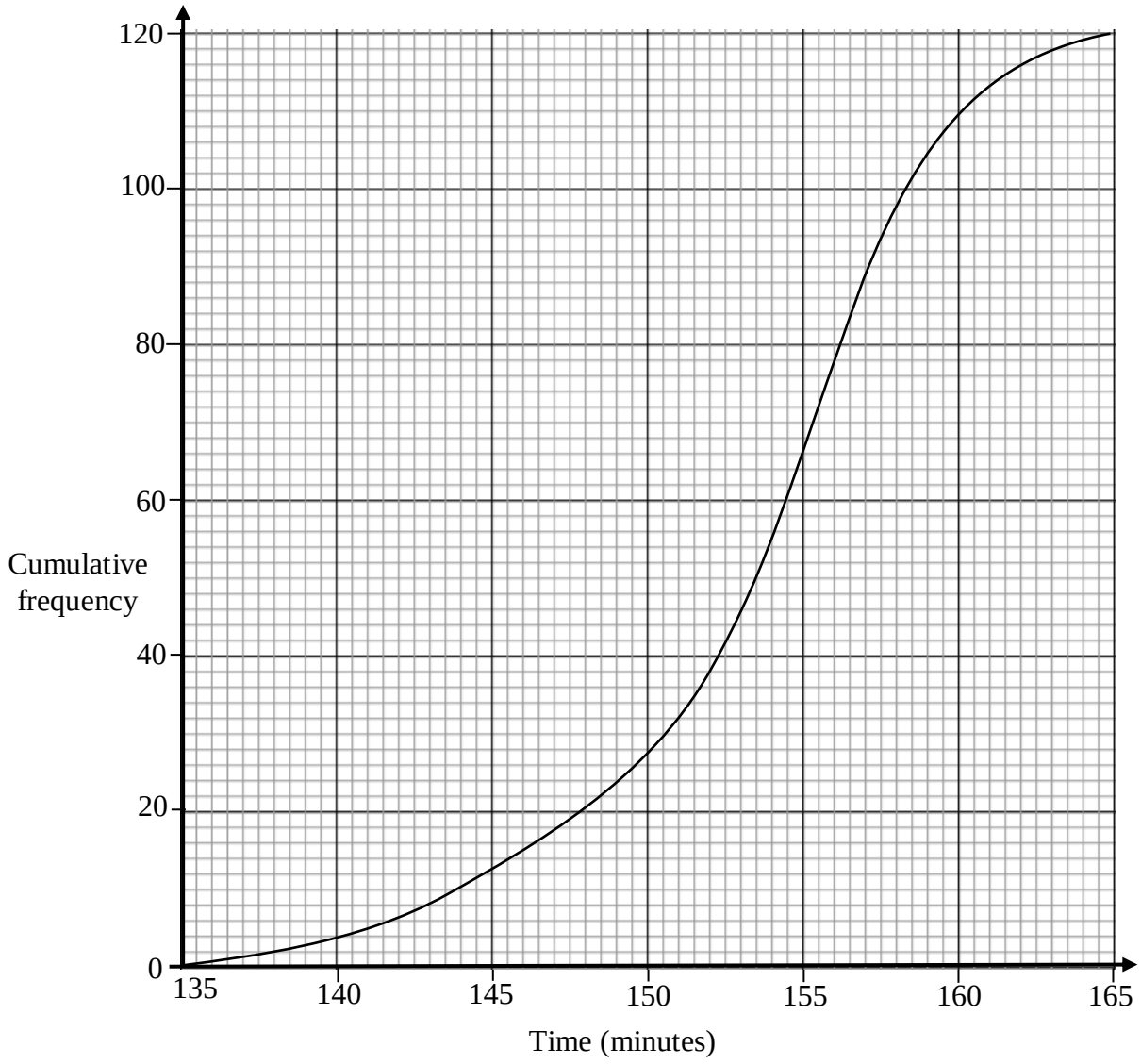
(iii) These values of x are the solutions of the equation $7x^2 + Ax + B = 0$.
Find the value of A and value of B.

Answer A = ……

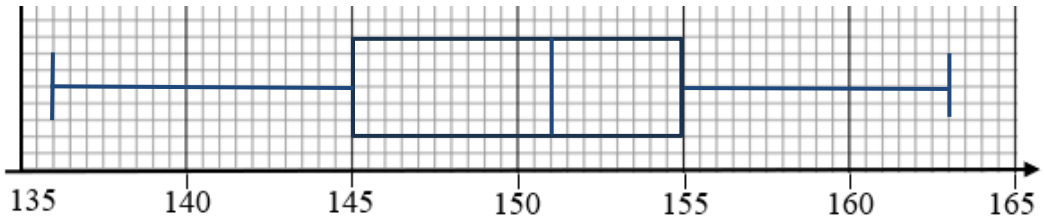
B = …… [2]

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8 **(a)** The cumulative frequency graph shows the distribution of times of the first 120 runners to finish a marathon in **2022**.



This box-and-whisker plot represents the distribution of the times of the first 120 runners to finish the marathon in **2023**.



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(i) Use the two diagrams to complete this table for the two marathons.

Year	Lower quartile	Median	Upper quartile	Interquartile range
2022		154.5		
2023	145		155	10

[3]

(ii) Simon says that the runners in 2022 were quicker on average.
Do you agree? Give a reason for your answer.

……...

……... [1]

(iii) Complete the frequency table below for the runners in **2023**.

Time (minutes)	Frequency
$135 < t \leq 140$	4
$140 < t \leq 145$	
$145 < t \leq 150$	32
$150 < t \leq 155$	28
$155 < t \leq 160$	
$160 < t \leq 165$	9

[2]

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(b) In a game two dice are used.
Die *A* has 2 blue faces and 4 yellow faces.
Die *B* has 4 blue faces and 2 pink faces.
The two dice are thrown together.

(i) Find the probability that

(a) both dice show a blue face on top.

Answer ……..…… [1]

(b) just one die shows a blue face on top.

Answer ……..…… [2]

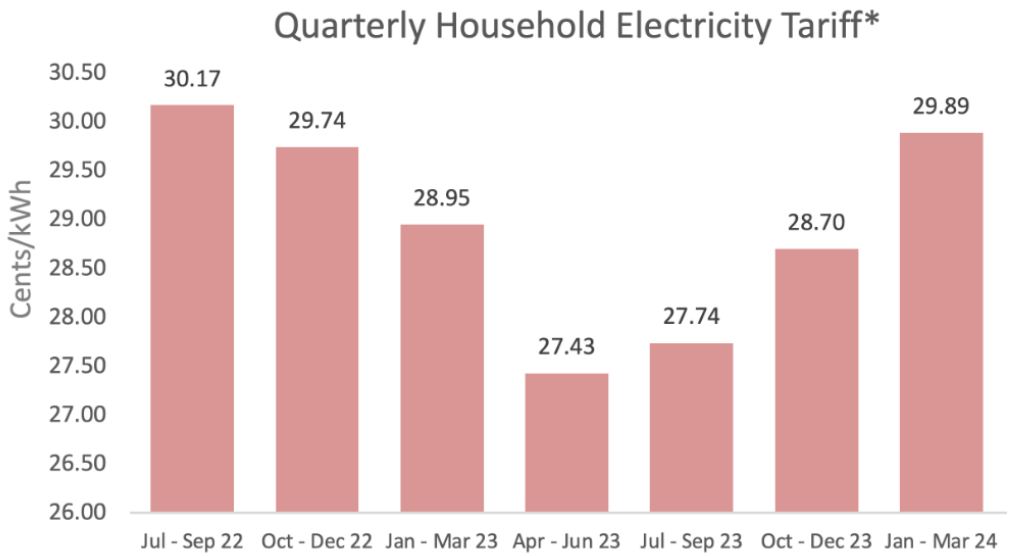
(ii) If both dice show blue, the player wins a prize.
If just one show blue, the player throws both dice again.
He also wins a prize if both show blue on the second throw.
Calculate the probability that the player wins a prize on either the first throw or second throw.

Answer ……..…… [2]

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9 Electricity tariffs are regulated by the Energy Market Authority (EMA) of Singapore and revised quarterly to reflect the actual cost of electricity.
The cost of electricity per kilowatt(kWh) is known as the electricity tariff rate, which is revised every quarter by SP power.

Electricity Tariff



* Price before GST.

Mr Faizal's average electricity consumption in January to March 2024

Month	Jan 24	Feb 24	Mar 24
Electricity consumption (kWh)	727	682	769

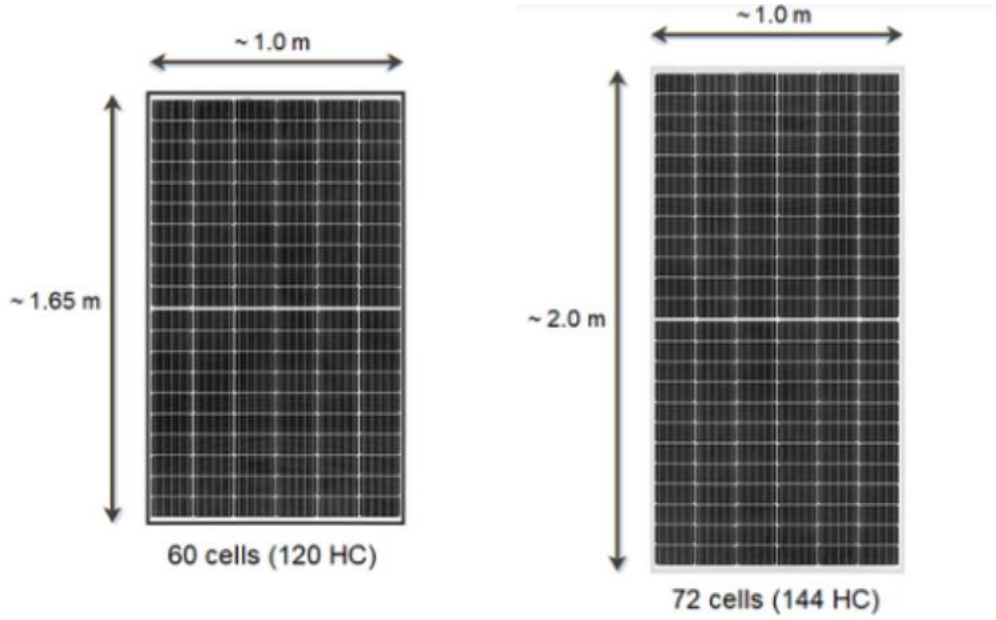
(a) Show that Mr Faizal paid $217 on average per month for his family consumption from January to March 2024.

[2]

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Mr Faizal stays in a terrace house in the east of Singapore. He is considering installing solar panel at his home. He wants to know if the cost of installing the solar panel can offset the cost of his electricity bill. He did some research and gets a quotation from a company that installs solar panel. Based on his house type, he is recommended to use the 60-cells solar panel.

Size of solar panel (with dimension)



Source: https://www.novergysolar.com/solar-panels-brief-guide-selecting-right-one/

Information for installation of solar panels

Dimensions of roof area for installation	9 m x 4 m
Cost of installing every 10 solar panels	$5950
Average amount of electricity produced by 1 solar panel	19 kWh per month
Maintenance fee per year	$500
Lifespan of solar panels	20 years

(b) Calculate the maximum number of solar panels that can be installed on the roof of Mr Faizal's house.

Answer

Answer ……..…… [2]

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(c) Using your answer in **(a)** and **(b),** determine if Mr Faizal should proceed with the installation of solar panel. Justify your answer and show your calculations clearly.

State one assumption you have used.

Assumption: …… [6]

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