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

CANDIDATE NAME

CLASS ____ - ____ INDEX NUMBER ____ ____

MATHEMATICS **4052/01**

Paper 1 22 August 2024

Setter: Mr Chin Zhi Hao 2 hours 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

This paper consists of **22** 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 = $4\pi r^2$

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

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

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

Arc length = $r\theta$, where θ 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

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

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

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Answer **all** the questions.

1 **(a)** Calculate $\dfrac{\sqrt[3]{123^2}}{\dfrac{3}{5.01}+2}$.

Answer ..... [1]

(b) An item costs \$24 when rounded off to the nearest dollar.
What is the maximum possible price of the item?

Answer \$..... [1]

---

2 **(a)** Given that $9^{12} = 27^x$, find x.

Answer $x =$ ..... [2]

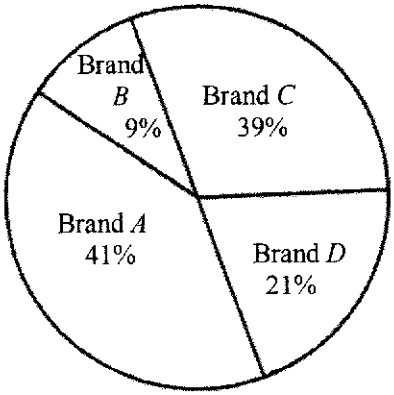
(b) The number of people owning cars in a country increased by p% every year, from 5000 in the year 2020, to 6500 in the year 2024.

Find the value of p.

Answer $p =$ ..... [2]

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3 School students were surveyed on their favourite brand of drink.
The results are represented in the pie chart below.



(a) State one error in the pie chart above.

Answer .....

.....

..... [1]

(b) State one way to correct the error stated in part (a).

Answer .....

.....

..... [1]

---

4 Factorise $6x^2 - x - 2$.

Answer ..... [2]

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

Answer ..... [2]

---

6 Six positive integers have a mean of 15, a median of 15 and a mode of 16.
The range of these numbers is 7. Find the six numbers.

Answer .... [2]

---

7 Solve the inequality $\frac{2x-3}{4} \leq \frac{5-x}{5}$.

Answer ..... [2]

[Turn over

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8 **(a)** Convert 40° into radians. Leave your answers in terms of π.

Answer ..... radians [1]

(b) Convert 23 km/h into m/s.

Answer ..... m/s [1]

---

9 Calculate the total surface area of a solid hemisphere with radius 6 cm.

Answer ..... cm^2 [2]

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10 $2c+b=\dfrac{b-c}{a}$

Rearrange the formula to make b the subject.

Answer $b =$ ..... [3]

---

11 Triangle ABC is such that $AB = 16$ cm, $BC = 63$ cm, $AC = 65$ cm.
Do points A, B and C lie on the circumference of a circle? Explain with working.

Answer .....

.....

..... [3]

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12 **(a)** Factorise $a^2b^4 - ab^2$.

Answer ..... [1]

(b) Expand and simplify $(3x + 2)^2 + 4x(2 - x)$.

Answer ..... [3]

---

13 **(a)** Find the area of a regular hexagon with each side 7 cm.

Answer ..... cm^2 [2]

(b) Find the interior angle of a regular 15-sided polygon.

Answer ..... [1]

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14 **(a)** y is directly proportional to $\sqrt[3]{x}$.
Find the percentage increase of y when x increases by 700%.

Answer ..... % [2]

(b) 6 men took 50 hours to paint a mural wall.
How long does it take for 4 men to paint the same wall?

Answer ..... hours [2]

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15 A bag contains some green counters, some orange counters and some yellow counters.
The probability of picking a green counter at random is 0.2.
The probability of picking an orange counter at random is 0.1 more than the probability of choosing a yellow counter at random.

(a) Show that the probability of picking a yellow counter at random is 0.35.

Answer

[1]

(b) If there are 14 yellow counters, how many counters are there altogether?

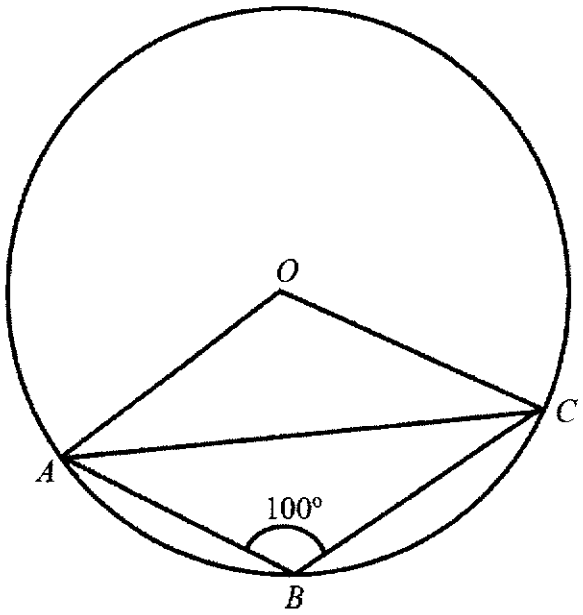
Answer ..... counters [2]

(c) If 3 orange counters are removed, what is the new probability of picking a yellow counter at random?

Answer ..... [1]

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16 The figure below shows a circle with centre O. Points A, B and C lie on the circle. Angle $ABC = 100°$. Find angle OAC, giving reasons for each step of your working.



Answer Angle OAC = ... [4]

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17 **(a)** These are the first four terms of a sequence.

2 6 10 14

Find an expression, in terms of n, for the nth term of the sequence.

Answer ..... [1]

(b) One term in the sequence is 82.
Find the value of n for this term.

Answer ..... [1]

(c) Explain why 360 is not a term of this sequence.

Answer .....

.....

..... [1]

(d) The **sum** of the first n terms of another sequence is $-4n^2 + 54n$.
Find the 8th term of this sequence.

Answer ..... [2]

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18 **(a)** $x^2 - 4x + 5 = (x - a)^2 + b$
Find the value of a and of b.

Answer $a =$ .....

$b =$ ..... [2]

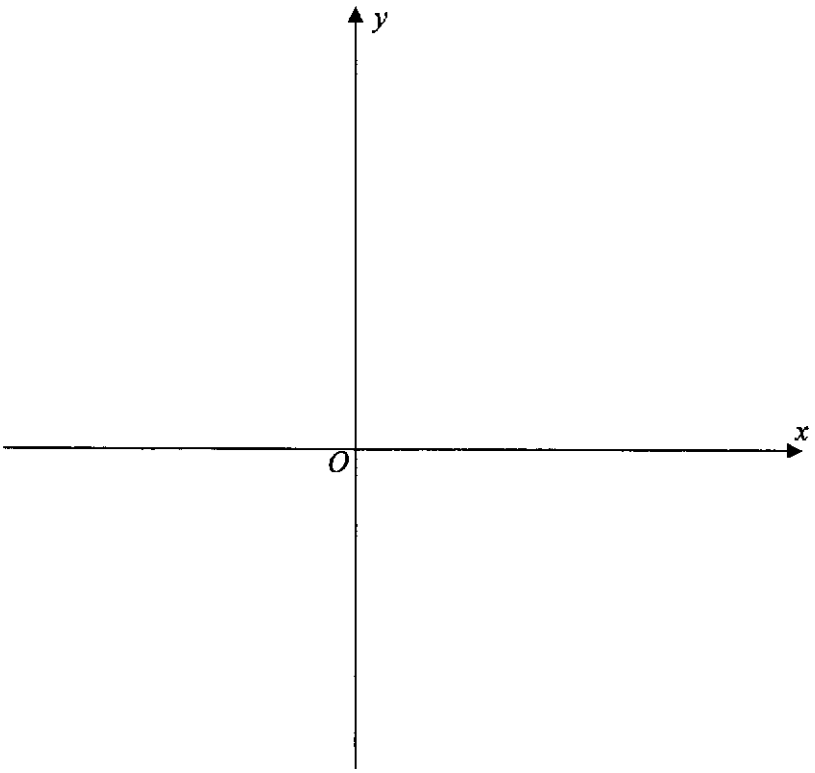
(b) The curve $y = x^2 - 4x + 5$ is drawn.

Write down the equation of the line of symmetry of the curve.

Answer ..... [1]

(c) **Sketch** the curve $y = x^2 - 4x + 5$ on the axes below.
Indicate clearly the coordinates of the points where the graph crosses the axes and the minimum point on the curve.

Answer



[3]

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19 Siti has x number of \$5 notes. Aisha has y number of \$2 notes.
They have a total of 30 notes with total value \$111.
Form and solve two simultaneous equations to calculate the amount of money Siti has.

Answer \$..... [4]

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20 The number of customers, c, served in a day at a counter for 40 days are given below.

Number of customers c	$0 < c \leq 5$	$5 < c \leq 10$	$10 < c \leq 15$	$15 < c \leq 20$
Frequency	11	18	9	2

(a) Calculate the mean number of customers served.

Answer ..... customers [1]

(b) Calculate the standard deviation.

Answer ..... customers [1]

(c) If 3 more customers were added to the counter each day, how would the mean and standard deviation be affected by this change?

Answer Mean .....

.....

Standard deviation .....

..... [2]

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21 **(a)** Express 5500 as a product of its prime factors.

Answer ..... [1]

(b) The number $\frac{5500p}{q}$ is a perfect cube.

p and q are prime numbers.
Find the value of p and the value of q.

Answer p = ...

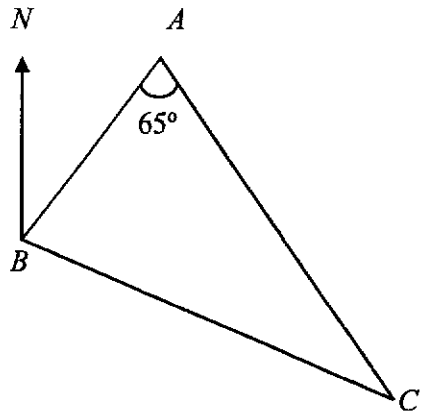
q = ... [2]

(c) Bus A takes 50 minutes to complete a route. Bus B takes 1 hour to complete the same route. Bus C takes 75 minutes to complete the same route. All 3 buses left the same bus stop at 6 am one morning. What time will all 3 buses meet again?

Answer ..... [2]

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22 A, B and C are three points on horizontal ground.
The bearing of A from B is 040°.



(a) Find the bearing of B from A.

Answer ..... [2]

(b) Find the bearing of C from A.

Answer ..... [2]

[Turn over

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23 A concert offers three types of seating areas, A, B and C, for Saturday and Sunday. The numbers of tickets sold for each type of seating area on each of these days in a particular week are shown in the following table.

	A	*B*	*C*
Saturday	1100	1000	1200
Sunday	1400	1200	1300

(a) The information in the table can be represented by a 2×3 matrix **S**. Write down the matrix **S**.

Answer **S** = [1]

(b) Each ticket for type A, B and C seating area costs \$110, \$80 and \$$x$ respectively. Write down a 3×1 matrix **P** to represent this information.

Answer **P** = [1]

(c) Find, in terms of x, the matrix **T** = **SP**.

Answer **T** = [2]

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(d) Explain what is represented by the elements of matrix **T**.

Answer .....

.....

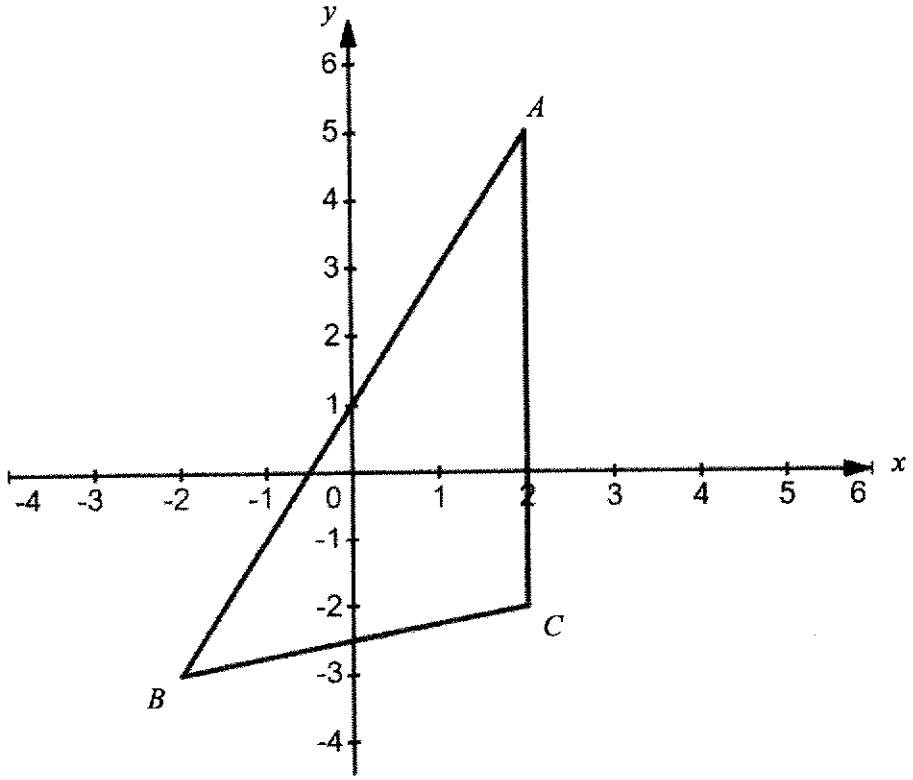
..... [1]

(e) The company collected \$688 500 from the sale of tickets for the weekend.
Find the value of x.

Answer $x =$..... [2]

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24 The triangle with vertices A (2, 5), B (–2, –3) and C (2, –2) is shown in the diagram below.



Find

(a) the area of triangle ABC,

Answer ..... unit^2 [1]

(b) the coordinates of point D such that $ABCD$ is a parallelogram,

Answer (..... , ...) [1]

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(c) the area of parallelogram $ABCD$,

Answer ..... unit^2 [1]

(d) angle BAC,

Answer Angle BAC = ... [1]

(e) the gradient of line AC,

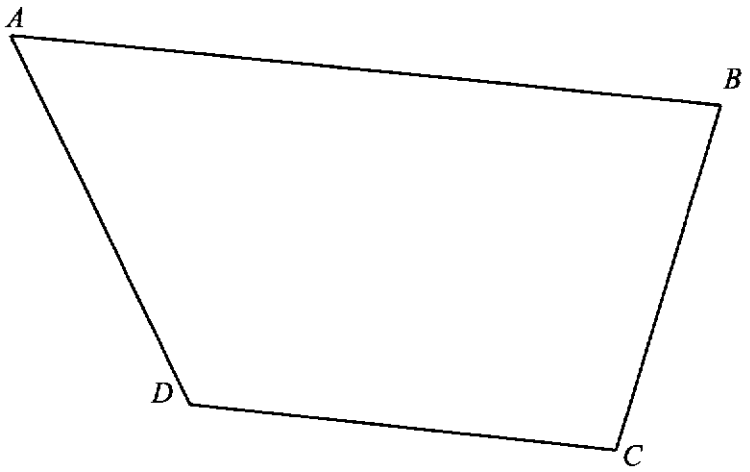
Answer ..... [1]

(f) the cosine value of angle BCA in terms of p, where $p = BC$.

Answer ..... [1]

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25 The diagram shows the map of a park in the shape of a quadrilateral $ABCD$.
The scale of the map is 1 cm to 10 m.



(a) Construct the bisector of angle ABC. [1]

(b) Construct the perpendicular bisector of AB. [1]

(c) Shade the region inside $ABCD$ that is closer to AB than to BC and closer to B than to A. [1]

(d) A tree T is located inside the park $ABCD$ such that it is 30 m from D and equidistant from A and B. Mark and label the exact position of T. [1]

END OF PAPER

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GREENRIDGE SECONDARY SCHOOL
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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

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[Turn over

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

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

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

Answer ..... [1]

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

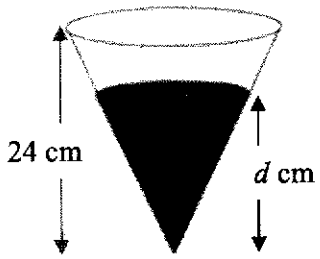
Answer ..... [1]

(iii) Given that $C \subset A$, $n(C) = 3$ 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]

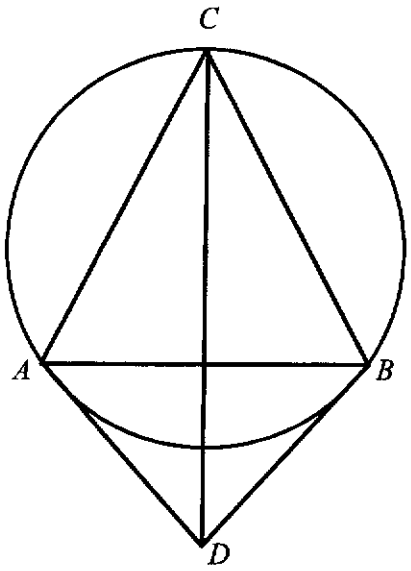
(ii) The volume of cone P is v cm^3.
Cone T has radius which is double that of the cone P and its height is one-third that of the cone P.

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*.

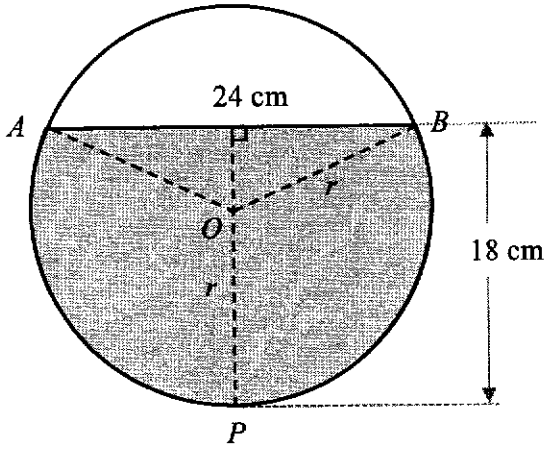
Prove that triangle *ACD* and triangle *BCD* are congruent.

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]

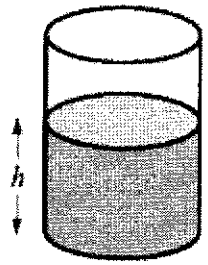
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(c) Hence calculate the area of the shaded segment.

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]

[Turn over

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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]

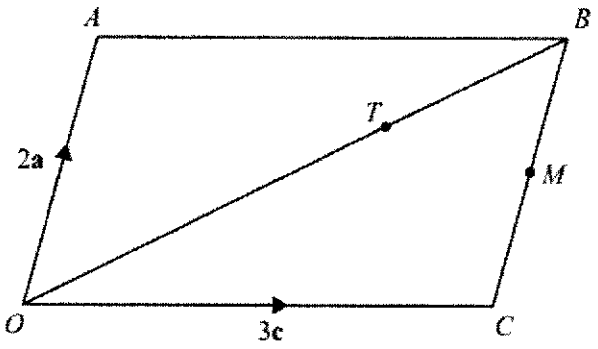
(iii) $\overrightarrow{BC} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$.

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.

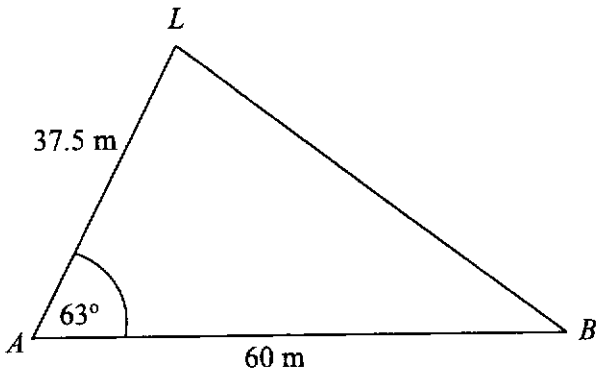
Answer

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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°.
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°. Calculate the distance that the bird must fly to catch its prey.

Answer ..... m [2]

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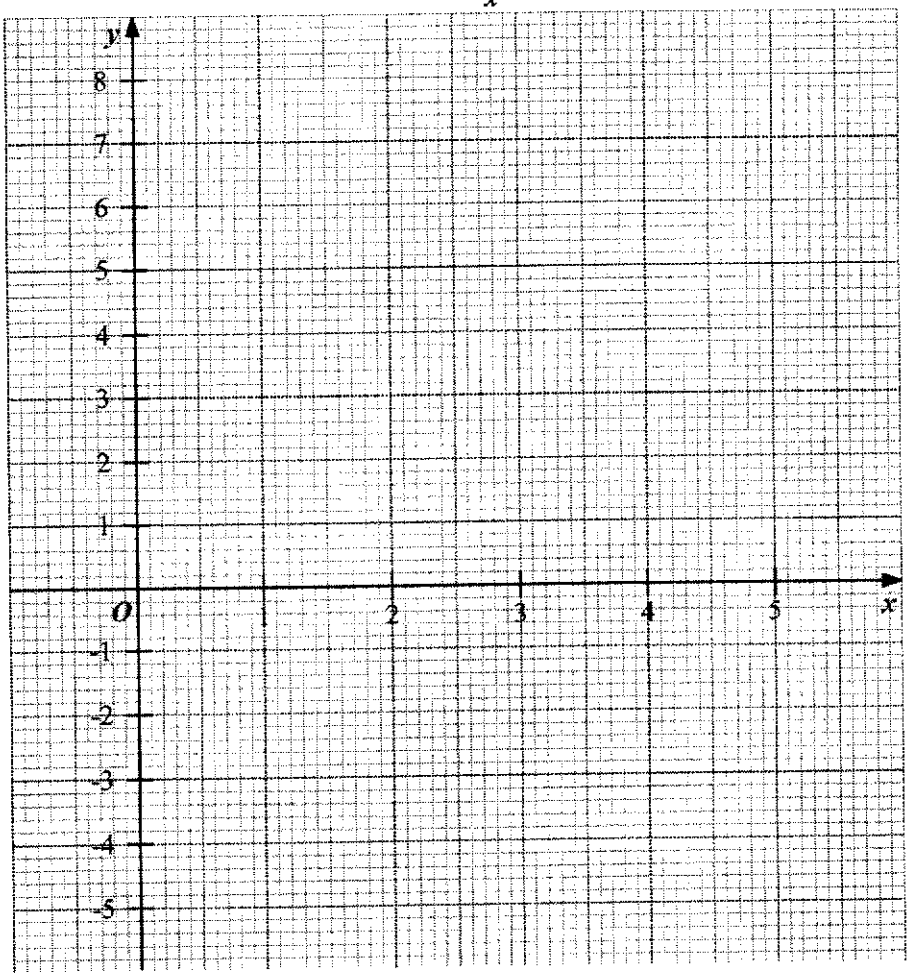
7 **(a)** Complete the table of values for $y = 2x + \frac{9}{x} - 11$.

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]

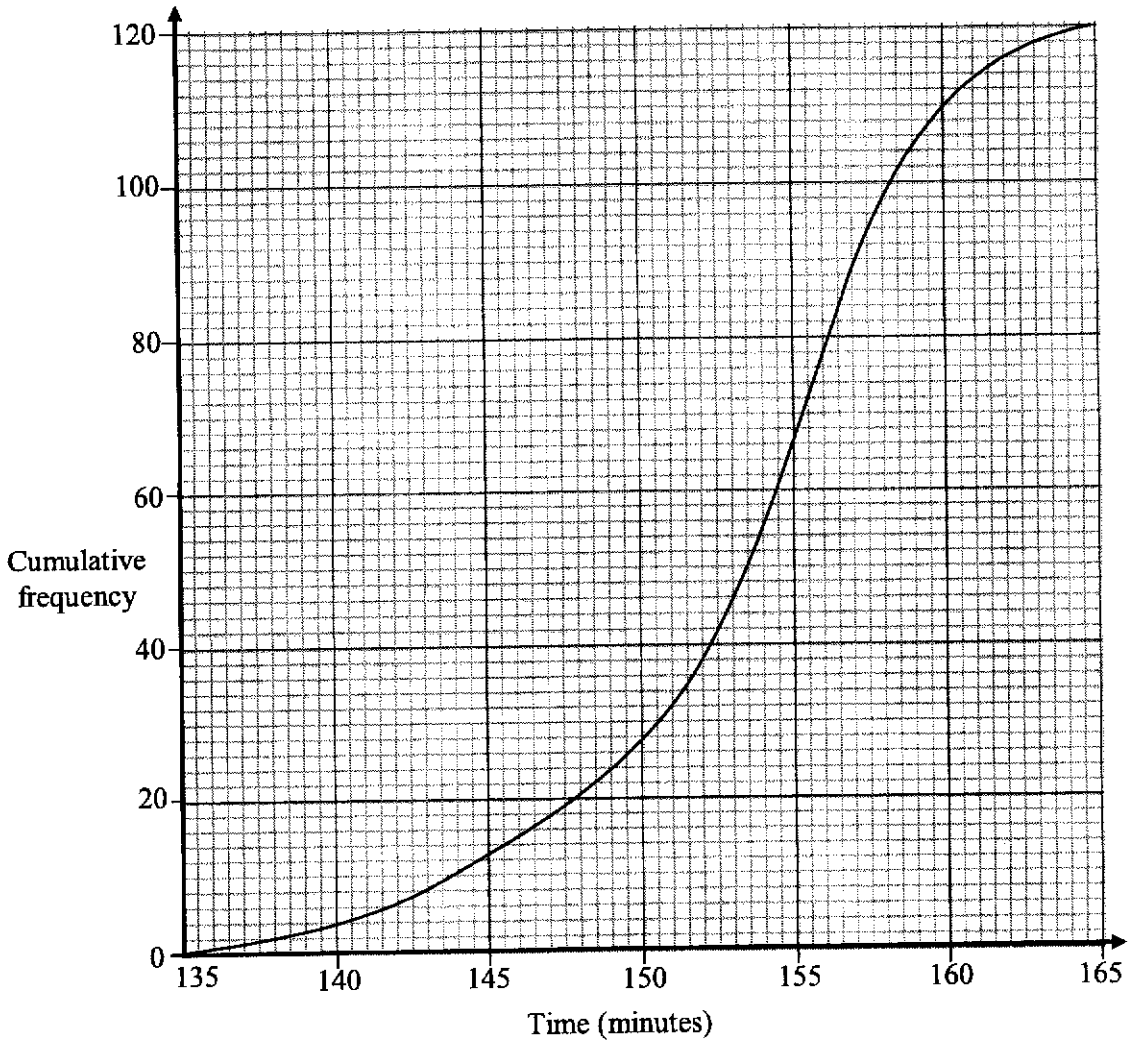
(iii) These values of x are the solutions of the equation $7x^2 + Ax + B = 0$.
Find the value of A and value of B.

Answer $A =$ .....

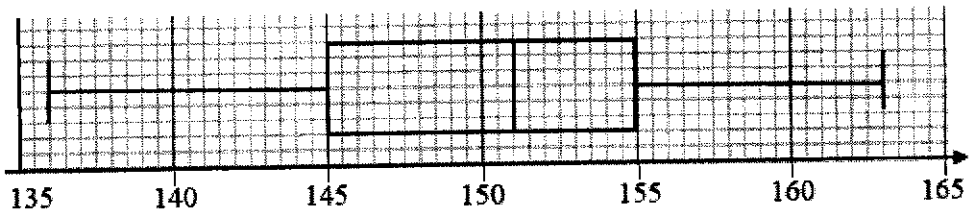
$B =$ ..... [2]

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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]

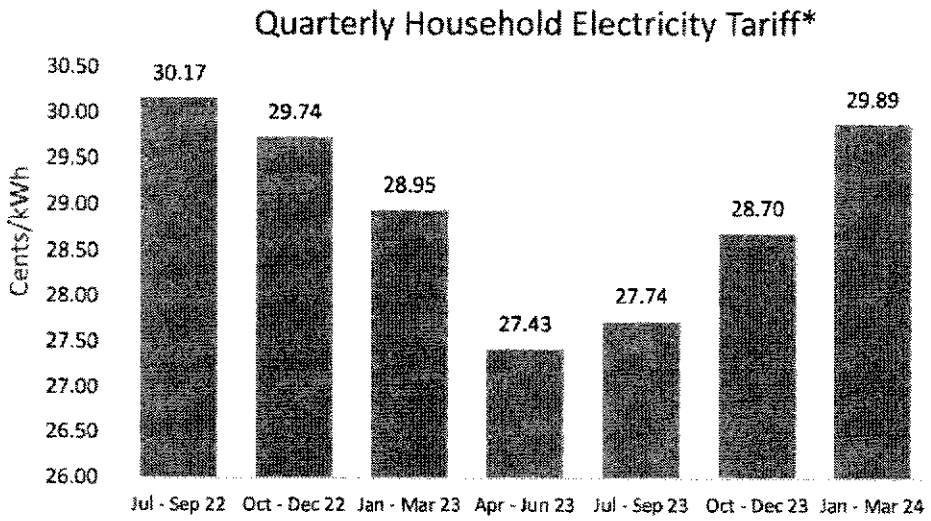
(ii) If both dice show blue, the player wins a prize.
If just one show blue, the player throws both dice again.
He also wins a prize if both show blue on the second throw.
Calculate the probability that the player wins a prize on either the first throw or second throw.

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.

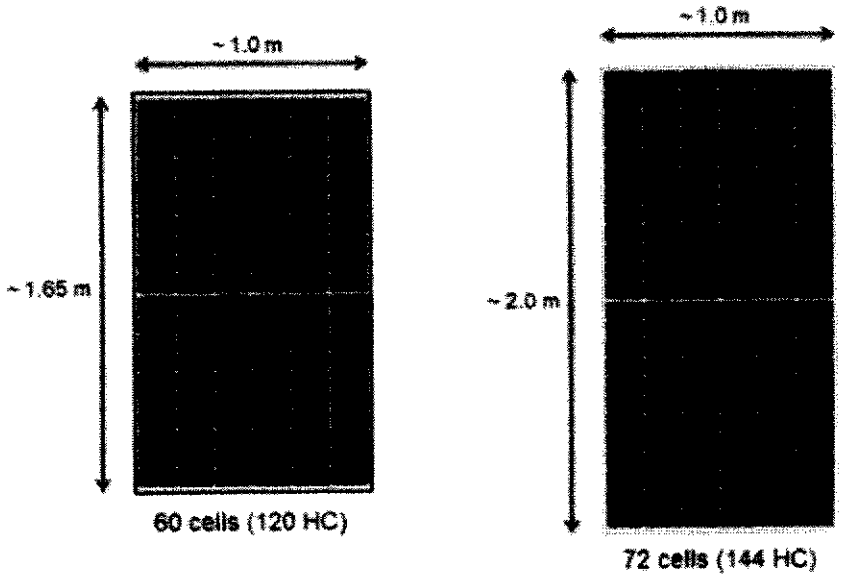
[2]

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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]

END OF PAPER

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24

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Marking Scheme For 2024 GSS Sec 4E5N Mathematics Preliminary Examinations Paper 1

2024 GSS Sec 4E5N Mathematics Preliminary Examination Paper 1

Item	Worked Solutions	Marks Awarded	Remarks
1(a)	9.52 (3 s.f.)	B1	Accept more exact answers.
1(b)	\$24.49	B1	
2(a)	$9^{12} = 27^x$ $(3^2)^{12} = (3^3)^x$ $3^{24} = 3^{3x}$ $24 = 3x$ $x = 8$	M1 A1	Express all in powers of 3.
2(b)	$6500 = 5000\left(1+\frac{p}{100}\right)^4$ $\left(1+\frac{p}{100}\right) = \sqrt[4]{\frac{6500}{5000}}$ $\frac{p}{100} = 0.06778997$ $p = 6.78\%$ (3 s.f.)	M1 A1	
3(a)	Brand C's and Brand D's sectors add up to 60% but is shown as half of the pie chart (which should be 50%). OR The total add up to 110% instead of 100%.	B1	
3(b)	Recalculate/Check the percentages for Brand C and Brand D so that the sectors of the pie chart should be proportional to the actual percentage.	B1	Accept "Recalculate all values to get the correct percentages."
4	$(2x+1)(3x-2)$	B2	M1 for multiplication frame or B1 for each correct factor
5	$\frac{2}{x-2} - \frac{3}{2x+1}$ $= \frac{2(2x+1)-3(x-2)}{(x-2)(2x+1)}$ $= \frac{4x+2-3x+6}{(x-2)(2x+1)}$ $= \frac{x+8}{(x-2)(2x+1)}$	M1 A1	M1 for combining fractions.
6	12,13,14, 16, 16, 19	B2	B1 for 14, 16, 16 in correct places. B1 for 12, 13, 19 in

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Marking Scheme For 2024 GSS Sec 4E5N Mathematics Preliminary Examinations Paper 1

			correct places.
7	$\frac{2x-3}{4} \le \frac{5-x}{5}$ $5(2x-3) \le 4(5-x)$ $10x-15 \le 20-4x$ $14x \le 35$ $x \le \frac{35}{14}$ $x \le 2.5$	M1 A1	M1 for multiplying 20 on both sides
8(a)	$\frac{\pi}{180} \times 40 = \frac{2}{9}\pi$ rad	B1	B1 for correct answer
8(b)	23 km/h $= \frac{23 \times 1000}{60 \times 60} = \frac{115}{18} = 6\frac{7}{18} = 6.39$ m/s	B1	B1 for correct answer
9	Total surface area $= \frac{1}{2} \times 4\pi(6)^2 + \pi(6)^2$ $= 72\pi + 36\pi$ $= 108\pi$ $= 339$ cm^2 (3 s.f.)	 M1 A1	M1 for hemisphere + circle
10	$2c + b = \frac{b-c}{a}$ $2ac + ab = b - c$ $ab - b = -2ac - c$ $b(a-1) = -(2ac+c)$ $b = \frac{-(2ac+c)}{a-1}$ $b = \frac{2ac+c}{1-a}$	 M1 M1 A1	M1 for cross-multiplication. M1 for isolating b. Accept answers with – sign in numerator.
11	$16^2 + 63^2 = 4225 = 65^2$ By the converse of Pythagoras' Theorem, triangle ABC is a right-angled triangle. A, B and C are also points on a circle by angle in a semicircle property. Yes, A, B and C lie on the circumference of a circle.	M1 A1 A1	M1 for showing P.T. A1 for P.T. A1 for circle property
12(a)	$ab^2(ab^2 - 1)$	B1	
12(b)	$(3x+2)^2 + 4x(2-x) = 9x^2 + 12x + 4 + 8x - 4x^2$ $= 5x^2 + 20x + 4$	M2 A1	M1 for $9x^2 + 12x + 4$ M1 for $8x - 4x^2$
13(a)	Area of hexagon $= 6 \times \frac{1}{2} \times 7 \times 7 \times \sin(60°)$	M1	

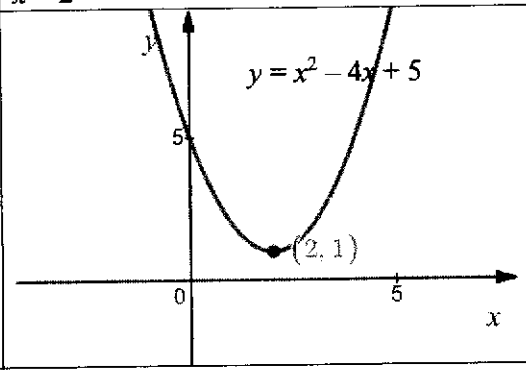
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	$= 127.3057344 \text{ cm}^2$ $= 127 \text{ cm}^2$ (3 s.f.)	A1	
13(b)	$\frac{(15-2)\times 180}{15} = 156°$	B1	
14(a)	original $y = k\sqrt[3]{x}$ new $y = k\sqrt[3]{8x} = 2k\sqrt[3]{x}$ Percentage change $= \frac{2k\sqrt[3]{x} - k\sqrt[3]{x}}{k\sqrt[3]{x}} \times 100$ $= 100\%$	M1 A1	
14(b)	6 men takes 50 hours to paint a mural. 4 men takes $\frac{6}{4} \times 50 = 75$ hours to paint the same mural.	M1 A1	
15(a)	P(yellow) $= \frac{1-0.2-0.1}{2} = 0.35$ (shown)	B1	
15(b)	Total number of counters $= \frac{1}{0.35} \times 14$ $= 40$	M1 A1	
15(c)	P(yellow) $= \frac{14}{40-3} = \frac{14}{37}$	B1	
16	Reflex Angle $AOC = 100 \times 2 = 200°$ (Angle at centre is twice the angle at circumference) Obtuse angle $AOC = 360° - 200 = 160°$ (Angles at a point) Angle $OAC = \frac{180° - 160°}{2} = 10°$ (Angles of an isosceles triangle OAC)	M1 M1 M1 A1	M1 awarded with correct reasoning
17(a)	$2+4(n-1) = 4n-2$	B1	
17(b)	$4n - 2 = 82$ $4n = 84$ $n = 21$	 B1	
17(c)	If $4n - 2 = 360$, $n = 90.5$ which is not an integer, so 360 is not a term in the sequence.	B1	
17(d)	8th term $= [-4(8)^2 + 54(8)] - [-4(7)^2 + 54(7)]$ $= 176 - 182$ $= -6$	M1 A1	M1 for subtraction

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18(a)	$x^2 - 4x + 5 = (x-2)^2 + 1$ $a = 2$ $b = 1$	B1 B1	
18(b)	$x = 2$	B1	
18(c)		B1 B1 B1	Correct shape Correct turning point Correct y-intercept
19	$5x + 2y = 111 --(2)$ $x + y = 30 --(1)$ $(2) - 2\times(1)$: $3x = 51$ $x = 17$ Sub into (1): $y = 13$ Amount of money Siti has = $17 \times 5 = \$85$	B1 B1 M1 A1	Forming correct equations. Solving.
20(a)	7.75	B1	
20(b)	4.18 (3 s.f.)	B1	
20(c)	The mean would be increased by 3. The standard deviation will remain the same.	B1 B1	
21(a)	$2^2 \times 5^3 \times 11$	B1	
21(b)	$p = 2$ $q = 11$	B1 B1	
21(c)	LCM of 50, 60 and 75 = 300 min = 5 hours They will meet again at 11 am.	M1 A1	M1 for LCM
22(a)	Bearing of B from A = 180 + 040 = 220°	 M1 A1	
22(b)	Bearing of C from A = 180 – (65 – 040) = 155°	 M1 A1	

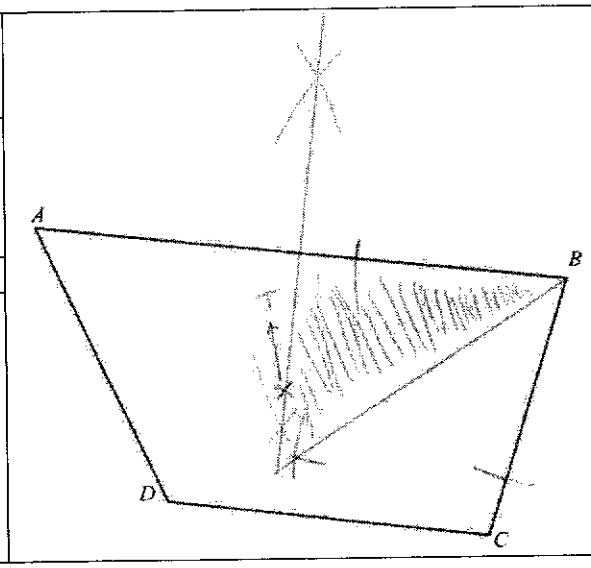
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23(a)	$\begin{pmatrix} 1100 & 1000 & 1200 \\ 1400 & 1200 & 1300 \end{pmatrix}$	B1	
23(b)	$\begin{pmatrix} 110 \\ 80 \\ x \end{pmatrix}$	B1	
23(c)	$\begin{pmatrix} 1100 & 1000 & 1200 \\ 1400 & 1200 & 1300 \end{pmatrix}\begin{pmatrix} 110 \\ 80 \\ x \end{pmatrix}$ $=\begin{pmatrix} 201000+1200x \\ 250000+1300x \end{pmatrix}$	M1 A1	
23(d)	The elements represent the amount of ticket sales for each day (Saturday, Sunday).	B1	
23(e)	$201000+1200x+250000+1300x=688500$ $2500x=323000$ $2500x=237500$ $x=95$	M1 A1	
24(a)	Area of triangle ABC $= 0.5 \times 4 \times 7$ $= 14$ unit^2	B1	
24(b)	(6, 6)	B1	
24(c)	Area of parallelogram $= 14 \times 2 = 28$ unit^2	B1	
24(d)	Angle $BAC = \tan^{-1}\left(\frac{4}{8}\right)$ $= 26.6°$ (1 d.p.)	B1	
24(e)	undefined	B1	
24(f)	$-\frac{1}{p}$	B1	Using cosine rule to get $\frac{p^2-31}{14p}$ also accepted.

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Marking Scheme For 2024 GSS Sec 4E5N Mathematics Preliminary Examinations Paper 1

25(a)		B1	Bisector constructed accurately with construction arcs
25(b)		B1	Perpendicular bisector constructed accurately with construction arcs on both sides of AB
25(c)		B1	Correct region shaded
25(d)		B1	Correct position of T

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2024 Preliminary Examination
Mathematics (Syllabus 4052/2)

1(a)	$\frac{5a^3}{6b} \div \frac{2ab}{4a^2b}$ $= \frac{5a^3}{6b} \times \frac{4a^2b}{2ab}$ $= \frac{5a^4}{3b}$	B1	
(b)	$\frac{x}{8} = \frac{50}{x}$ $x^2 = 400$ $x = \pm 20$	B2	
(c)	$\frac{4v^2 - 1}{2pv + p - 10v - 5}$ $= \frac{(2v-1)(2v+1)}{(p-5)(2v+1)}$ $= \frac{2v-1}{p-5}$	M1 M1 A1	$(2v-1)(2v+1)$ $(p-5)(2v+1)$
(d)	$2x^2 = 3(3x-1)$ $2x^2 = 9x - 3$ $2x^2 - 9x + 3 = 0$ $x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(2)(3)}}{2(2)}$ $x = 4.14$ or 0.36	M1 M2 A1	Quadratic eqn formed M1 for $b^2 - 4ac$ correct

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2(a)	$3\times3.5\%=10.5\%$ $10.5\%-\$10374$ $100\%-\frac{10374}{10.5}\times100$ $=\$98\,800$	M1 A1	OR I = P x r% x T
(b)	Total petrol consumption $=\frac{16992}{100}\times6.7$ $=1138.464\,l$ Total amount paid $=1138.464\times\$2.72$ $=\$3096.62$	 M1 A1	
(c)(i)	The decreased of 5% is compounded. The value of the car (base) for each year is lower than the previous year.	 B1	
(c)(ii)	<table><tr><td>Year 0</td><td>120500</td></tr><tr><td>Year 1</td><td>$0.95\times120500=\$114\,475$</td></tr><tr><td>Year 2</td><td>0.95 x 114 475 = $108 751.25</td></tr><tr><td>Year 3</td><td>0.95 x 108 751.25 = $103 313.69</td></tr></table> Ans $103 314 (nearest dollars)	M1 M1 A1	Year 1 Year 2

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3(a)(i)	$A = \{2, 3, 5, 7, 11, 13\}$ $B = \{3, 6, 9, 12\}$ $(A \cup B)' = \{4,8,10,14\}$	 B1	
(a)(ii)	$(A \cap B) = \{3\}$	B1	
(a)(iii)	Any subset with 3 elements from {2,5,7,11,13}	B1	
3(b)(i)	$\left(\frac{d_1}{24}\right)^3 = \frac{1}{2}$ $d = 19.0$	M1 A1	
(b)(ii)	Let r be the radius of cone P. Volume of cone P, $v = \frac{1}{3}\pi r^2(24) = 8\pi r^2 \text{cm}^3$ Volume of cone T $= \frac{1}{3} \times \pi(2r)^2(\frac{1}{3} \times 24)$ $== \frac{4}{3} \times 8\pi r^2$ $= \frac{4}{3}v \quad \text{cm}^3$	 M1 A1	
(c)	CD is common. $DA = DB$ (tangent from an external point) Since, angle CAB = angle CBA $\Rightarrow$ triangle CAB is isosceles, Hence, $AC = BC$. Therefore, triangle ACD and triangle BCD are congruent (SSS).	B1 B1 B1	

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4(a)	$(18-r)^2+12^2=r^2$ $324-36r+r^2+144=r^2$ $36r=468$ $r=13cm$	M1 A1	
(b)	Angle AOB $=2\times\tan^{-1}\left(\frac{12}{5}\right)$ $=134.76^\circ$	M1 A1	Or ½ absinC
(c)	Reflex angle AOB = $360^\circ-134.76^\circ=225.24^\circ$ Area of major sector = $\frac{225.24}{360}\times\pi(13)^2$ Area of triangle AOB = $\frac{1}{2}\times13^2\times\sin134.76$ Area of segment $=\frac{225.24}{360}\times\pi(13)^2+\frac{1}{2}\times13^2\times\sin134.76$ = 392.18 = 392 cm^2	M1 A1 M1 A1	R
(d)	Volume of water = $392.18\times40=15687.2\,cm^3$ $h=\frac{15687.2}{\pi(13)^2}$ $h=29.547\,cm$ $h=29.5\,cm$	M1 A1	

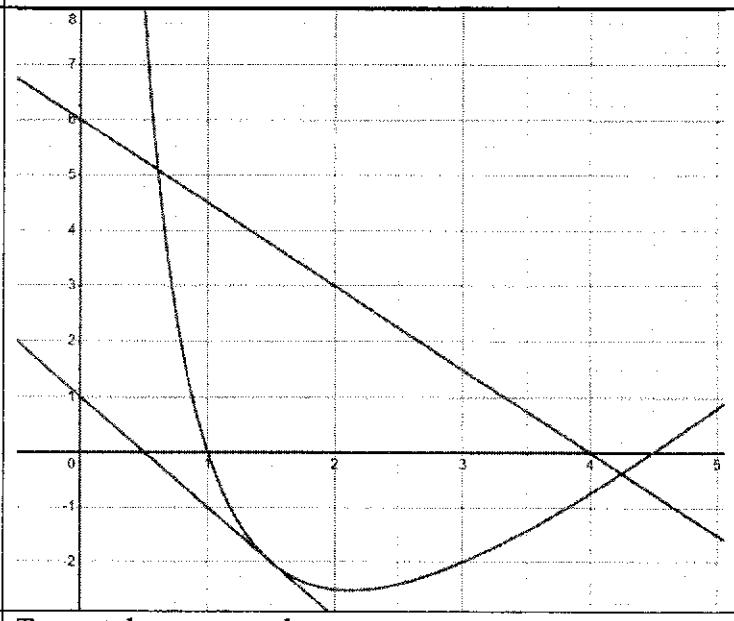
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5(a)(i)	$Gradient = -8$ $3 = -8(2) + c$ $c = 19$ $y = -8x + 19$	M1 A1	
(a)(ii)	$\sqrt{(2-3)^2 + (3+5)^2}$ $= 8.06$ units OR $\overrightarrow{AB} = \begin{pmatrix} 3 \\ -5 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \end{pmatrix} = \begin{pmatrix} 1 \\ -8 \end{pmatrix}$ $\left\|\overrightarrow{AB}\right\| = \sqrt{1^2 + (-8)^2} = 8.06$	M1 A1 M1 A1	
(a)(iii)	$\overrightarrow{OC} = \begin{pmatrix} 3 \\ -5 \end{pmatrix} + \begin{pmatrix} -4 \\ 3 \end{pmatrix} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$ $C(-1, -2)$	M1 A1	
5(b)(i)	$\overrightarrow{OB} = 2\mathbf{a} + 3\mathbf{c}$	B1	
5(b)(ii)	$\overrightarrow{OT} = \frac{2}{3}(3\mathbf{c} + 2\mathbf{a})$	B1	
(b)(ii)	$\overrightarrow{AT} = -2a + \frac{2}{3}(3\mathbf{c} + 2\mathbf{a})$ $\overrightarrow{AT} = 2\mathbf{c} - \frac{2}{3}\mathbf{a}$ $\overrightarrow{AT} = \frac{2}{3}(3\mathbf{c} - \mathbf{a})$ $\overrightarrow{AM} = 3\mathbf{c} - \mathbf{a}$ $\overrightarrow{AT} = \frac{2}{3}\overrightarrow{AM}$ AT is parallel to AM and A is common. Therefore A, T and M lies on a straight line.	M1 M1 A1	$\overrightarrow{AT}$ or $\overrightarrow{AM}$ or $\overrightarrow{TM}$ $\overrightarrow{AT} = k\overrightarrow{AM}$

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6(a)	$LB^2 = 60^2 + 37.5^2 - 2(60)(37.5)\cos 63°$ $LB = 54.436$ $LB = 54.4\text{m}$	M2 A1	
(b)	$\frac{\sin \angle LBA}{37.5} = \frac{\sin 63}{54.436}$ $\angle LBA = 37.865$ $\angle LBA = 37.9°$	M1 A1	
(c)	$\frac{LT}{37.5} = \tan 10°$ $LT = 6.6123\text{m}$ $LT = 6.61\text{m}$	M1 A1	
(d)	$\frac{3}{d} = \sin 60°$ $d = \frac{3}{\sin 60}$ $d = 3.46\text{m}$	M1 A1	

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7(a)	0.8	B1	
(b)		P2 P1 C1	Plot all points correctly Plot at least 6 points correctly Smooth curve
(c)	Tangent drawn correctly -2 ± 0.2	M1 A1	
(d)(i)	Straight line passing through (0,6) and (4,0)	B1	
(d)(ii)	0.6 ± 0.05, 4.2 ± 0.05	B1 B1	
(d)(iii)	$2(2x + \frac{9}{x} - 11) = 12 - 3x$ $4x + \frac{18}{x} - 22 = 12 - 3x$ $4x^2 + 18 - 22x - 12x + 3x^2$ $7x^2 - 34x + 18 = 0$ $A = -34$ $B = 18$	M1 M1 A1	

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<table>
<tr><td>8(a)</td><td>
<table>
<tr><th>Year</th><th>Lower quartile</th><th>Median</th><th>Upper quartile</th><th>Interquartile range</th></tr>
<tr><td>2022</td><td>150.5</td><td></td><td>157</td><td>6.5</td></tr>
<tr><td>2023</td><td></td><td>151</td><td></td><td></td></tr>
</table>
</td><td>M1
A1
B1</td><td>LQ or UQ
IQR
Median</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>(b)</td><td>No, I do not agree.
The mean time for the runners in 2023 is lower than the mean time in 2022.</td><td>B1</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>(c)</td><td>
<table>
<tr><th>Time (minutes)</th><th>Frequency</th></tr>
<tr><td>$135 < t \leq 140$</td><td>4</td></tr>
<tr><td>$140 < t \leq 145$</td><td>26</td></tr>
<tr><td>$145 < t \leq 150$</td><td>32</td></tr>
<tr><td>$150 < t \leq 155$</td><td>28</td></tr>
<tr><td>$155 < t \leq 160$</td><td>21</td></tr>
<tr><td>$160 < t \leq 165$</td><td>9</td></tr>
</table>
</td><td>B1

B1</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>8(b)(i)(a)</td><td>$\frac{1}{3} \times \frac{2}{3} = \frac{2}{9}$</td><td>B1</td><td></td></tr>
<tr><td>(b)(i)(b)</td><td>$\left(\frac{1}{3} \times \frac{1}{3}\right) + \left(\frac{2}{3} \times \frac{2}{3}\right)$
$= \frac{5}{9}$</td><td>M1

A1</td><td></td></tr>
<tr><td>(b)(ii)</td><td>$\frac{2}{9} + \left(\frac{5}{9} \times \frac{2}{9}\right)$
$= \frac{28}{81}$</td><td>M1

A1</td><td></td></tr>
</table>

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10(a)	Amount paid before GST $=\frac{(737+692+749)}{3}\times 0.2989$ $=726\times 0.2989$ $=\$217$	M1 A1	
(b)	$9\div 1.65\approx 5$ $4\div 1=4$ $5\times 4=20$	M1 A1	
(c)	Average amount of electricity produced = 20 x 19 = 380 kWh	P1	
	Average cost per month after solar energy savings = (726-380) x \$0.2989 =\$103.42	C1	
	Average cost of installing & maintenance of solar panel per month $=(2\times\$5950+20\times\$500)\div(20\times 12)$ $=\$91.25$	I1	
	Total average amount paid per month after installation =\$103.42 + \$91.25 =\$194.67 (< \$217)	T1	
	Since the average amount paid by Mr Faizal after installing the solar panels is less than what he is currently paying, he should proceed with the installation.	A1	Conclusion
	Assumption: The average electricity consumption remains the same, The price of tariff did not increase.	A1	Either one

Method 2 (Total cost based on 20 years)

(c)	Average amount of electricity produced = 20 x 19 = 380 kWh	P1
	Cost for 20 years before installation = \$217x20x12= \$52080	C1
	Cost of installation & maintenance $=(2\times\$5950+20\times\$500)$ =\$21900	I1
	Total cost for 20 years after installation =(726-380) x \$0.2989x12x20 +21900 = 46720.66 < \$52080	T1
	Since the total amount paid by Mr Faizal after installing the solar panels is less than what he is currently paying, he should proceed with the installation.	A1

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