Geylang Methodist School (Secondary)
Preliminary Examination 2024

Candidate Name			
Class		**Index Number**	

MATHEMATICS

4052/01

Paper 1

4 Express
5 Normal (Academic)

Candidates answer on the Question Paper.

2 hours 15 minutes

Setter: Ms Nainee Ismail

Monday, 5 August 2024

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** the questions.
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 90.

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.

For Examiner's Use
90

This document consists of **20** printed pages including the cover page.

[Turn Over

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

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

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

Answer **all** the questions.

1 Expand and simplify $(4x - y)(3x + 4y)$.

Answer ..... [2]

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2 **(a)** Find the lowest common multiple (LCM) of 108 and 140.

Answer ..... [1]

(b) Find the highest common factor (HCF) of 108 and 140.

Answer ..... [1]

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3 Solve $4 - \frac{1}{3}x = 2$.

Answer $x =$ ..... [1]

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4 10 23 34 40 25 35 17 44 23

(a) Find the median of the set of numbers.

Answer ..... [1]

(b) Find the range of the set of numbers.

Answer ..... [1]

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5 **(a)** A hotel made breakfast milkshake for its guests.
A mixture of mango juice, milk and yogurt in the ratio 7 : 5 : 3 are mixed together.
2.5 litres of milk is used in the mixture.

(i) How much yogurt is used in the milkshake?

Answer ..... litres [1]

(ii) How much breakfast milkshake is made?

Answer ..... litres [1]

(b) Another milkshake is made using apple juice, peach juice and milk.
The ratio of apple juice : milk = 2 : 3.
The ratio of milk : peach juice = 5 : 4.

Find the ratio of apple juice : milk : peach juice.

Answer ..... : ..... : ..... [1]

6 Find the equation of the straight line passing through $(7, -7)$ and $(-4, 15)$.

Answer ..... [3]

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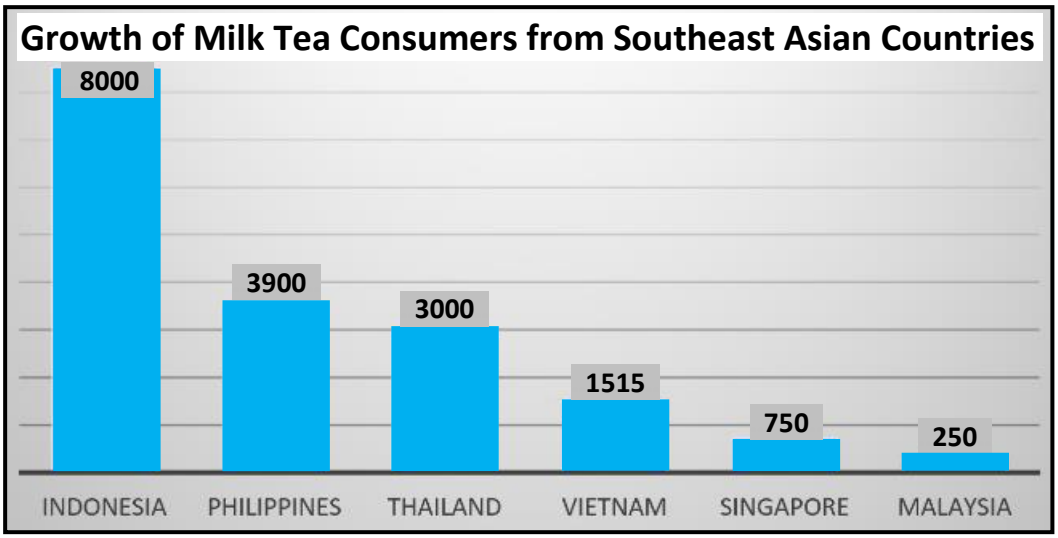
7 The graph shows the growth in milk tea consumers regionally.



Adapted from source: https://www.mdpi.com/

(a) State one misleading feature of the graph.

.....

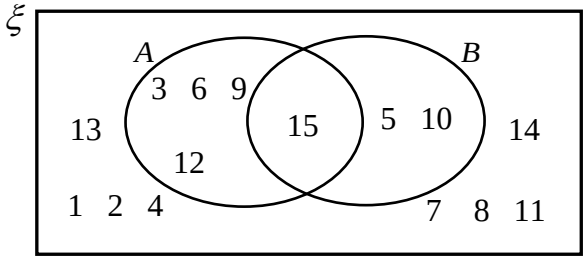
..... [1]

(b) Based on your answer in **part (a)**, explain how this feature affects the reader's interpretation of the graph.

.....

..... [1]

8 The Venn diagram shows the elements of $\xi = \{\text{integers } x: 1 \leq x \leq 15\}$ and two sets A and B.



(a) Use one of the symbols below to complete each statement.

$$\varnothing \quad \subseteq \quad \in \quad \cap \quad \not\subset$$

(i) $\{ 15 \}$ ..... $A \cap B$ [1]

(ii) 1 ..... $(A \cup B)'$ [1]

(b) Suggest a description to define set A.

.....

..... [1]

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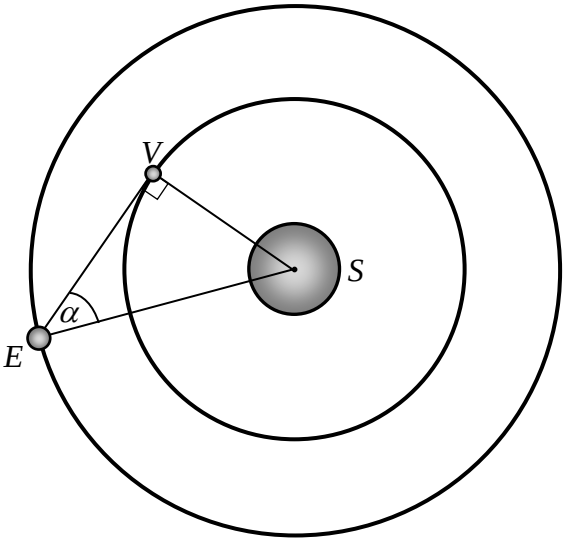
9 The number of social media users globally grew from 4.72 billion in January 2023 to 5.04 billion in January 2024. The number increased by r % every month during that period. Find the value of r. $\left(1 \text{ billion} = 1 \times 10^9\right)$

Answer $r =$ ..... % [2]

10 The following diagram shows the positions of Earth, *E*, and Venus, *V*, and their orbit around the Sun, *S*. The radius of Venus' orbit is 1.082×10^8 km.

[Follow the degree of accuracy of the values specified in this question and leave your answers in standard form where necessary.]



(a) If the angle α is 46.054°, calculate the distance between Earth and the Sun.

Answer ..... km [1]

(b) State the value of α when Earth is furthest from Venus and calculate this distance.

Answer α = ...

..... km [2]

11 Simplify $\dfrac{x^3-4x}{2x^2-7x+6}$.

Answer ..... [3]

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12 **(a)** A box is said to contain blue marbles, red marbles and yellow marbles.
A marble is picked at random from the box.
The probability that the marble is blue is 0.27.
The probability that the marble is red is 0.73.

Deduce if there are any yellow marbles in the box, showing the calculations clearly.

.....

..... [2]

(b) Another box contains 10 green marbles, 8 orange marbles and 3 purple marbles.
The probability of picking a purple marble is $\frac{1}{4}$ when x purple marbles are added in.
Find the total number of purple marbles in this box.

Answer ..... [2]

13 Factorise completely $8 - 2x - 24y + 6xy$.

Answer **……** [3]

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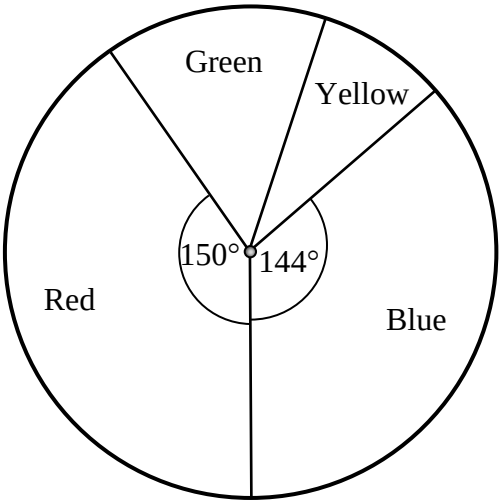
14 A container of oil is 65% full. 20% of the oil is used for cooking.
15.6 litres of oil is left in the container.
If 14.8 litres of oil is then poured into the container, determine whether there will be a spill.
Show your working.

……

…… [4]

[Turn Over

15 A survey is conducted on the number of students in Red, Green, Yellow and Blue House who participated in the Inter-House Games. The results are shown as a pie chart.



There are twice as many students that are from Green House as compared to Yellow House. Explain why this information may not be useful to find the number of students from the Red and Blue House who participated in the Inter-House Games.

……

…… [1]

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16 The Marina Coastal Expressway (MCE) tunnel is about 3.6 km long. The speed limit in expressway tunnels is 70 km/h. Find the shortest time possible for a car of length 4.8 m to pass through the MCE tunnel **completely**, within the speed regulations.
Give your answer in minutes and seconds (nearest whole number).

Answer …… minutes …… seconds [3]

17 $N = \dfrac{a^6}{b^3}$ where a and b are prime numbers.

(a) Explain why N is a perfect cube.

……

…… [1]

(b) Show that M is divisible by 6, given that $\dfrac{MN}{2} = (3ab)^2$ and M is a natural number.

Answer

[2]

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18 The expression $2 + px - x^2$ can be written in the form $q - (x - 3)^2$.

(a) Find the value of p and the value of q.

Answer p = ……

q = …… [2]

(b) Explain why when $x = 3$, the expression has its maximum value.

……

…… [1]

[Turn Over

19 **(a)** The force, F Newtons, between any two particles in the universe is inversely proportional to the square of the distance, r metres, between them.
It is known that $F = 100$ Newtons for a particular value r.
Find the value of F when this value of r is doubled.

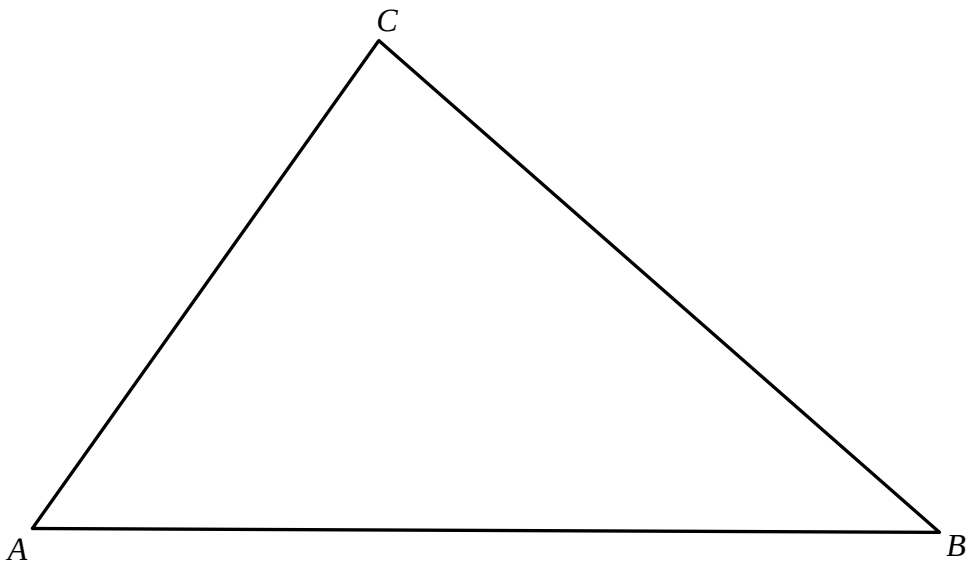
Answer ..... Newtons [2]

(b) y is proportional to x^3.
Explain the effect on the value of x in order for y to be 2700% of its original value.

.....

..... [1]

20 The diagram shows an eco-garden in a school in the shape of triangle ABC.
The diagram is drawn to a scale of 1 : 1000.



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

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

(c) A flagpole with the school flag is erected at a point P such that it is equidistant from A and B **and** equidistant from AB and BC.
Mark the point P on the diagram and measure the actual length of CP.

Answer CP = **……** m [1]

(d) A tiled path is to be constructed in the eco-garden, where each tile is equidistant from P. The tiled path also meets the line AB and BC at points X and Y respectively such that $BX = BY$. Describe the shape of the tiled path and find its actual length.

Answer Shape of tiled path: **……**

Length of tiled path = **……** m [2]

21 **(a)** $\dfrac{2^a \times \left(\sqrt[3]{64}\right)^c}{16^b} = 1$.

Find an expression for a in terms of b and c.

Answer $a =$ ..... [2]

(b) Simplify $\left(\dfrac{27y^{12}}{x^6}\right)^{-\frac{1}{3}}$.

Answer ..... [2]

22 The table shows the distribution of weight of 40 students in a class.

Weight (x kg)	Frequency
$40 < x \leq 50$	2
$50 < x \leq 60$	13
$60 < x \leq 70$	20
$70 < x \leq 80$	5

(a) Calculate an estimate for

(i) the mean weight of the students,

Answer ..... kg [1]

(ii) the standard deviation of the weight.

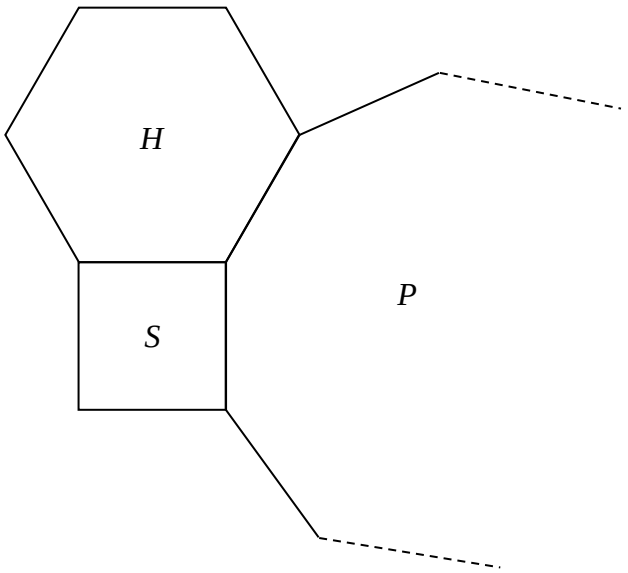
Answer ..... kg [1]

(b) Due to a fault in the weighing machine, the weight recorded was 2 kg lighter than the actual weight. Explain how this may have affected the mean and standard deviation and state its correct value.

.....

..... [2]

23 The diagram below shows a square *S*, a regular hexagon *H* and a part of a regular *n* – sided polygon *P*.



Find the number of sides, *n*, of the regular polygon *P*.

Answer $n =$ **……** [4]

24 **(a)** The first five terms of a sequence are 2, 7, 12, 17 and 22.

(i) T_n is the nth term of the sequence.
Find an expression, in terms of n for T_n.

Answer T_n = **……** [1]

(ii) The sum of the first n terms of this sequence is given by $an^2 + bn$.

When $n = 1$, $a + b = 2$.
Show that $4a + 2b = 9$.

Answer

[1]

(iii) Solve the equations from **part (ii)**.

$$a + b = 2,$$
$$4a + 2b = 9.$$

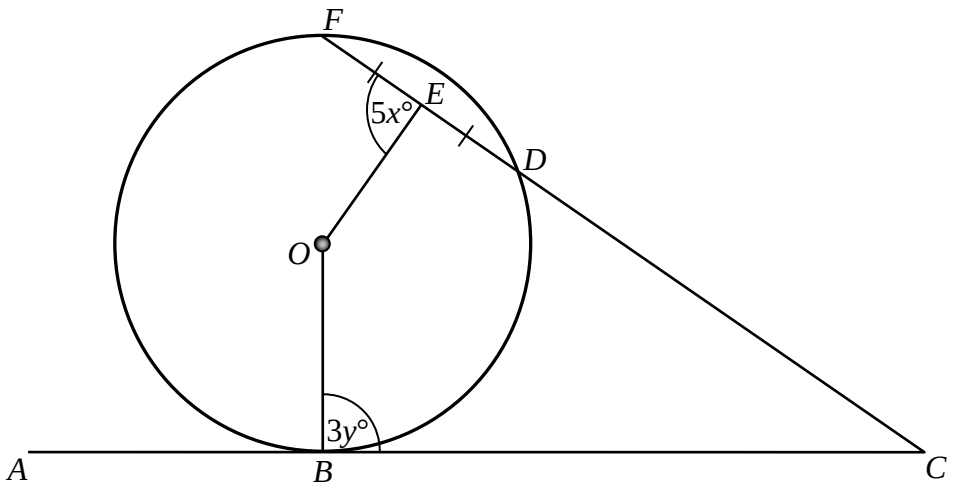
Answer a = **……**

b = **……** [2]

(b) The sum of the first n terms of a different sequence is given by $5n^2 + 3n$.
Find the 11th term of this sequence.

Answer **……** [2]

25 In the diagram, B, D and F lie on a circle, centre O.
AC is a tangent to the circle at B, $DE = FE$, angle $OEF = 5x°$ and angle $OBC = 3y°$.



(a) A statement was made that $BC = CE$.
Do you agree? Give reasons for your answer.

……

…… [1]

(b) Complete these statements.

(i) $x =$ …… because ……

…… [1]

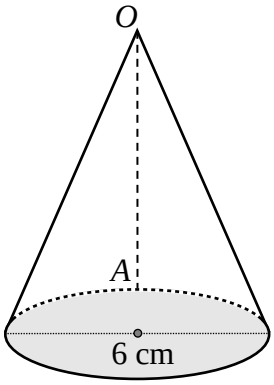
(ii) $y =$ …… because ……

…… [1]

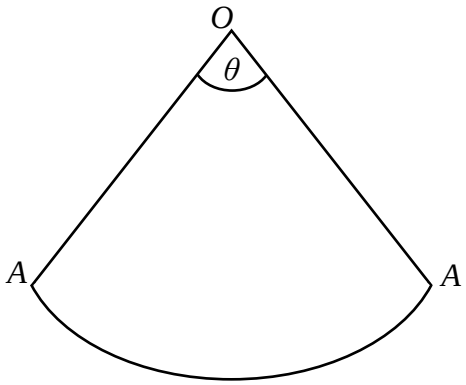
(c) Using the answers in **part (b)** and given that angle $BCD = (x + y)°$,
find the value of reflex angle BOE. Give a reason for each step of your answer.

Answer …… [3]

26



A conical cup, shown above, has a diameter of 6 cm with a volume of 40π cm^3.
A cut is made along the dotted line, OA.
The cup is unfolded to form a sector subtended by angle θ, shown below.



(a) Show that θ is approximately 1.3792 radians (correct to 4 decimal places).

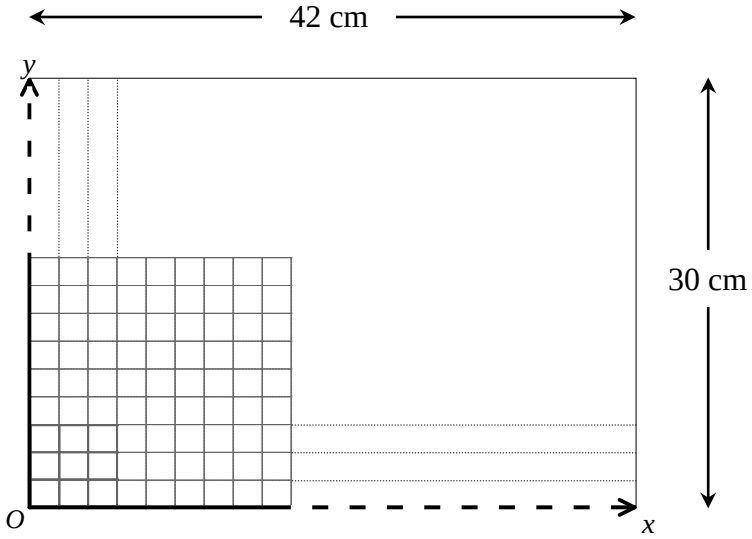
Answer

[4]

(b) Hence, evaluate the area of the sector.

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

27 A rectangular cardboard, *ABCD*, with dimensions 14 cm by 22 cm is to be drawn exactly at the centre of an A3-sized paper with dimensions 42 cm by 30 cm. For an accurate drawing, a grid with *x*-axis, *y*-axis and origin, *O*, at the bottom left-hand corner of the A3-sized paper, is drawn. A part of an incomplete grid (not drawn to scale) is shown below.
A scale of 1 cm to represent 1 unit is used.



(a) State a possible coordinate for the centre of the A3-sized grid.

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

(b) State the possible coordinates for each of the points of the cardboard, *A*, *B*, *C* and *D*.

Answer *A* **(..... , ...)**

B **(..... , ...)**

C **(..... , ...)**

D **(..... , ...)** [2]

(c) The rectangular cardboard and the A3-sized paper are **not** similar.
The A3-sized paper is to be kept as it is as the grid is already drawn as a reference.
Suggest how the cardboard can be cut to make it similar to the A3-sized paper, such that there is minimal wastage and cutting.

.....

..... [2]

End of Paper