CANBERRA SECONDARY SCHOOL

O

2024 Preliminary Examination

Secondary Four Express/Five Normal Academic

MATHEMATICS
4052/01

20 Aug 2024
2 hours 15 minutes
1130h – 1345h

Name: _____ ( ) **Class:** _____

READ THESE INSTRUCTIONS FIRST

Write your full name, class and index number on all work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the 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.
Calculators should be used 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 number of marks for this paper is 90.

FOR MARKER'S USE		
	Marks Awarded	Max Marks
Total		90

This question paper consists of 21 printed pages including the cover page.

Setter: Mr Ng Chuen Joo

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Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

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Answer **all** the questions.

1 Solve $9-\frac{1}{2}x=25$.

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

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2 Ahmad, Simon and Bala share a sum of money in the ratio 3 : 2 : 5.
If Bala has \$900 more than Simon, what is the sum of money being shared by the three of them?

Answer \$ ..... [2]

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

Answer ..... [2]

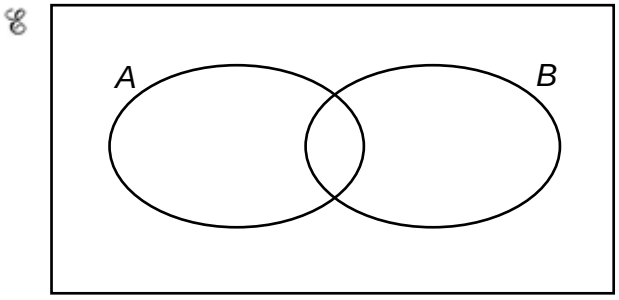
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4 Five positive integers have a mean of 5, median of 4, mode of 3 and a range of 7. Find the five numbers.

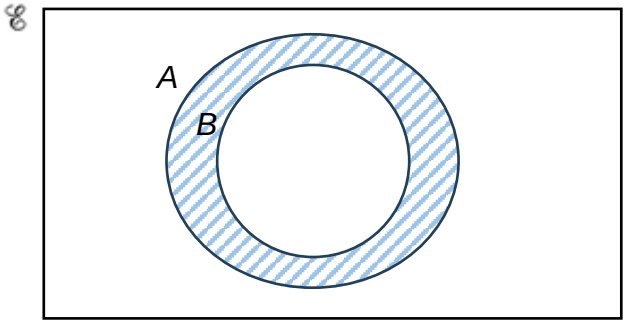
Answer ..... [2]

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5 **(a)** On the Venn diagram, shade the region that represents $A' \cup B$. [1]



(b) Use set notation to describe the shaded region.



Answer ..... [1]

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6 The quadratic curve $y = x^2 + 4x - 21$ can be written as $y = (x - a)(x + b)$.

(a) Find the value of *a* and the value of *b*, where *a* and *b* are positive integers.

Answer a = ... [1]

b = ... [1]

(b) Explain why *y* will not have a value smaller than -25.

Answer

.....

..... [1]

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7 **(a)** Expand and simplify $(3x - y)(y + x)$.

Answer ..... [2]

(b) Factorise completely $3 - 12a^2$.

Answer ..... [2]

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8 **(a)** Given that $\sqrt{a} \times a^3 \div a^x = 1$, find the value of x.

Answer _____ [1]

(b) Simplify $4 \div \left(\frac{x}{2}\right)^{-2}$, giving your answer in positive index.

Answer _____ [2]

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9 **(a)** $x^2 - 10x + 27$ can be expressed in the form $(x + p)^2 + q$.
Find the value of p and the value of q.

Answer p = _____ [1]

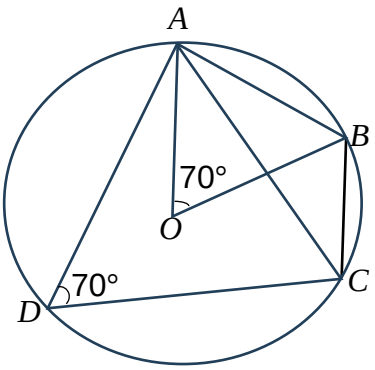
q = _____ [1]

(b) Hence write down the coordinates of the minimum point of the graph of $y = x^2 - 10x + 27$.

Answer (_____, _____) [1]

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10



In the diagram, O is the centre of the circle and $ABCD$ is a cyclic quadrilateral.
Angle AOB = angle $ADC = 70^\circ$.
Explain why triangle ABC is an isosceles triangle.
Give reasons for each step of your working.

[3]

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11 **(a)** The angles of a quadrilateral taken in order are $3x$, $6x$, $5x$ and $4x$.
Find the value of x.

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

(b) Explain whether the quadrilateral is a parallelogram or a trapezium.

because ..... [2]

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12 A square pyramid P has base with side x m, height y m and a volume of $300\,\text{m}^3$.

Find

(a) the volume of a similar square pyramid, which has a height double that of the pyramid P.

Answer ..... m^3 [1]

(b) the volume of another square pyramid with side $3x$ m and height $\frac{2}{3}y$ m.

Answer ..... m^3 [2]

---

13 The following stem-and-leaf diagram shows the scores of students in a math test.

Stem	**Leaf**
6	8 9
7	0 2 3 3 4 4 4 7 8
8	3 4 5 6 7 7 9
9	1 3 7

6|8 represents 68 marks

Find

(a) the median score,

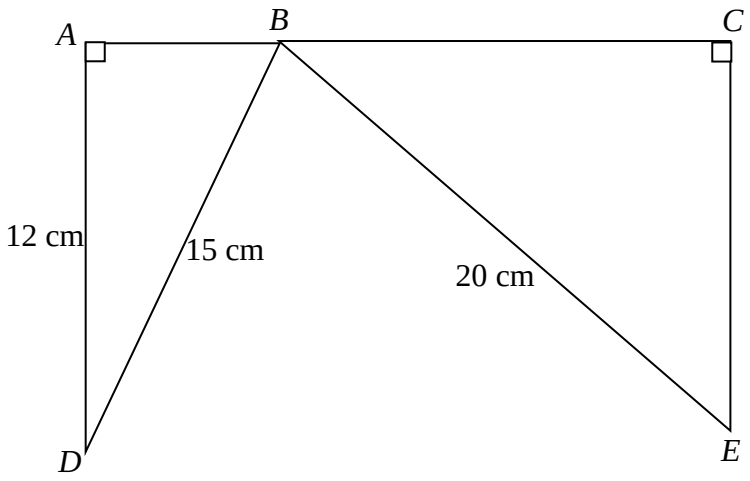
Answer ..... [1]

(b) the interquartile range.

Answer ..... [2]

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14 In the diagram, there are two right-angled triangles ΔABD and ΔCEB such that $AD = 12$ cm, $BD = 15$ cm and $BE = 20$ cm.



(a) Find $\cos \angle ABD$.

Answer _____ [2]

(b) If ΔABD and ΔCEB are similar, find the length of BC.

Answer _____ cm [2]

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15 As of 2023, the population of Singapore is approximately 5.64 million and the population of Malaysia is approximately 33.57 million.

(a) Find the total population of both countries, giving your answer in standard form.

Answer ..... [2]

(b) The population of Singapore in 2023 was 5% more than its population in 2013.
Calculate the population of Singapore in 2013.

Answer ..... [2]

---

16 A box contains 15 marbles of which x are green and the rest are yellow.

(a) Write down the probability, in terms of x, that a marble chosen from the box is yellow.

Answer ..... [1]

(b) When 5 more green marbles are added to the box, the probability of choosing a yellow marble becomes $\frac{1}{2}$.
Find the initial number of green marbles in the box.

Answer ..... [2]

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17 **(a)** **(i)** Express 1500 as the product of its prime factors.
Leave your answer in index notations.

Answer ..... [1]

(ii) $p = 2^m \times 3^2 \times n$, where m and n are positive integers.
Find the values of m and n if the HCF of 1500 and p is 6,
given that $100 < p < 150$.

Answer $m =$ ..... [1]

$n =$ ..... [1]

(b) In a race, Car A, Car B and Car C took 3 minutes, 6 minutes and 8 minutes respectively to complete one lap around the racing track.
If the race started at 7 pm, at what time will the cars be back at the starting point together again?

Answer ..... [2]

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18 A length of 5 cm on a map represents an actual distance of 2.5 km.

Find

(a) the actual distance represented by 20 cm on the map, giving your answer in km,

Answer ..... *km* [1]

(b) the scale of the map in the form 1 : *n*,

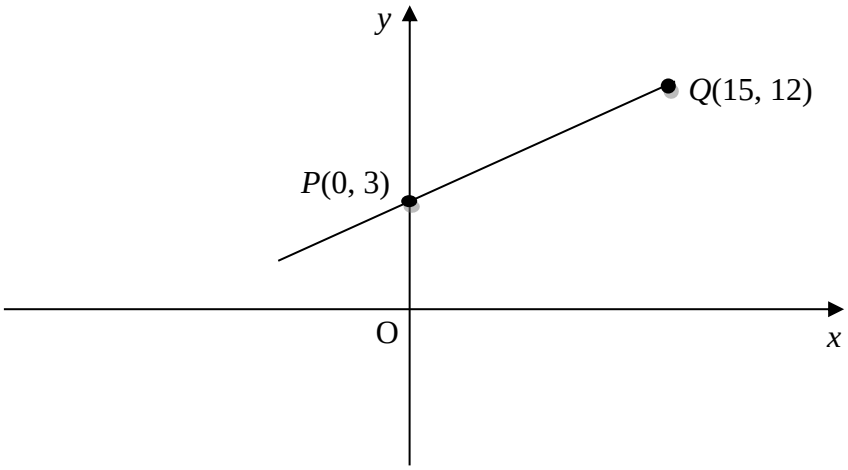
Answer ..... [2]

(c) the land area in km^2, which is represented by $30\ cm^2$ on the map.

Answer ..... km^2 [2]

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19 The coordinates of P and Q are (0, 3) and (15, 12) respectively.



(a) Find the equation of PQ.

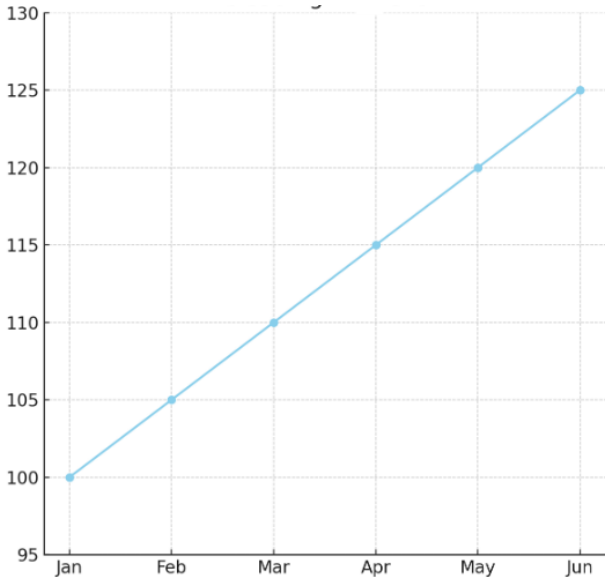
Answer ..... [2]

(b) Find the perimeter of trapezium $OPQR$, where O is the origin and R is the point of reflection of Q along the x-axis.

Answer ..... [3]

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20 The line chart below shows the sales performance of a company.



Explain what is misleading about this line chart and how it may mislead the reader.

.....

.....

..... [2]

21 12 men will take 54 days to complete a building project.

(a) Assuming that the men work at the same rate, how long will it take for 9 men to complete the project?

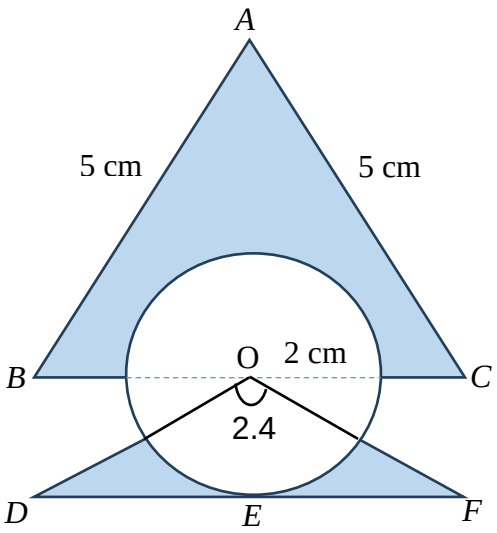
Answer ..... days [1]

(b) How many days can be saved if 6 more men are added to the team?

Answer ..... days [2]

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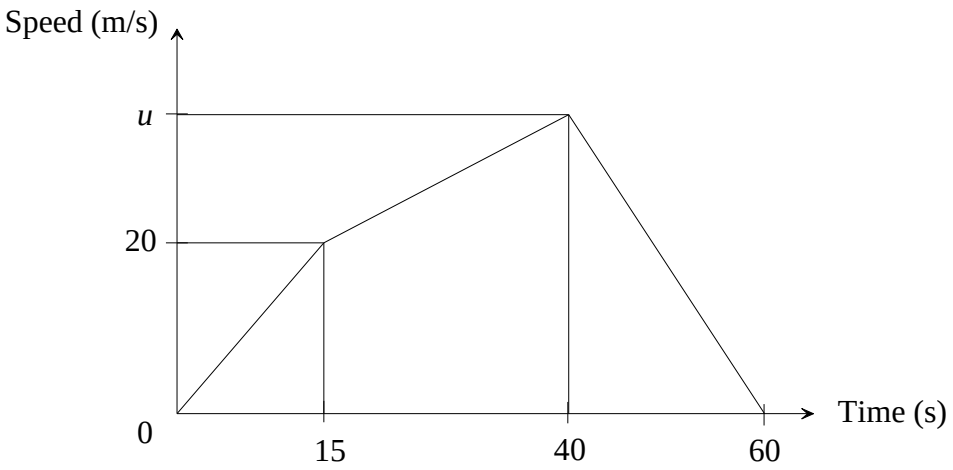
22 A logo, as shown below, has a circle with centre O and radius 2 cm, an equilateral triangle ABC of side 5 cm and an isosceles triangle ODF with $OD = OF$.
DEF is a tangent to the circle at E and angle $DOF = 2.4$ radians.
Half of the circle lies inside triangle ABC.
Calculate the area of the shaded region.



Answer ..... cm^2 [5]

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23 The diagram below shows the speed-time graph of a car which starts from rest.



(a) Calculate the speed of the car after 9 seconds.

Answer ..... m/s [2]

(b) **(i)** Find the value of u, if the total distance covered in the first 40 seconds is 900 m.

Answer ..... [2]

(ii) Hence find the deceleration of the car at the last 20s.

Answer ..... m/s^2 [1]

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24 At Café A, a latte costs \$3.50, a croissant costs \$2.70 and a sandwich costs \$5.00. At Café B, a latte costs \$0.40 more, a croissant costs \$0.20 less and a sandwich costs \$0.50 less.

This information can be represented by the matrix $\mathbf{Q} = \begin{pmatrix} 3.50 & 0.40 \\ 2.70 & -0.20 \\ 5.00 & -0.50 \end{pmatrix}$.

(a) Azza buys 2 latte, 3 croissants and 3 sandwiches.
Yu Fei buys 1 latte and 4 sandwiches.
Represent their purchases in a 2×3 matrix **P**.

Answer $\mathbf{P} =$ $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

(b) Evaluate $\mathbf{M} = \mathbf{PQ}$.

Answer $\mathbf{M} =$ $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

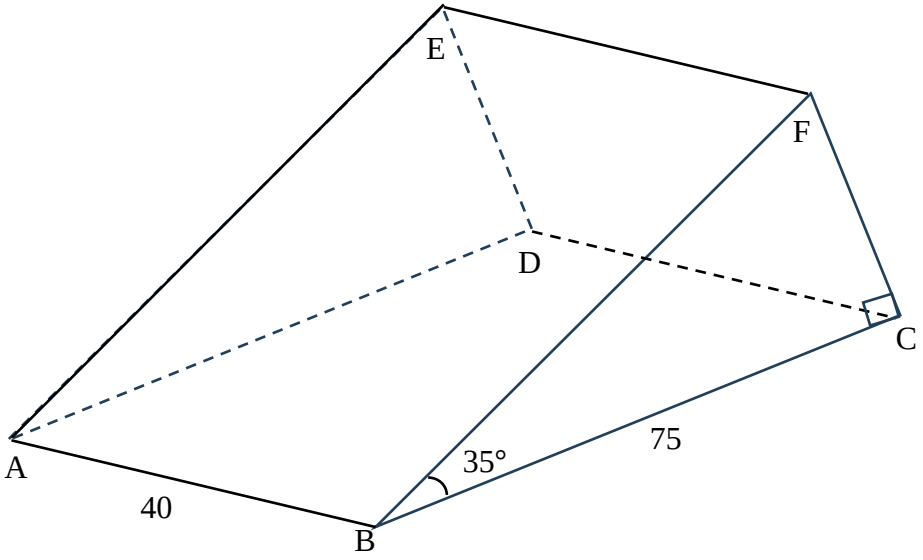
(c) Should Azza buy from Café A or Café B? Give your reasons.

.....

..... [2]

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25

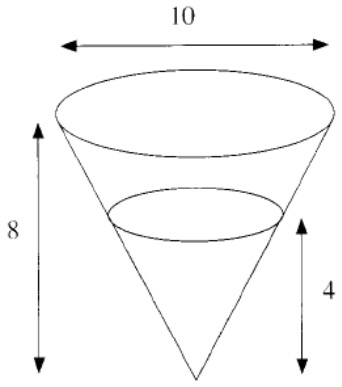


In the diagram, a wooden ramp is shown where $\angle BCF = 90^\circ$ and $\angle CBF = 35^\circ$.
ABCD, *CDEF* and *ABFE* are rectangles. $AB = 40$ cm and $BC = 75$ cm.
Find $\angle FAC$.

Answer _____ [3]

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26 A conical container with a diameter of 10 cm and a height of 8 cm is filled with water to a depth of 4 cm.



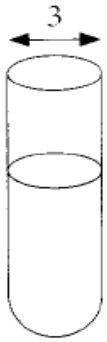
(a) Show that the volume of the water in the container is $\frac{25}{3}\pi\ cm^3$. [2]

(b) Find the surface area of the inside of the container that is in contact with the water.

Answer _____ cm^2 [2]

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(c) The water in the cone is poured into a test tube.
The test tube is made by joining together a cylinder of diameter 3 cm and a hemisphere of diameter 3 cm.
Calculate the height of the water in the test tube.



Answer ..... cm [3]

End of paper

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