

CANBERRA SECONDARY SCHOOL



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	Max					
	Awarded	Marks					
Total		90					

This question paper consists of $\underline{21}$ printed pages including the cover page.

Setter: Mr Ng Chuen Joo

Mathematical Formulae

Compound interest

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

Mensuration

Curved Surface area of a cone = πrl

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

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

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

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]

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]

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

Answer [2]

[Turn Over

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

Answer _____ [2]

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

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

Answer [2]

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

Answer _____ [2]

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]

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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7

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

[3]

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 m^3 .

Find

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

Answer $\underline{m^3}$ [1]

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

Answer ______ m³ [2]

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

Stem	Le	af								
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 medi	ian s	score	e,							
(b) the inter	qua	rtile	rang	ge.					Answer [1	[]
									Answer [2	2]

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



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

Answer [2]

(b) If $\triangle ABD$ and $\triangle CEB$ are similar, find the length of BC.

Answer _____ [2]

- **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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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 .

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]

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 _____ [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 cm² on the map.

Answer <u>km</u>² [2]

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



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]



(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
$$\mathbf{P} = \begin{pmatrix} & & \\$$

(b) Evaluate M = PQ.

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

1

[2]

1

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

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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]

[Turn Over

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]

(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