HUA YI SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024

4-G3 / 5-G2

NAME

CLASS

INDEX NUMBER

MATHEMATICS **4052/01**

PAPER 1

13 August 2024

2 hour 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class, and index number 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

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Setter: Ms Jasmine Tan

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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

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

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

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1 **(a)** Calculate $\dfrac{-(-11.8)-\sqrt{(-11)^2-7\times16\times(-40)}}{2\times16}$.

Answer ……. [1]

(b) There are 800 people in an auditorium, correct to the nearest hundred.
State the minimum number of people that could be in the auditorium at this time.

Answer ……..… people [1]

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2 **(a)** Express 1400 as the product of its prime factors.

Answer ……. [1]

(b) Write down the smallest positive integer k such that $1400k$ is a perfect cube.

Answer k = ...……. [1]

(c) n is a number between 300 and 400.
The highest common factor of n and 1400 is 35.
Find the largest possible value for n.

Answer n = ……. [2]

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3 **(a)** Simplify $y^0 \div 9x^{-2} \times x^7$.

Answer ..... [2]

(b) Simplify $\left(81a^{12}\right)^{\frac{5}{4}}$.

Answer ..... [1]

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4 **(a)** Express as a single fraction in its simplest form $\frac{18b^7}{5c^2} \div \frac{3b^4}{81}$.

Answer ..... [2]

(b) Use the laws of indices to show that $6^4 \times 100 + 116 \times 36^2$ can be expressed as **a single power of six**.

Answer [2]

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5 In a greenhouse, the estimated number of flowering plants increased from 4100 in January 2024 to 4980 in June 2024. The number increased by c% every month.
Find the value of c.

Answer $c =$ ……. [3]

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6 Kyle runs a tennis club. 54 of the members are adults and 31 are children.
His aim is that **at least** 60% the members should be children.
Form an inequality to find the smallest number of children that Kyle would still need to recruit achieve his aim.

Answer ……..…… children [3]

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7 A car travels at an average speed of 74.5 km/h for 2.25 hours.

(a) Convert 75 km/h to m/s.

Answer ……..… m/s [1]

(b) By rounding the numbers correct to 1 significant figure, find an estimate of the distance travelled by the car. Show your working clearly.

Answer ……..… km [2]

(c) Without doing any calculation, explain why the actual distance travelled by the car is greater than the answer to **(b)**.

Answer [1]

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8 Isha has written down five numbers.

The mean of these numbers is 13.2, the median is 12 and the mode is 7.

The largest number is three times the smallest number.

Find the five numbers in **ascending** order.

Answer ……. , ……. , ……. , ……. , ……. [2]

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9 Factorise completely

(a) $2p^4 - 32s^4$,

Answer ……. [3]

(b) $12cd - 9cx + 6xy - 8dy$.

Answer ……. [2]

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10 **(a)** Express $9 - 8x + x^2$ in the form $a + (x + b)^2$. Find the value of *a* and of *b*.

Answer a = ……. [1]

b = ……. [1]

(b) Explain why when $x = 4$, the expression $9 - 8x + x^2$ has its minimum value.

Answer [1]

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11 Solve the equation $5+2x=\dfrac{20}{1+x}$.

Answer x = …… or ……. [3]

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12 The points $(4,20)$ and $(10,-4)$ satisfy the curve given by the equation $y=ax^2+bx-4$.

Use an algebraic method to determine the values of *a* and *b*.

Answer a = …… , b = …..…. [4]

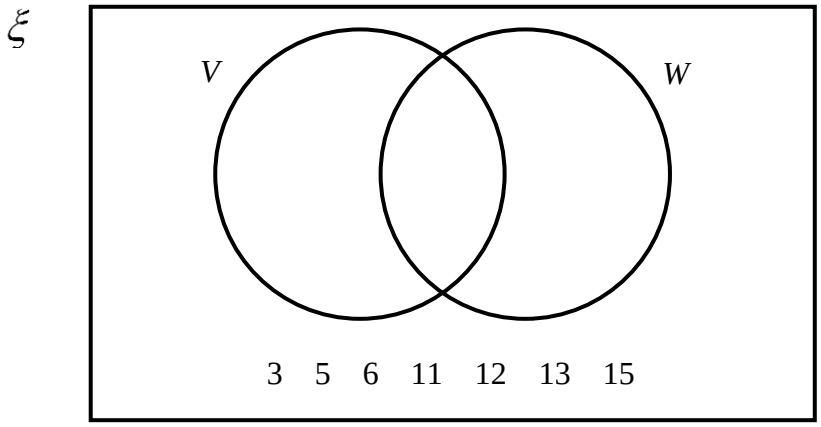
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13 $\xi = \{\text{integers } x : 1 \le x \le 16\}$

$V = \{1, 2, 4, 8, 16\}$

$W = \{1, 4, 7, 9, 10, 14\}$

Some of the information is shown on the Venn diagram.



(a) Complete the Venn diagram by representing all the elements in the given sets.

Answer in above Venn diagram [1]

(b) Describe the elements of Set *V*.

Answer [1]

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(c) List the elements contained in the set $V' \cap W$.

Answer ……. [1]

(d) Find the number of elements in $(V \cap W') \cup (V \cup W)'$.

Answer ……. [1]

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

$= \quad \varnothing \quad \subset \quad \not\subset \quad \notin \quad \in \quad \xi$

(i) $\{2, 16\}$ …… V

(ii) 13 …… W

Answer (e) (i) ……... [1]

(ii) …...…… [1]

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14 In grocery mart *G*, water costs \$1.80 per litre, fresh milk costs \$2.90 per litre and juice costs \$2.30 per litre.

In grocery mart *H*, water costs \$0.20 more per litre, fresh milk costs \$0.40 less per litre and juice costs \$0.10 less per litre.

This information can be represented by the matrix $\mathbf{Q} = \begin{matrix} \\ \text{W} \\ \text{M} \\ \text{J} \end{matrix} \begin{matrix} G & H \\ \left(\begin{matrix} 1.8 & 0.2 \\ 2.9 & -0.4 \\ 2.3 & -0.1 \end{matrix}\right. & \left.\begin{matrix} \\ \\ \\ \end{matrix}\right) \end{matrix}$.

(a) Rayyen and Zinnie went shopping together.

Rayyen bought 4 litres of water, 2 litres of milk and 3 litres of juice.

Zinnie bought 3 litres of water and 4 litres of juice.

Represent their purchases in a 2×3 matrix **P**.

Answer **P** = ... [1]

(b) Evaluate the matrix **R** = **PQ**.

Answer **R** = ... [2]

(c) State what the elements in the second column of matrix **R** represent.

Answer [1]

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(d) Rayyen shopped in grocery mart *H*. He got a discount coupon that entitled him to a discount of 15%. How much did he pay altogether for his items?

Answer \$ ..... [2]

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15 In a regular polygon, the ratio of an interior angle : exterior angle = 14 : 1.

(a) Find the number of sides of the polygon.

Answer …… sides [3]

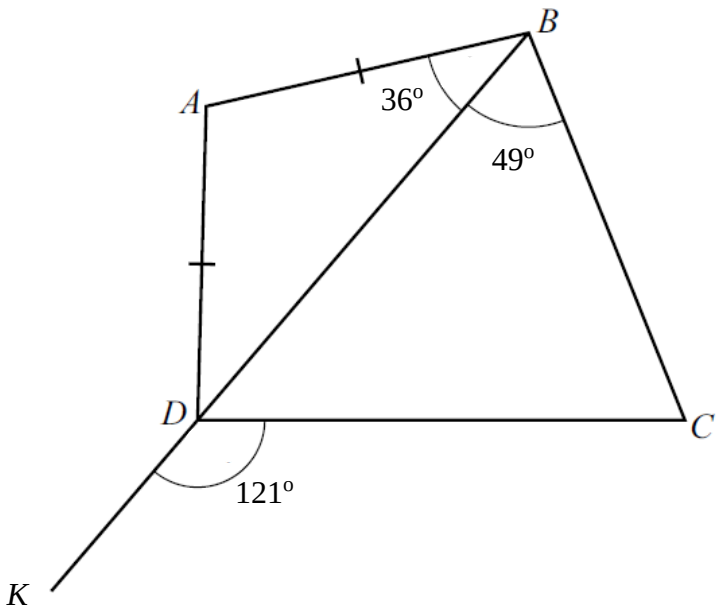
(b) Find the sum of the interior angles of the polygon.

Answer ……^{o} [1]

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16 In the diagram, *BDK* is a straight line and *AB* = *AD*.

Angle *ABD* = 36°, angle *CBD* = 49° and angle *CDK* = 121°.



Explain why it is possible to draw a circle that passes through the points *A*, *B*, *C* and *D*.

Give reasons for each step of your working.

Answer [3]

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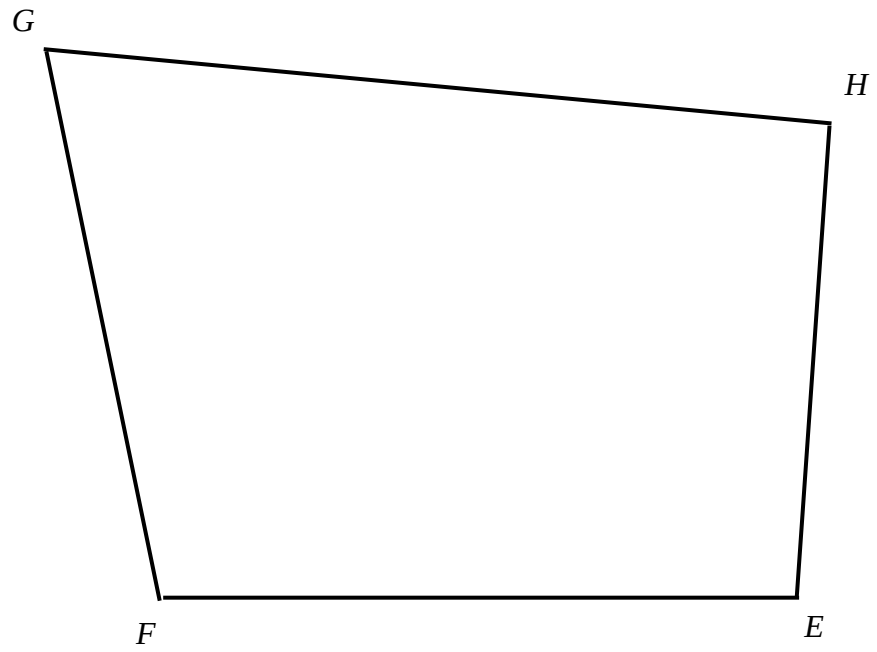
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17 The diagram represents a plot of land, *EFGH*, which is to be used for an observatory.



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

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

(c) A café is to be built in the observatory, nearer to *E* than to *F* and nearer to *GH* than to *EH*.

Shade the region where the café is to be built. [1]

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18 **(a)** A cargo ship has an average fuel consumption of 0.000 892 kilometres per litre.
Write this consumption in litres per kilometre.

Answer ..... *l* / km [1]

(b) A model of another cargo ship is made to a scale of 1 : 60.
The length of this model cargo ship is 550 cm.

(i) Find the actual length of this cargo ship in metres.

Answer ..... m [1]

The capacity of the fuel tanks in the model cargo ship is 7.75 litres.

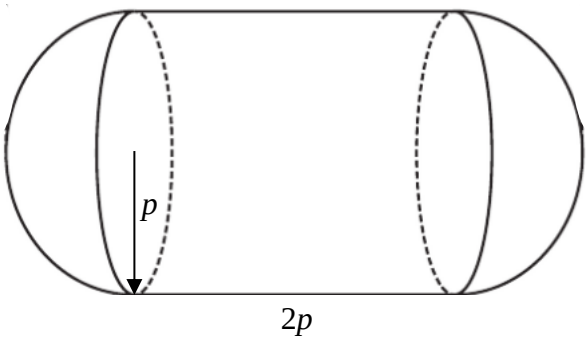
(ii) Find the actual capacity of the fuel tanks of the cargo ship.
Express your answer in standard form.

Answer ..... *l* [2]

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19 A composite solid is made from a cylinder and two hemispheres.

The cylinder has radius p and length $2p$, while the hemispheres have radius p.



The total surface area of the solid is six times the total surface area of a solid cone with radius p and slant height l.

Find l in terms of p.

Answer l = ... [3]

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20 Gino can paint 6 fence panels in 4 hours, while Danish can paint 7 fence panels in 5 hours. Gino and Danish work together to paint a total of 21 panels.

If they continue to paint at the same rate, how long will it take them to paint 21 panels? Give your answer in hours and minutes, correct to the nearest minute.

Answer ..... h ..... min [3]

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21 A fitness centre has 16 employees.

One of the 16 employees is selected at random.

The probability that it is a woman working part time is $\frac{1}{8}$.

Two of the 16 employees are selected at random.

The probability that they are both men working full time is $\frac{1}{8}$.

Complete the table of information below about the 16 employees of the fitness centre.

Show all supporting calculations clearly.

Answer [4]

	Part-time employees	***Full-time employees***
Women		5
Men		

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22 A librarian wants to find out how much time patrons spend at the library in a week.

He uses the questionnaire.

How many hours do you spend at the library in a week (including weekends)?

Please tick one box.

1 – 2	*3 – 4*	*5 – 7*	*over 7*

List **two** ways to improve the questionnaire.

Answer [2]

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23 K is the point $(7, -8)$ and L is the point (x, y).

The gradient of the line KL is $\frac{2}{3}$.

Maverick claims that it is possible to express x in terms of y, such that $x = a + by$, where a and b are constants.

Explain why Maverick is correct.

Answer [2]

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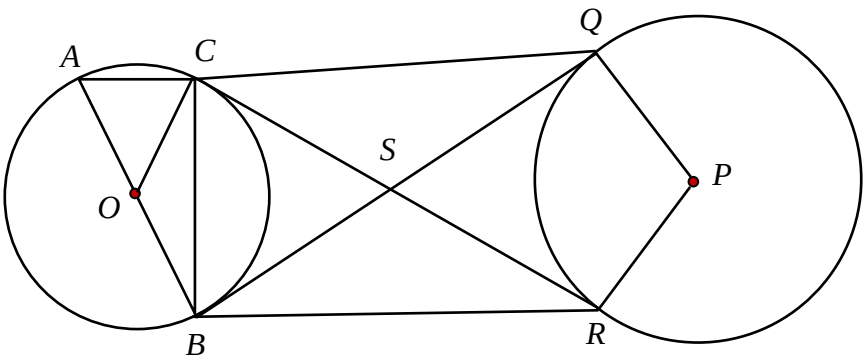
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24 *A*, *B* and *C* are points on the circle with centre *O*.

Q and *R* are points on the circle with centre *P*.

CSR and *BSQ* are tangents on to both circles.

AOB is a straight line.



(a) Show that triangle *CQS* is congruent to triangle *BRS*.

Give a reason for each statement you make.

Answer [3]

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24 **(b)** Angle $ABC = y°$

Find, in terms of y,

(i) angle BAC,

Answer ……° [1]

(ii) angle QPR.

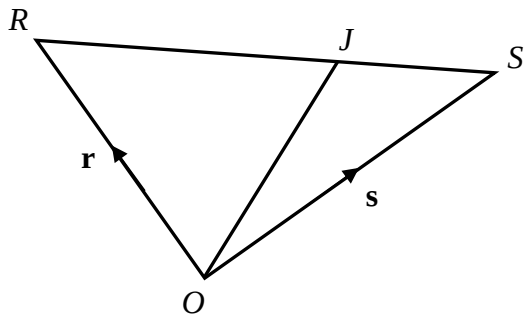
Answer ……° [2]

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25 ORS is a triangle.

J is a point on RS such that $RJ : JS = 3 : 2$.

$\overrightarrow{OR} = \mathbf{r}$ and $\overrightarrow{OS} = \mathbf{s}$.



(a) Show that $\overrightarrow{OJ} = \frac{1}{5}(2\mathbf{r} + 3\mathbf{s})$.

Answer [2]

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(b) X is a point such that $\overrightarrow{RX} = \frac{1}{5}(\mathbf{r} + 9\mathbf{s})$.

Explain why O, J and X lie on a straight line.

Answer [2]

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END OF PAPER

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