Full Name	Class Index No	Class



Anglo-Chinese School (Parker Road)

PRELIMINARY EXAMINATION 2023

SECONDARY FOUR EXPRESS

MATHEMATICS 4052 PAPER 1

2 HOURS 15 MINUTES

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in. Write in dark blue or black pen.

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.



Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone
$$= \pi r l$$

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

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

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

1 Simplify 5a-3(a-2).

Answer _____ [1]

2 (a) Calculate $\frac{12.5^2}{5.48-2.47}$. Write down the first five digits of your answer.

Answer [1]

(b) Write your answer to **part** (a) correct to 2 significant figures.

Answer _____ [1]

3 The sine of an angle is 0.6420.Give two possible values for the angle.

Answer _____ ° or _____ ° [2]

4	(a)	Express	168 as	the produ	ct of its	prime	factors.
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Answer [1]

(b) The number 168k is a perfect square. Find the smallest positive integer value of k.

Answer k = _____ [1]

5 (a) Factorise completely 3xy - 6ay - 5x + 10a.

Answer _____ [2]

(b) Solve (2x+1)(x-3)=0.

Answer x =_____ or x =_____ [1]

(c) (i) Solve the inequalities $9x-1 < 11+3x \le 7x+21$.

Answer [3]

(ii) Represent the solution on the number line below.

Answer



- 6 A gardener wants to plant flowers in his garden and he wants to arrange them in rows. He has 60 red flowers, 72 yellow flowers and 84 blue flowers. He wants to make the same number of rows of each color.
 - (a) Find the largest number of rows he can make of each colour.

Answer _____ [2]

(b) Write down the number of red, yellow and blue flowers in each row.

Answer _____red

_____yellow

_____blue [1]

7 (a) Express $y = x^2 - 8x + 18$ in the form $y = (x+a)^2 + b$.

Answer _____ [2]

(b) Write down the equation of the line of symmetry of the graph of $y = x^2 - 8x + 18$.

Answer [1]

(c) Explain why the graph $y = x^2 - 8x + 18$ will not pass through the x-axis.

Answer_____

[1]



In the triangle, AC = 20.5 cm, BC = 13.3 cm and angle $ABC = 90^{\circ}$.

(a) Calculate *AB*.

		Answer $AB =$	_cm	[1]
(b)	(i)	Explain why it is possible to draw a circle that passes through <i>A</i> , <i>B</i> and <i>C</i> .		
		Answer		
				[1]
	(ii)	State the radius of this circle.		

Answer ______cm [1]

9 The diagram shows a triangle *ABC*.



(a)	Construct the angle bisector of angle ACB.	[1]
(b)	Construct the perpendicular bisector of <i>BC</i> .	[1]
(c)	Shade the region closer to AC than to BC and closer to C than to B.	[1]

10	Joe and Jack each have a savings account.			
	The ratio	Joe's savings : Jack's savings $= 29 : 8$.		
	They each spend \$15 from their savings.			
	The new ratio	Joe's savings : Jack's savings = 4 : 1.		
	Find how much	n money Joe now has in his account.		

Answer \$_____

11 Simplify
$$\frac{a^2 - 2ab - 3b^2}{4b^2 - 4a^2}$$
.

Answer _____ [3]

12 Solve
$$\frac{5}{3(x-1)} + \frac{3}{2(1-x)} + 4 = 0$$
.

Answer _

13 Given that $a = 5 \times 10^{-3}$ and $b = 2 \times 10^{2}$, evaluate

(a)
$$\frac{2b}{a}$$
, giving your answer in standard form,

Answer [1]

(b) $\frac{3}{a} - b$, giving your answer in ordinary notation.

Answer _____ [1]

14 On a particular week, a 40-seater bus ferries 10 adults and 30 children to their destination every morning from Monday to Friday.

It ferries 20 adults and 10 children every afternoon from Monday to Friday.

The information may be represented by the matrix $\mathbf{C} = \begin{pmatrix} 10 & 30 \\ 20 & 10 \end{pmatrix}$.

On Saturday morning, it ferries 25 adults and 15 children and in that afternoon, it ferries 10 adults and 30 children.

(a) Represent the number of passengers carried on Saturday in a 2x2 matrix **D**.

Answer $\mathbf{D} =$

[1]

(b) Evaluate the matrix $\mathbf{E} = \mathbf{5C} + \mathbf{D}$.

(c) State what the elements of **E** represent.

An	nswer
Th	he fare for an adult is \$2.50 and the fare for a child is \$1.50.
(i)	Evaluate the matrix $\mathbf{F} = \mathbf{C} \begin{pmatrix} 250\\ 150 \end{pmatrix}$.

Answer $\mathbf{F} = [1]$

(ii) State what the elements of **F** represent.

Answer _____ [1]

15 (a) On the Venn diagram shown in the answer space, shade the set $A \cap B'$.



[1]

- (b) $\xi = \{x : x \text{ is an integer, } 1 \le x \le p \text{ and } p < 50\}$ $S = \{x : x \text{ is a multiple of } 2\}$
 - $T = \{x : x \text{ is a perfect square}\}$
 - (i) List the elements of $S \cap T$ such that there are only 3 elements in it.

Answer _____ [1]

(ii) Find the largest p such that $S \cap T = \emptyset$.

Answer _____ [1]

16 X(5,5) and Y(5,-5) are points on a cartesian plane. Find the equation of line *L* passing through (1,-2) if it has the same gradient as the line passing through the points *X* and *Y*.

$$Answer [2]$$
17 (a) Simplify $(x^6)^{\frac{2}{3}}$.

Answer [1]

(b) (i) Given that $\frac{1}{81} = 3^k$, find *k*.

Answer k =_____ [1]

(ii)
$$\frac{625^p}{5^q} = 125^r$$

Find an expression for q in terms of p and r.

Answer q =[2]



ABCD is a regular hexagon. Show that triangle *BOC* and triangle *EOF* are congruent. Give a reason for each statement.

Answer _____

[3]

17

19 (a) (i) By factorisation, show that
$$1 + x + x(1+x) + x(1+x)^2 = (1+x)^3$$
.

Answer _____ [2]

(ii) Given $1 + x + x(1+x) + x(1+x)^2 + x(1+x)^3 + x(1+x)^4 = (1+x)^n$, State the value of *n*.

Answer n = [1]

(b) Hence, evaluate $2+2x+2x(1+x)+2x(1+x)^2+2x(1+x)^3+2x(1+x)^4+...+2x(1+x)^{99}$ if x=3. Express your answer in index notation as a power of 2.

Answer [4]



A, B, C and D are points on the circle, centre O. ED is a tangent to the circle and angle $EDB = x^{\circ}$.

Find, in terms of *x*, angle *BCD*. Give a reason for each step of your answer.

Answer _____

[3]

0

21 The marks of 20 students for their Mid-Year Mathematics examination are listed in the tables below.

Mid-Year Mathematics Exam Marks					
51	72	66	61	65	
58	64	80	83	48	
47	54	45	75	50	
51	91	40	77	59	

(a) Find the mean mark.

Answer _____ [1]

(b) The passing mark for the examination is 50.

(i) Find the probability of selecting a student who passed the examination.

Answer _____ [1]

(ii) Two students are selected. Find the probability that one passed and the other failed the examination.

Answer [2]

(c) The same group of 20 students sat for their End-of-Year Mathematics examination and achieved a mean mark of 63.7. The probability of selecting a student who passed the End-of-Year Mathematics examination was $\frac{9}{10}$. Determine, based on your answers to **parts (a) and (b)**, if there is an improvement in the performance of the students in the End-of-Year Mathematics examination.

Answer	 	

[2]

22 The diagram shows two geometrically similar solid cylinders. Cylinder *J* has radius 5 cm and cylinder *K* has radius 9 cm. These cylinders are made with the same material.



- (a) Find the ratio
 - (i) volume of cylinder *K* : volume of cylinder *J*,

Answer _____ [1]

(ii) total surface area of cylinder J: total surface area of cylinder K.

Answer _____ [1]

(b) If the mass of J is 250 g, find the mass of K in kg.

Answer _____kg [2]



Match the above figures to the following equations.

(a) $y = \frac{2}{x^2}$

Answer Figure_____ [1]

(b) x + y - 2 = 0

Answer Figure_____ [1]

(c) $y = e^{-x}$

Answer Figure [1]

24 The diagram below shows the velocity-time graph of the first 20 seconds of the journey by an object.



Find

(a) (i) its acceleration for the first 5 seconds of the journey,

Answer _____ m/s² [1]

(ii) the velocity of the object at t = 14s,

Answer _____ m/s [2]

(iii) the total distance travelled for the journey.

Answer _____ m [2]

(b) Complete the distance-time graph for the same journey in the answer space below.

Answer



25 In the diagram, AQBP is a square of side $\sqrt{2}$ cm. BPR is a sector, centre B.



Answer

[3]

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