Full Name	Class Index No	Class



Anglo-Chinese School (Parker Road)

END-OF-YEAR EXAMINATION 2023 SECONDARY THREE EXPRESS

MATHEMATICS 4052 PAPER 1

1 HOUR 45 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 70.

For Examiner's Use

This question paper consists of 16 printed pages.

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 Expand and simplify $(2x-3y)^2$.

Answer _____ [2]

2 The first 4 terms in a sequence are 6, 10, 14, 18,
(a) Write down an expression, in terms of *n*, for the *n*th term, T_n, of this sequence.

Answer _____ [1]

(b) Evaluate T_{11} .

Answer _____ [1]

(c) Explain why T_n is always an even number, for all values of n.

Answer _____ [1]

- 3 The population of Zimbabwe was 15.99 million with a land area of 390 745 km^2 in 2021.
 - (a) Write 15.99 million in standard form.

Answer _____ [1]

(b) Calculate the number of people per square kilometre, correct your answer to the nearest whole number.

Answer _____ [2]

4 (a) Express 540 as the product of its prime factors.

Answer _____ [1]

(b) The number $\frac{540p}{q}$ is a perfect cube. *p* and *q* are prime numbers. Find the value of *p* and the value of *q*.

Answer p =_____ [2]

5 (a) The time taken to put together a wooden crate is inversely proportional to the number of workers.
 Four workers take 12.5 hours.
 Find the time it would have taken 5 workers to put together a wooden crate.

Answer ______ hours [1]

(b) A quantity y is directly proportional to x^3 . If x is increased by 200%, calculate the percentage change in y.

Answer ______% [2]

6 If $2^x \div 8^{x-2} \times 4^{2x+3} = \frac{1}{16}$, find the value of *x*.

Answer _____ [3]

7 (a) Express
$$x^2 - 6x + 4$$
 in the form $(x-p)^2 + q$.

Answer _____ [2]

(b) Write down the coordinates of the minimum point of the graph of $y = x^2 - 6x + 4$.



In the diagram, ST // VW, angle $TUV = 95^{\circ}$ and angle $UVW = 128^{\circ}$. Calculate angle STU. Give a reason for each step of your working.

Answer ______° [3]



9 The graph of $y = -x^2 + x + 6$ is drawn on the grid.



(b) The equation $\frac{-x^2}{2} + x + 2 = 0$ can be solved by drawing a suitable straight line on the axid

the grid.

(i) Find the equation of the straight line.

(ii) By drawing this straight line, solve the equation
$$\frac{-x^2}{2} + x + 2 = 0$$
.

Answer <u>x = _____ or _____ [3]</u>

10 (a) Given that
$$p = \frac{\sqrt{h^2 - 4k^2}}{n}$$
, express k in terms of h, n and p.

Answer _____ [3]

(b) Hence, find the values of k when p = -1, h = 9 and n = 2.

Answer k =_____ or _____ [2]



The diagram shows the interior angles of each of three regular polygons, A, B and C. A is a square, B is a regular pentagon and C is a regular n-sided polygon. The polygons fit together at O. Find the value of n.

11



12 (a) The diagram shows a bar graph of the number of students in Clubs in a school.

State one aspect of the graph that may be misleading and explain how this may lead to a misinterpretation of the graph.

(b) The table shows the number of private buses in Singapore from 2020 to 2022.

Year	2020	2021	2022
Number of	2835	2717	2634
private buses			

Suggest one advantage of using a line graph compared to using a pictogram to represent the above data.

Answer

[1]

13 (a) Simplify
$$\frac{5(3n-4.5)}{3} + \frac{(2n+9)}{2}$$
.

Answer _____ [3]

(b) Hence show that $\frac{5(3n-4.5)}{3} + \frac{(2n+9)}{2}$ is a multiple of 3 for all positive integers *n*.

Answer

[2]

14 *ABC* is a triangle in which AC = 10 cm, BC = 9 cm and AB = 17 cm. *D* is a point on *BC* produced, where CD = 6 cm and AD = 8 cm.



- (a) Explain why angle *ADB* is a right angle.
 - Answer
- (b) Find $\cos \angle ACB$, expressing your answer as a fraction.

Answer _____ [2]

(c) Hence calculate the largest angle in the triangle *ABC*.

Answer ______° [1]

[2]

15 The screen times, to the nearest hours, 20 students spent on handphone games in a week are represented in a stem-and-leaf diagram.

	Scree	n time	s of 20	studen	ts				
Stem	Leaf								
0	4	5	6	7	9				
1	0	3	4	5	6	6	6	7	9
2	0	0	1	1	2	2			

Key: 0 6 means 6 hours

(a) A value is chosen.

Find the probability that the value chosen is the same value as the median.

Answer _____ [1]

- (b) The value, x, of another student is recorded and added to the diagram.
 - (i) If the mean of the new set of data is 15, find the value of x.

Answer <u>x</u> = _____ [2]

(ii) If the mode of the new set of data is affected, write down an inequality in x.

Answer _____ [1]

16 (a) Factorise completely 4ax - 3ay - 8bx + 6by.

Answer _____ [2]

(b) Simplify
$$\frac{16x^2 - 9}{4x^2 - 9x - 9}$$
.

Answer _

[3]

17 A store owner purchased *x* number of small boxes and *y* number of big boxes.

A small box cost \$0.10 and a big box cost \$0.18. If the total number of boxes he purchased was 343 and he spent \$42.70 altogether, by forming a pair of simultaneous equations, find the number of each type of box he purchased.

Answer	1 st equation:	
	2 nd equation:	
	Number of small boxes =	
	Number of big boxes =	[5]

18 (a) A container is made up of a cylinder and a hemisphere. The height of the cylinder is (r+5) cm and the radius of the hemisphere is r cm.

Find an expression, in terms of π and r, for the total surface area of the container.



Answer _____ cm² [4]

(b) Water is poured at a constant rate into the container through a hole as shown below.

Use the grid below to sketch the change in the water level of the container if it takes 1 minute to fill the container with water.



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