PRESBYTERIAN HIGH SCHOOL

MATHEMATICS PAPER 2

1 August 2023

Rest Contraction

4045/02

Tuesday

2 hours

PRESBYTERIAN HIGH SCHOOL PRESBYTERIAN HIGH SCHOOL

2023 SECONDARY FOUR NORMAL (ACADEMIC) PRELIMINARY EXAMINATION

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

INSTRUCTIONS TO CANDIDATES:

Write your name, index number and class on the spaces provided above. 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.

Section A

Answer all questions.

Section B

Answer one 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 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.

Note that all the diagrams in this paper are not drawn to scale.

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														
	Qn	1	2	3	4	5	6	7	8	9	10	11	12	Marks Deducted	TOTAL MARK
	Marks														
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Setter:	Mrs Joyce Yeo
Vetter:	Mr Tan Chee Wee

Question No.

This paper consists of <u>17</u> printed pages (including this cover page) and <u>1</u> blank page.

Mathematical Formulae

Compound Interest

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

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

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

Section A (62 marks) Answer **all** the questions in this section.

1	(a)	Woi	'k out
		(i)	$\sqrt{-12^2 - (-9)^2(-6)}$,
			Answer[1]
		(ii)	$\frac{0.2031}{\sqrt[3]{17.95} + 1.292}.$
			Answer
	(b)	(i)	Write 29.951 correct to 3 significant figures.
			Answer
		(ii)	Write 4.523 million to the nearest ten thousand.
			Answer[1]
2	(a)	Give	en that $3^3 \times 81^{\frac{1}{4}} = 3^m$, find the value of <i>m</i> .

(b) Simplify
$$\sqrt{\frac{9a^7}{a^3}}$$
.

- 3 (a) p is directly proportional to q^3 . Given that p = 24 when q = 2, find
 - (i) the formula connecting p and q,

(ii) the value of q when p = 192.

(b) 5 men can paint a house in 6 days. The house was painted in *n* days. Write down an expression, in terms of *n*, for the number of men needed to paint the house.

4

4 (a) Find 130% of 2 litres in millilitres.

Answerml [1]

(b) A map is drawn to a scale of 1 : 50000.

(i) The perimeter of a reservoir on the map is 22.8 cm. Find the actual perimeter, in kilometres, of the reservoir.

Answerkm [2]

(ii) The actual area of a plantation is 46 km².Calculate the area, in square centimetres, of the plantation on the map.

Answercm² [2]

5 The diagram shows the speed-time graph of a particle over a period of 60 seconds.



Answerm/s² [1]

(c) Calculate the speed of the particle at t = 45.

Answerm/s [2]

(d) The area under the graph represents the total distance travelled. Calculate the total distance travelled by the particle.

Answerm [2]

6 In the diagram, angle AEC = angle ACB = angle CAD = 90°. Angle EAC = 55°, AC = 4.1 cm and CD = 5.4 cm.



Calculate

(a) the length of AD,

Answercm [2]

(b) the length of AB,

Answercm [2]

(c) the angle *ADC*.

7

Answer^o [2]

7 The table shows the number of times students of a class were late for school in a month.

Number of times	0	1	2	3	4
Number of students	6	12	3	8	р

(a) State the largest value of *p* if the mode is 1.

Answer[1]

(b) Find the value of p if the probability of choosing a student who was late more than 2 times is 0.5.

Answer[2]

- (c) It is given that p = 11.
 - (i) Find the mean.

Answer[2]

(ii) A student's record was left out of the table. This student was late 3 times in a month. The table is now updated to include this student's record. Without calculation, explain how the mean will be affected.

Answer

•••••	
	 [1]

(i) Write 1.4 billion in standard form.

Answer[1]

(ii) Calculate the average number of times the lightning strikes the earth in a day, assuming there are 365 days in a year. Write your answer in standard form.

Answer[2]

(b) Solve the simultaneous equations.

$$5x - 2y = 16$$
$$x + 3y = -7$$

Answer $x = \dots$

y =[3]

(c) Solve $3x^2 - 5x - 1 = 0$. Give your answers correct to 2 decimal places.

x	-3	-2	-1.5	-1	0	1	1.5	2	3	4
у	0	10		8	0	-8	-10.125		0	28

(c) Use your graph to find the values of x when y = 5.

9

(d) By drawing a tangent, find the gradient of the curve $y = x^3 - 9x$ when x = 2.5.

Answer[2]



10 The rescue base detected that a group of 12 mountain climbers were stranded on a mountainous area, 230 km away from the base.

A rescue helicopter is sent out for the rescue mission. The rescue helicopter travels at a speed of 306 km/h.



(a) Find the time, in minutes, the helicopter takes to travel 230 km to reach the mountain climbers.

Answermin [2]

Useful information							
Fuel Tank Capacity	760 gallons						
Fuel Consumption	576 litres/ hour						
Estimated time taken for lift off	2 minutes						
Estimated time taken to land	3 minutes						
Estimated time taken to rescue one person	10 minutes						
Source: Sikorsky-S92-multi-mission-helicopter-brochure.							

(b) Given that 1 gallon = 3.785 litres, calculate the fuel tank capacity, in litres, of the helicopter.

Answerlitres [1]

(c) Calculate the time taken, in hours, for the helicopter to run out of 760 gallons of fuel.

Answerhours [1]

(d) The helicopter is unable to land on the mountainous terrain and has to hover for the rescue mission. It can carry 8 passengers in one trip.

Assume the helicopter leaves the rescue base with a full fuel tank, does the helicopter have sufficient fuel for the rescue mission? Show working to support your answer.

Answer

Section B (8 marks)

Answer one question from this section. Each question carries 8 marks.

11 (a) A, B, C and D are points on the circle, centre O. EF is a tangent to the circle at D. Angle $ODA = 43^{\circ}$, angle $BAD = 72^{\circ}$ and angle $COD = 68^{\circ}$.



Stating the reasons clearly, find

(i) angle *CBD*,

Answer^o [1]

(ii) angle ABC,

Answer^o [2]

(iii) angle ADE.

Answer^o [1]

(b) The figure shows a triangle *OAB*. *AC* is the arc of a circle with centre *O* and radius *OA*. OA = 10.2 cm and OB = 13.9 cm. The length of the arc *AC* is 7 cm.



(i) Show that angle *AOB* is 0.686 radian. *Answer*

(ii) Calculate the area of the shaded region.

Answercm² [3]

[1]



12 (a) The cumulative frequency graph shows the wages per week of 80 workers in a shipyard.

Use the graph to

(i) estimate the median wage per week,

Answer \$.....[1]

(ii) estimate the interquartile range,

Answer \$.....[1]

(iii) find the percentage of workers who earn more than \$460 a week.

Answer% [1]

- (b) A box contains 15 red balls and 6 blue balls. Two balls are drawn at random from the box **without** replacement.
 - (i) Complete the tree diagram.



(ii) Find the probability that the second ball drawn is blue.

[1]

(iii) Find the probability that both balls drawn are different in colour.

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