



TAMPINES SECONDARY SCHOOL

Secondary Four Normal Academic PRELIMINARY EXAMINATION 2023

NAME		
CLASS	REGISTER NUMBER	

MATHEMATICS SYLLABUS A

Paper 2

7 August 2023

2 hours

4045/02

Candidates answer on Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register 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.

Section A Answer all questions.

Section B Answer one question.

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 number of marks for this paper is 70.

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.

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 a 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

$$Mean = \frac{\Sigma f x}{\Sigma f}$$

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

Section A (62 marks)

Answer all the questions in this section.

(a) By writing each value correct to 1 significant figure, estimate the value of $\frac{245.5 \times 0.5391}{5.49}$. 1 Show your working.

(b) Write 0.000015 in standard form.

The population of Singapore is 5.45 million in 2021. (c) The area of Singapore is $7.3 \times 10^8 \text{ m}^2$.

> Write 5.45 million in standard form. (i)

(ii) Find the average area, in square metres per person, in Singapore in 2021.

Answer m²/person [1]

2 The stem-and-leaf diagram shows the heights of 12 students.

Stem	Le	af					
11	7	8					
12	0	5	5	5	р	9	
13	2	2	4				
14	2						

Key: 11 | 7 means 117 cm

(a) If the median height is 126 cm, find the value of *p*.

Answer p =[2]

(**b**) Find the range of the heights.

Answer cm [1]

(c) 25% of the students have a height of less than x cm. Find the largest integer value of x.

- 3 A hotel and an airport are 8 km apart. The distance between the hotel and the airport is 3.2 cm on a map drawn to the scale of 1 : n.
 - (a) Find the value of *n*.

(b) The actual area of the airport is 30 km².Find the area, in square centimetre, of the airport on the map.

Answer cm² [2]

4 (a) *ABCDE* is a regular pentagon.



Calculate

(i) angle *BAE*,

Answer[2]

(ii) angle *DCE*,

Answer[1]

(iii) angle *BEC*.

Answer[1]



Angle $ABC = (4x - 21)^\circ$, angle $BAC = (3x + 12)^\circ$ and angle $ACD = (167 - x)^\circ$. *BCD* is a straight line. Find the value of *x*.

(b)



A man is standing at point *S*, on top of a vertical cliff *SR*. The cliff is 200 m above sea level. A boat Q is 210 m away from the base of the cliff.

(a) Find the length QS.

5

Answer m [2]

(b) Find the angle of depression of Q from S.

6 (a)



P, *Q* and *R* are three points on the circumference of the circle. *O* is the centre of the circle. Angle POR = 2.15 radians and OR = 5 cm. Find the area of the shaded segment *PQR*.

(b) Find the percentage of the circle that is shaded.

- 7 (a) 2p-1 is an odd number, where p is an integer.
 - (i) Find, in terms of p, the next odd number after 2p 1.

Answer[1]

(ii) Find, in terms of *p*, the sum of these two odd numbers.

Answer[1]

(iii) Hence, explain why the sum of two odd numbers is always even. *Answer*

Answer $x = \dots$ [3]

(c) Solve the simultaneous equations.

$$4x + 3y = 4$$
$$2x - 5y = -11$$

Show your working.

Answer $x = \dots$

y =[3]

8 (a) Complete the table of values for $y = x^3 - 6x^2 + 9$.

x	-1	0	1	2	3	4	5	6
у		9	4	-7	-18	-23		9

[2]

(b) On the grid, plot the graph of $y = x^3 - 6x^2 + 9$ for $-1 \le x \le 6$.



[3]

(c) By drawing a tangent, find the gradient of the curve $y = x^3 - 6x^2 + 9$ when x = 3.5.

(d) Write down the minimum point of the curve $y = x^3 - 6x^2 + 9$.

Answer (.....)[1]

(e) The line y = k intersects with the curve at three points. Find a possible value of k.

9 Two mobile plans for a mobile phone from a particular service provider are shown in the tables below.

	2-year plan	SIM only 1-year plan
Device cost	\$881	\$2253
Voice calls	800 mins	1000 mins
Number of SMS	800	1000
Monthly subscription	\$130.21	\$45.42
Mobile data	140 gigabytes	140 gigabytes

Excess charges	2-Year plan and SIM only 1-year plan
Voice calls	16.20 cents per minute
Number of SMS	5.40 cents per SMS
Mobile data	\$10.80 / gigabytes capped at \$240.22 / month

(a) Sally bought the mobile phone using the 2-year plan. The device cost is 62.5% of her monthly salary. Calculate her monthly salary.

Answer \$.....[2]

(b) Sally claims that signing up for the 2-year plan is more value-for-money than signing up for two years of the SIM only 1-year plan.
Do you agree with her? Explain your answer with clear working.
Answer

Answer \$.....[2]

(d) Sally can recontract the 2-year plan at \$115 per month. Find the percentage decrease in monthly subscription charges if she recontracts.

Answer % [2]

- 10 The potential energy in a spring, E Joule, is directly proportional to the square of tension applied to the spring, T Newton. The potential energy in the spring is 320 Joules when the tension applied is 4 Newtons.
 - (a) Find the formula connecting E and T.

(b) Find the potential energy in the spring when the tension applied is 10 Newtons.

Answer Joules [1]

(c) Find the tension applied to the spring, when the potential energy is 180 Joules.

Answer Newtons [2]

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 circumference of the circle. O is the centre of the circle and EF is a tangent to the circle at A. Angle $ABC = 62^{\circ}$ and EF is parallel to BC.



Complete these statements by calculating the size of each angle. Give a reason for each statement.

	Reason
Angle <i>AOC</i> =	
Angle <i>ADC</i> =	
Angle <i>BAO</i> =	
	[3]



A boat travels along the path *ABC*. The bearing of *C* from *A* is 046° and the bearing of *B* from *A* is 074° . AB = 90 km and AC = 60 km.

(i) Find the distance *BC*.

(ii) Find the bearing of A from C.

18

Answer[2]

12 (a) Alex has five 10-cent coins, four 20-cent coins, and six 50-cent coins. He picks 2 coins one after another without replacement. The following tree diagram shows the possible outcomes.

19



(i) Complete the tree diagram.

(ii) Find the probability that the two coins add up to \$0.60.

Answer[2]

[1]

(b) 120 customers were queuing at a restaurant and their waiting time were recorded. The results are shown in the cumulative frequency diagram.



(i) Use the diagram to estimate the median waiting time.

Answer mins [1]

(ii) Use the diagram to estimate the interquartile range.

Answer mins [1]

(iii) 28 customers waited more than p minutes. Find the value of p.

(c) The waiting time of 50 customers at a different restaurant is recorded in the table below.

Waiting time (x mins)	$30 < x \le 35$	$35 < x \le 40$	$40 < x \le 45$	$45 < x \le 50$	$50 < x \le 55$
Number of	10	16	13	7	1
customers	10	10	15	,	т

(i) Find the estimated mean waiting time.

Answer mins [1]

(ii) Find the estimated standard deviation.

Answer mins [1]

--- End of Paper ---