智行菘願

MANJUSRI SECONDARY SCHOOL
文 殊 中 學

2024 PRELIMINARY EXAMINATION

Name

Class

Index Number

MATHEMATICS
Secondary Four Normal (Academic) / NT SBB
Paper 2

4045/02
2 August 2024
2 hours

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your Name, index number and class 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 questions. In Section A and answer one question in Section B.
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	
Total	**/ 70**

Parent's / Guardian's Signature: ……..

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 = $4\pi r^2$

$$\text{Volume of a cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2}ab\sin C$$

Arc length = $r\theta$, where θ is in radians

$$\text{Sector area} = \frac{1}{2}r^2\theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

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

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

Section A (62 marks)

Answer **all** the questions in this section.

1 Work out

(a) $\dfrac{-1-\sqrt{6-0.5(2)^2}}{2}$,

Answer ……..... [1]

(b) $\dfrac{5.3^2}{4.83\times 2.4}$.

Answer ……..... [1]

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2 The table shows the land size of 4 countries.

Countries	Area in km^2
India	3.29×10^9
Myanmar	6.77×10^5
Indonesia	1.49×10^6
Vietnam	331 114

Calculate the total land sizes of the four countries, giving your answer in standard form.

Answer ……..... [1]

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3 **(a)** Written as a product of its prime factors, $8640 = 2^x \times 3^y \times 5$ .Find the values of x and y.

Answer x = …… , y = …….. [2]

(b) Written as a product of its prime factors, $378 = 2\times 3^3 \times 7$.
Find the smallest positive integer p, such that $378p$ is a square number.

Answer ……..... [1]

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4 Solve these simultaneous equations.

$$5x - 3y = 23$$
$$2x + y = 18$$

Show your working.

Answer $x =$ …… , $y =$ ……. [3]

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5 Jane bought a bottle of perfume at £62.00 in UK for her mother, inclusive of tax.
The exchange rate between Singapore dollars (S$) and Pound sterling (£) was S$1 = £0.58.
When she returned to Singapore, she found that the same perfume was priced at S$102, before the 9% GST is charged.

The price of the perfume is cheaper in which country,

Singapore or UK?

Answer …… [3]

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6 The stem-and-leaf diagram shows the height, in cm, of plants in a plant nursery.

4	3		
5	1	7	
6	0	1	
7	3	6	6
8	4		

Key 4|3 = 43

(a) State

(i) the modal height,

Answer ……..…. cm [1]

(ii) the median height,

Answer ……..…. cm [1]

(b) Calculate

(i) the mean height,

Answer ..……..... cm [2]

(ii) the standard deviation.

Answer ……..…. cm [1]

7 Rose received a bonus of $5000. She wanted to save it in a bank for 5 years. The bank offered two plans.

Plan A	Plan B
3% simple interest per annum	2.8 % compound interest compounded yearly

Explain which plan should Rose choose? Show your working clearly.

Answer

She should choose Plan …… because ……

…… [4]

8 The points P, Q and R lie on the circumference of a circle. $PQ = 34$ cm, $QR = 16$ cm and $PR = 28$ cm.

Determine if PQ is a diameter.

Answer ……

……

…… [3]

9 The table shows the information of students from 4B and 4C.

	Boys	**Girls**
4B	**23**	**14**
4C	**19**	**16**

Two student supporters are selected at random from the two classes **without replacement**. Find the probability that

(a) the first student chosen is a 4B boy and the second student is a 4C girl,

Answer …… [1]

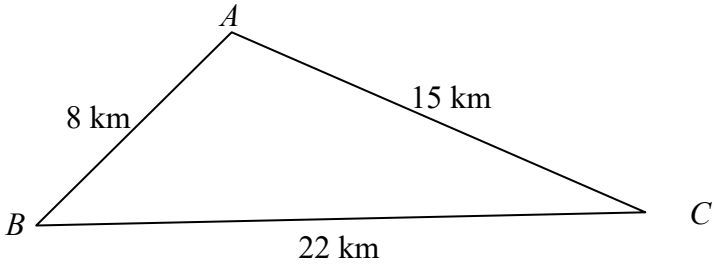
(b) both students chosen are girls,

Answer …… [1]

(c) at least one of the students chosen is from **4B**.

Answer …… [2]

10 A, B and C are three ships on the sea.



Calculate

(a) $\angle ABC$,

Answer ..... ° [3]

(b) the area of ΔABC,

Answer ..... km^2 [2]

(c) the shortest distance from A to BC.

Answer ..... km [2]

11 A hat in the shape of a cone is shown below in figure 1. The measurements are in cm.

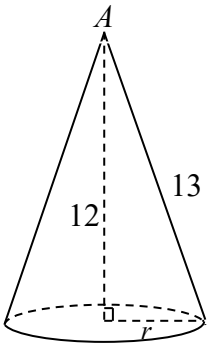


Figure 1

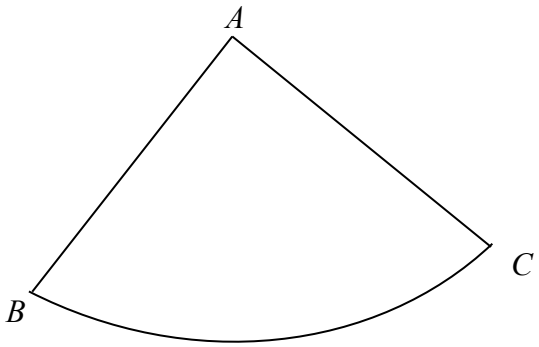


Figure 2

The cone is made from a sector (Figure 2) by joining AB and AC together.

The circumference of the circle of the base of the cone is the arc length of the sector.

Find

(a) the radius, r, of the base circle of the cone,

Answer ..... cm [2]

(b) the circumference of the base circle of the cone,

Answer ..... cm [1]

(c) $\angle BAC$, in radians.

Answer ..... radians [2]

12 Mary bought a washing machine for $2840. She paid a down payment of 20% and repaid the balance in 36 equal monthly instalments. The interest charged was 5% per annum on the remaining amount.

Find

(a) the amount of the down payment,

Answer $ ..... [2]

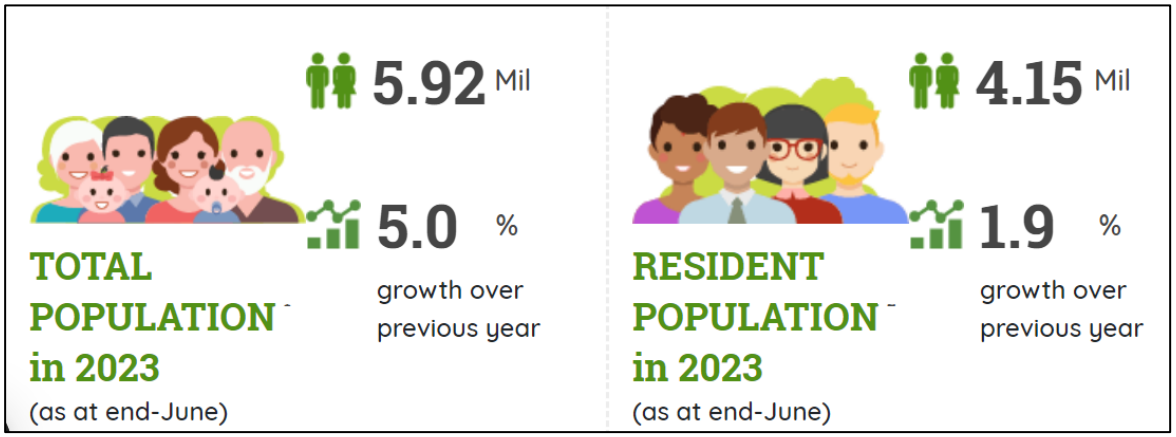
(b) the interest paid,

Answer $ ..... [2]

(c) the amount of each monthly instalment.

Answer $ ..... [2]

13 The infographics below shows Singapore's population in 2023. (https://www.singstat.gov.sg)



** The total population comprises Singapore residents and non-residents.

(a) Using the above information, John calculated some data in the shaded part of the table below.

	Total Population (in million)	Resident Population (in million)	Non-resident Population (in million)
2023	5.92	4.15	*x*
Percentage growth over previous year	5%	1.9%	*z*
2022	*y*	4.07	1.57

Calculate the value of

(i) *x*, the non-resident population in 2023,

Answer x = …….. million [1]

(ii) *y*, the total population in 2022.

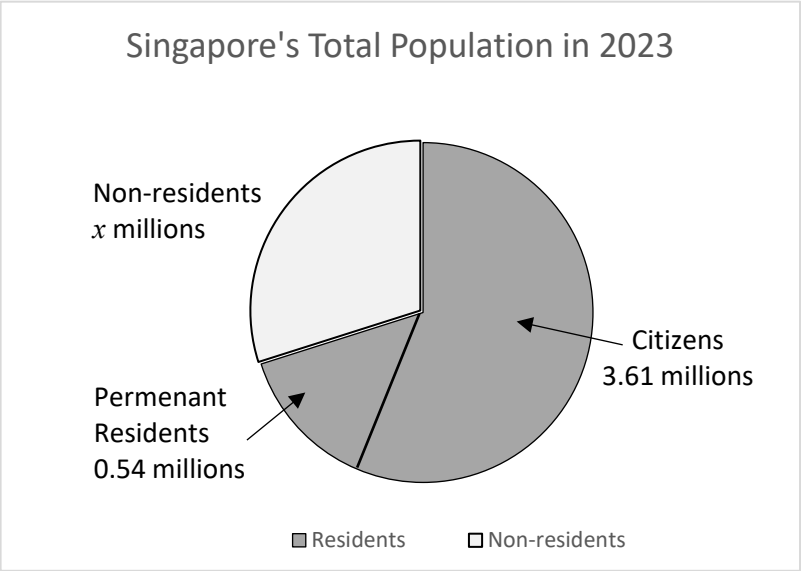
Answer y =…… million [2]

(iii) John's calculated value of z, the percentage growth over previous year for non-resident population is 3.1%. Do you think he is correct? Verify with your working.

Answer ……
……[3]

(b) Resident population comprises Singapore citizens and permanent residents.

Jane created a pie chart below based on the data from the website.



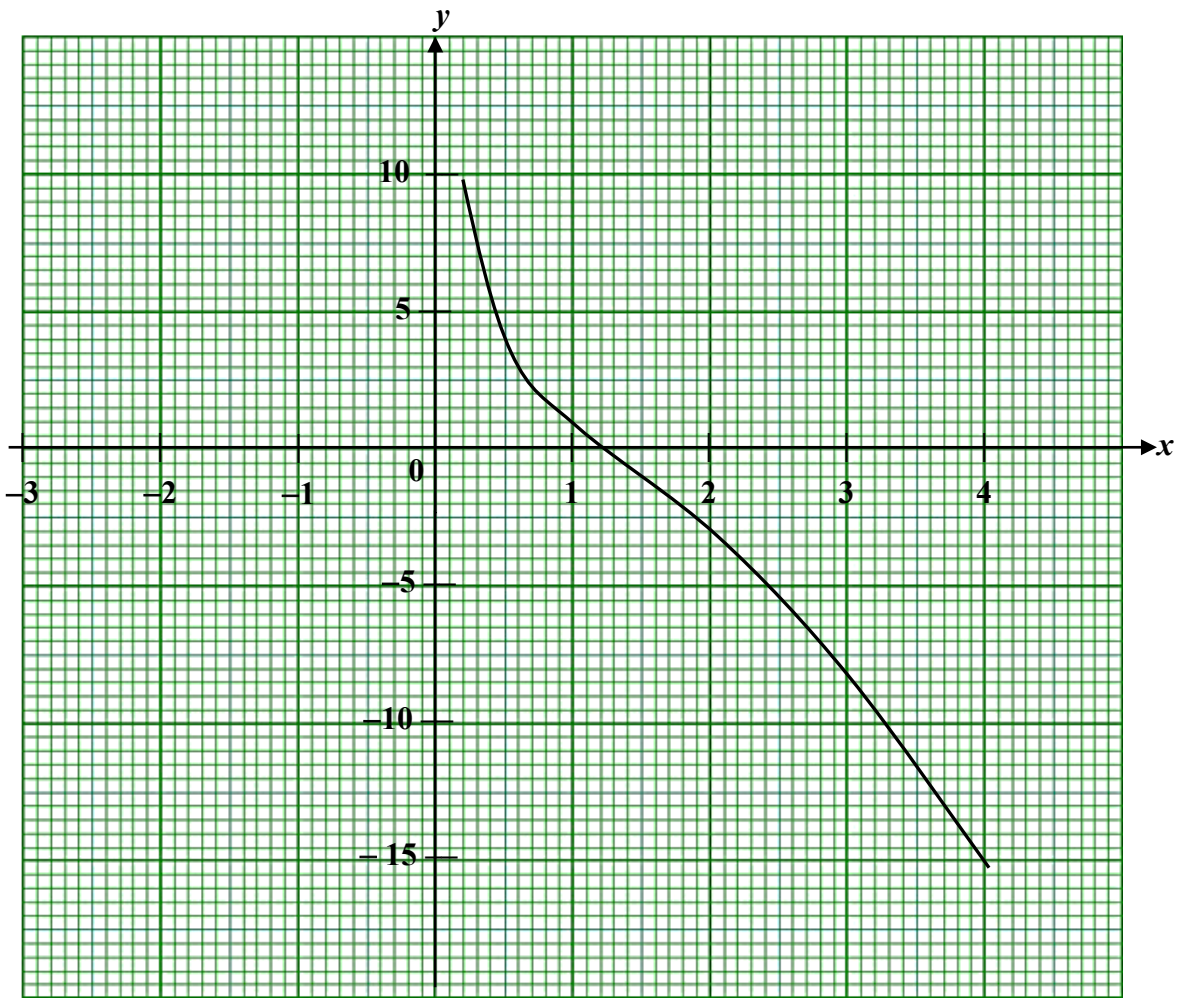
Calculate the angle of the sector representing "Citizens" in the pie chart.
(Cannot be done by measurements)

Answer …… ° [2]

14 **(a)** Complete the table of values for the curve $y = \frac{2}{x} - x^2$. [1]

x	–3	–2.5	–2	–1.5	–1	–0.5
Y	–9.7	–7.05	–5	–3.6	–3	

(b) Draw the graph of $y = \frac{2}{x} - x^2$ for $0.2 \le x \le 4$. A part of the graph of $y = \frac{2}{x} - x^2$ has been drawn for you. [2]



(c) Explain why it is not possible to find a value of y when $x = 0$.

Answer ……

…… [1]

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

Answer $x =$ ..... [2]

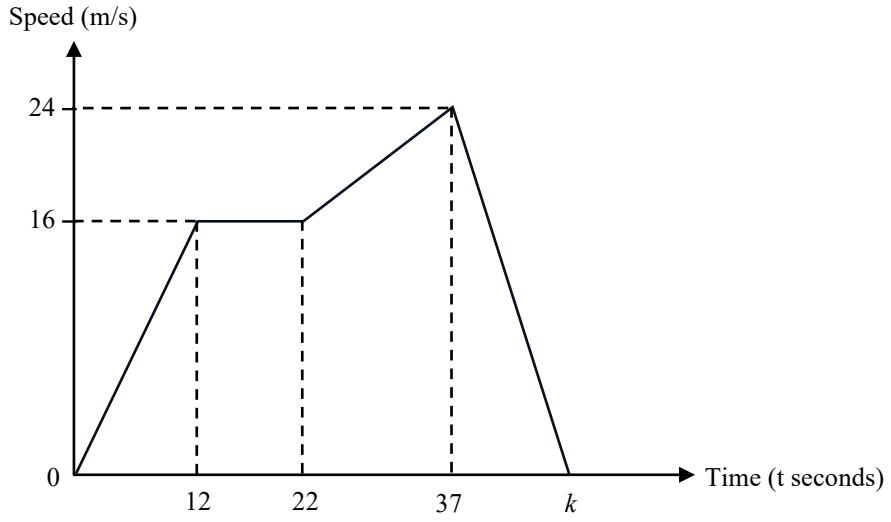
(e) By drawing a suitable tangent, find the gradient of the curve when $x = -2$.

Answer ..... [2]

Section B (8 marks)

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

15 The diagram shows the speed-time graph of a vehicle.



(a) Find the acceleration at $t = 10$.

Answer ……..….. m/s^2 [1]

(b) Given that the distance travelled by the vehicle from $t = 37$ to $t = k$ is 96 m.
Find the value of k.

Answer k = …… [2]

(c) Find the average speed of the whole journey.

Answer …… m/s [3]

(d) Express 24 m/s into km/h.

Answer …… km/h [2]

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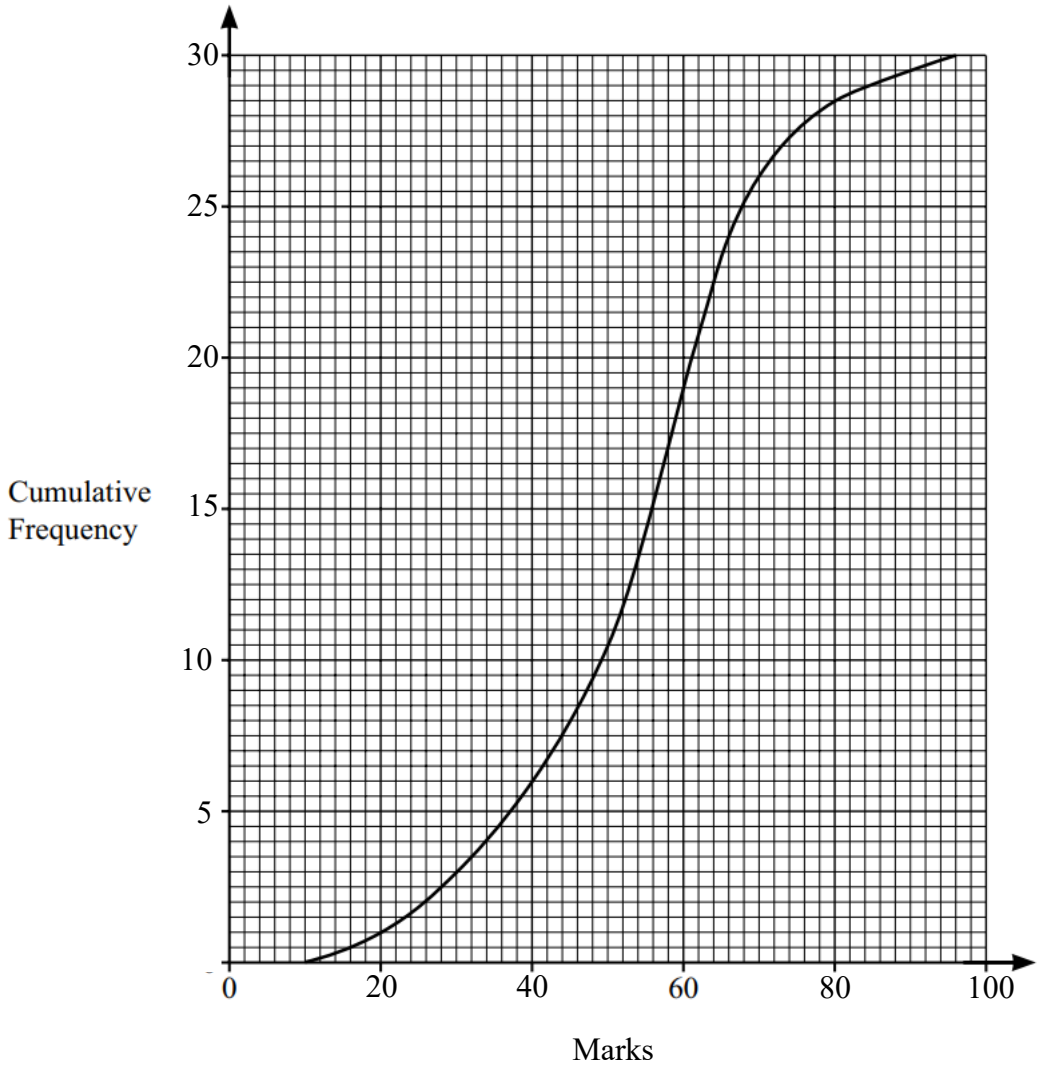
16 **(a)** The marks of students in a Mathematics test in **4H** are recorded.
The results are shown in the cumulative frequency diagram.



(i) Find the inter-quartile range.

Answer ..... marks [2]

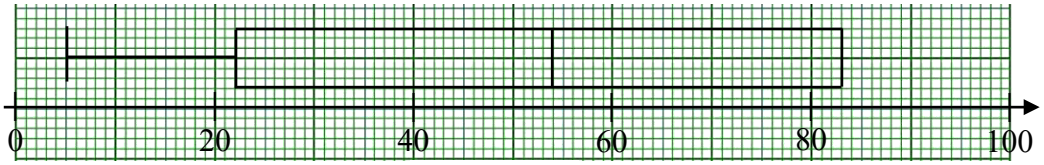
(ii) Find the 90th percentile.

Answer ..... marks [1]

(iii) 20 %of the students scored distinctions. Find the minimum marks for distinction.

Answer ..... marks [2]

(b) The same mathematics test marks of **4I** students are presented in the incomplete box-and-whiskers plot below.



Marks

It is given that the median mass is 54 marks and the range is 93 marks.

(i) Based on the information given, **complete** the box-and-whiskers plot above. [1]

(ii) Find the inter-quartile range for class 4H.

Answer ..... marks [1]

(c) Which class' recorded marks were more consistent on average?
Give a reason for your answer.

Answer

Class ..... because .....

..... [1]

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