BUKIT VIEW SECONDARY SCHOOL

Secondary Four Express/Five Normal (Academic)
Preliminary Examination 2024

CANDIDATE NAME

CLASS

REGISTER NUMBER

Mathematics **4052/02**

Paper 2

20 August 2024

2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, register number and class in the spaces provided on top of this cover page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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.

At the end of the examination, fasten all your work securely together.
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.

Marks
90

Setter: Mrs Irni Prasad Parents' Signature:

This question paper consists of **20** printed pages and **2** blank pages

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Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone $= \pi rl$

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

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

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

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Answer all the questions.

1. **(a)** Factorise completely $x^2 - 4x - xy + 4y$.

Answer …… [2]

(b) Given that $4^{-\frac{1}{2}} = 8^{\frac{1}{4}} \div 2^{x+1}$, find the exact value of x.

Answer x = …… [3]

(c) Given that $k = \dfrac{2h+1}{3h-1}$, express h in terms of k.

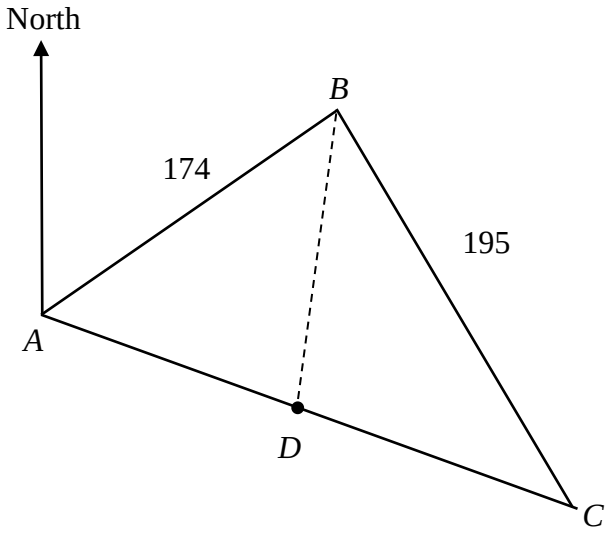
Answer h = …… [2]

(d) Solve $\dfrac{2x}{3} < \dfrac{2x+1}{2} \leq \dfrac{3x+7}{4}$.

Answer …… [3]

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2. The diagram shows three points, *A*, *B* and *C* on the ground.
AB = 174 m and *BC* = 195 m.
The bearing of *A* from *B* is 238°. The bearing of *C* from *A* is 108°.
A point *D* lies on the path *AC* such that it is equidistant to *A* and to *B*



(a) Show that angle *BAC* = 50°.

Answer :

[3]

(b) Find the angle *BCA*.

Answer ……..° [2]

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(c) Find the area of triangle *ABC*.

Answer …… m^2 [3]

(d) Find distance from *C* to *D*.

Answer …… m [4]

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3. The variables x and y are connected by the equation $y = \frac{x^3}{2} - 4x + 3$.

Some corresponding values of x and y are given in the table below.

x	−3.5	−3	−2	−1	0	1	2	2 .5	3
y	−4.4	1.5	p	6.5	3	−0.5	−1	0.8	4.5

(a) Find the value of p.

Answer p = …… [1]

(b) On the graph paper found in the next page, draw the graph of $y = \frac{x^3}{2} - 4x + 3$ for $-3.5 \le x \le 3$. [3]

(c) By drawing a tangent, find the gradient of the curve at x = 2.5.

Answer …… [2]

(d) (i) On the same axes, draw the line $y = -x - 1$ for $-3.5 \le x \le 3$.

Answer [on graph] [1]

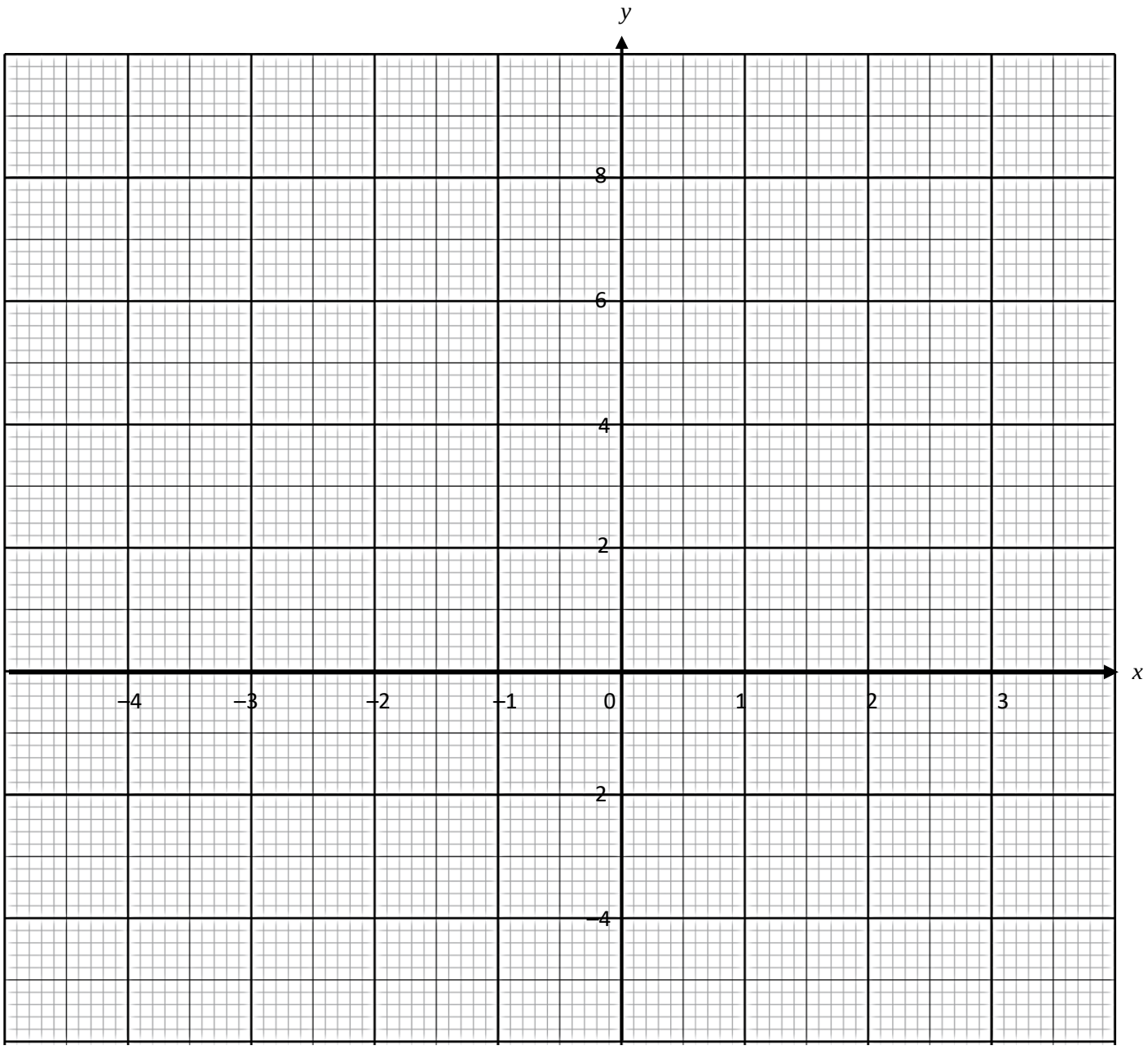
(ii) Write down the x-coordinate of the point where this line intersects the curve.

Answer x = …… [1]

(e) State the minimum value of $y = \frac{x^3}{2} - 4x + 3$ for $0 \le x \le 3$.

Answer …… [1]

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(f) The equation $\frac{x^3}{2} - 4x + 5 = 0$ has only one solution.

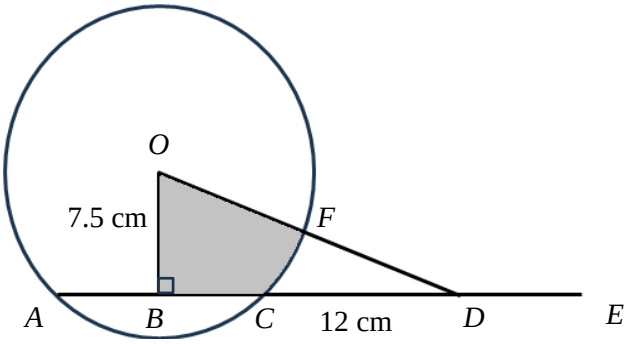
Explain how this can be seen from your graph.

Answer :

[2]

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4. The diagram shows a circle with centre O.
$ABCDE$ is a straight line. $AC = CD$ and line OD meets the circle at F.
It is given that $OB = 7.5$ cm, $CD = 12$ cm and $\angle OBD = 90°$.



(a) Find the length of OD.

Answer …… cm [1]

(b) Without the use of a calculator, find the value of $\cos \angle ODE$ in its simplest form.

Answer …… [1]

(c) Show that angle COD is approximately 0.501 rad.

Answer :

[3]

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(d) Find the perimeter of shaded region.

Answer ……. cm [3]

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5. A lead technician working with his trainee, can repair a machine in 4.2 hours together. If each of them worked alone, the lead technician would take x hours, while the trainee will need 3.5 hours more.

(a) If each of them worked alone, find in terms of x,

(i) the fraction of work done by the lead technician in one hour,

Answer …… [1]

(ii) the fraction of work done by the trainee in one hour.

Answer …… [1]

(b) Form an equation and show that it reduces to $10x^2 - 49x - 147 = 0$.

[3]

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(c) Solve $10x^2 - 49x - 147 = 0$.

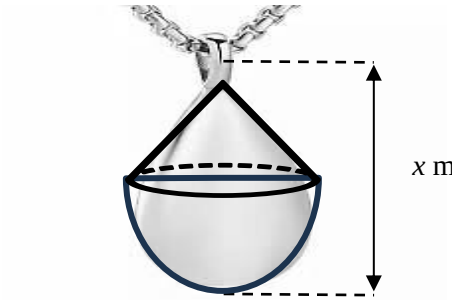
Answer $x =$ ……. or $x =$ ……. [3]

(d) Hence, find the number of hours needed to repair the machine by **two trainees**.

Answer ……. h [1]

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6. A gold pendant is made by joining a hemisphere and a cone.



(a) The radius of the hemisphere is 6 mm.
The volume of the pendant is 0.2π cm^3.

Find x, the height of the pendant in mm.

Answer x =……..… [4]

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(b) The mass of the pendant is 1.8π grams.

The gold pendant is priced at \$101.60 per gram.

(i) Mrs Tan bought it at a discount and paid \$528.60.

Calculate the percentage discount given, correct to the nearest whole number.

Answer ……..…..…… % [3]

(ii) A week later, the shop removed the discount offer.
Mr Pang bought the pendant. He also bought a gold chain priced at \$810.

He paid a downpayment of \$200 and paid the balance with a fixed interest rate of 5.3% per annum for a period of 4 months.

Calculate the amount of each monthly instalment, correct to the nearest 10 cents.

Answer \$ ……..…..…… [4]

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7. A class of 40 Secondary Four students were asked how much time they have spent on social media in the last week.

The results are shown in the table.

Time spent (x hours)	$0 < x \leq 10$	$10 < x \leq 20$	$20 < x \leq 30$	$30 < x \leq 40$	$40 < x \leq 50$
Frequency	p	6	12	q	3

The lower quartile of the time spent on social media was 20 hours.

(i) Show that $p = 4$.

[2]

(ii) Hence state the value of q.

Answer $q =$ …… [1]

(iii) Estimate the mean number of hours spent by the students.

Answer …… [2]

(iv) Estimate the standard deviation.

Answer …… [1]

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A class of 40 Secondary Three students were asked how much time (in hours) they have spent on social media in the last week.

The results are summarised in the table.

Mean	15.8
Standard Deviation	10.9

(v) Make two comparisons between the number of hours spent on social media by the Secondary Three students and by the Secondary Four students. Use the data to support your answers.

Answer

……

……

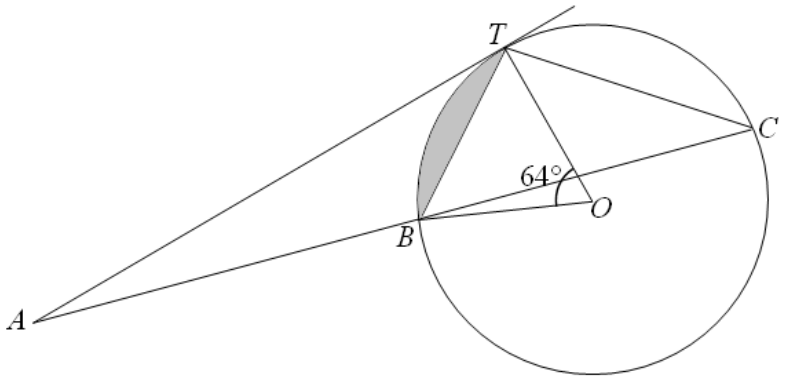
……

……

…… [2]

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8.



In the diagram, AT is a tangent to the circle, centre O.

A line through A meets the circle at B and C.

It is given that angle $TOB = 64°$.

(a) Find each of the following angles, stating your reason(s) clearly.

(i) $\angle BCT =$ …….. °.

Reason : ……. [1]

(ii) $\angle BTO =$ …….. °.

Reason : ……. [1]

(b) Hence or otherwise, show that triangle ATB and triangle ACT are similar.

Answer :

[3]

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(c) Given that $AB = 4.5$ cm and $BC = 3.5$ cm, find the length of AT.

Answer …… cm [2]

(d) Find the value of $\frac{\text{Area } \Delta ABT}{\text{Area } \Delta BCT}$.

Answer …… [1]

(e) Given that the radius of the circle is 1.8 cm, find the area of the shaded segment.

Answer …… cm^2 [3]

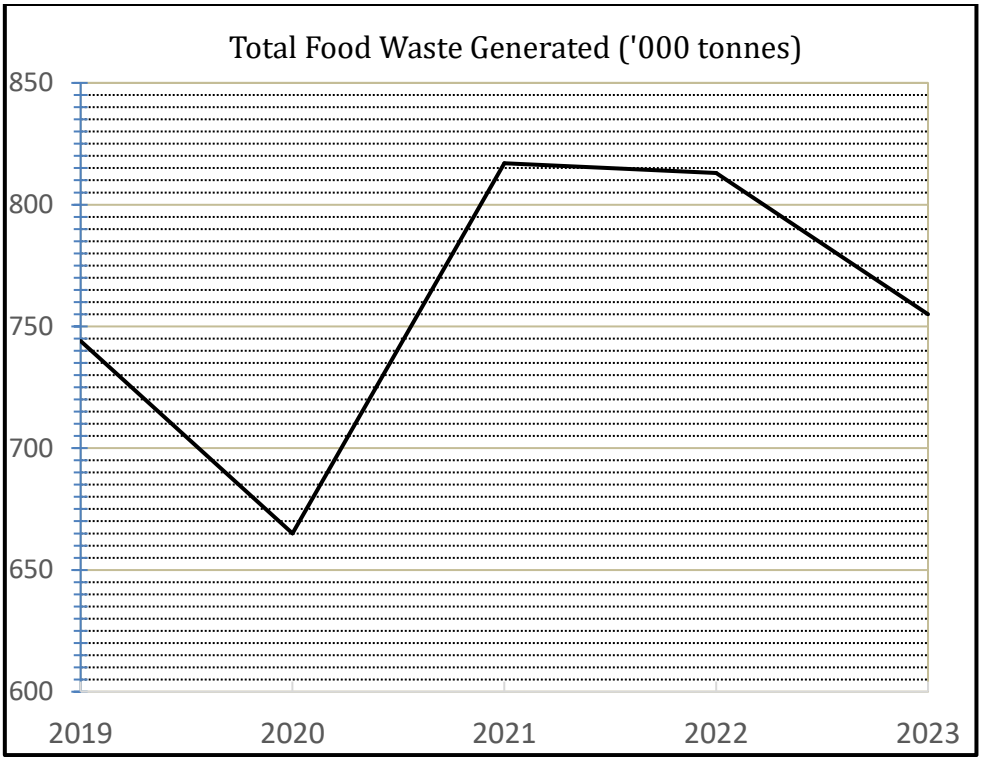
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9. To achieve **Singapore's Zero Waste Masterplan goal**, the government aims to reduce food waste by 30% by 2030.

The annual waste and recycling statistics from the National Environment Agency shows the amount of food waste generated (in 1000 tonnes) in Singapore from 2019 to 2023.



[Source: NEA Website on Waste Statistics]

Year	Estimated Singapore Population
2022	5.64 million
2023	5.9 million

The National Environment Agency (NEA) reported that in **2022**, Singapore generated 813 000 tonnes of food waste annually.

[1 Tonne = 1000 kg]

(a) Express 813 000 tonnes in kg, in standard form.

Answer : ……..…… kg [1]

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(b) Calculate the average mass, in kg, of food waste **per person**, **per day**, in **2022**.

Answer : …… kg [2]

Mrs Kim's household is made up of **5 persons** altogether.

The table below shows the estimated average mass of food wastage (in kg) for the three meals in her household in 2022.

Breakfast	Lunch	Dinner
0.25	0.9	1.25

(c) Calculate the average mass, in kg, of food waste per person in Mrs Kim's household, per day, in 2022.

Answer : …… kg [1]

According to NEA, **a household of 5 persons** can reduce food waste in these 4 ways.

Ways to reduce food waste	**Estimated food waste reduction**
Composting	4.9 kg per week
Utilising leftovers	175 g per day
Keeping track of expiry dates	0.8 kg per week
Proper storage	2.4 kg per month

In 2023, Mrs Kim encouraged her family to reduce their food waste by implementing the methods listed above. However, Mrs Kim's household does not have a food composting machine.

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(d) Determine if Mrs Kim's household managed to reduce their food waste more effectively than the national average mass. Provide your reasoning and calculations clearly.

Working:

Answer : ……..

…… [6]

End of Paper

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