

NOTES

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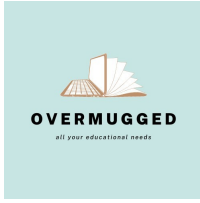


SEPTEMBER HOLIDAY REVISION

SEC 3 E-MATH

Instructions:
Please complete your
Mock Exam Paper
under timed conditions
and bring it for class.





SECONDARY 3 MATHEMATICS

Quadratic Graphs, Similarity of 3D Figures, Circular Measure

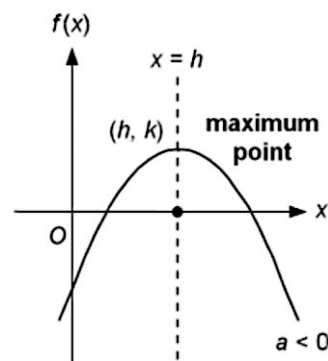
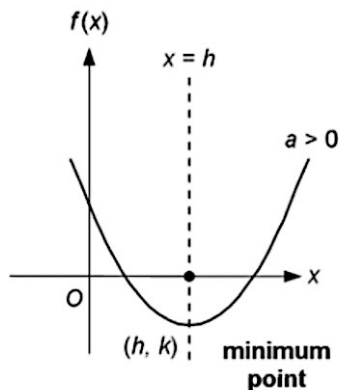
Name: _____

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Quadratic Graphs

1. Sketching of graphs $y = ax^2 + bx + c$

- Identify the shape of the quadratic graph based on the signature of the quadratic coefficient a .
- y - intercepts of the graph can be obtained by solving for $x = 0$.
- x - intercepts of the graph can be obtained by solving for $f(x) = 0$.
- Determine the Maximum/Minimum values with the above mentioned 3 methods.



Curve	Assumptions	Feature
$y = \pm(x - h)^2 + k$	$h, k > 0$	(h, k) is the turning point of the graph
$y = \pm(x - p)(x - q)$	$p, q > 0$	$(p, 0)$ and $(q, 0)$ are the x -intercepts

2. Find the roots of quadratic equations

a) Factorisation

- This method works when the equation is easily factorized.
- Factorise $f(x) = ax^2 + bx + c = 0$ to get the product of its linear factors $a(x - p)(x - q) = 0$ where p and q are known as the roots of the equation.
- Use the multiplication property that when $ab = 0 \Rightarrow a = 0$ or $b = 0$

b) Quadratic Formula

- The roots of the equation $y = ax^2 + bx + c = 0$ can be obtained with

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, a \neq 0$$

c) Completing the Square

- Rearrange the quadratic equation $f(x) = ax^2 + bx + c = 0$ in the form of

$$f(x) = a(x - h)^2 + k = 0$$

- Make $(x - h)^2$ the subject of the equation

$$f(x) = (x - h)^2 = \frac{k}{a}$$

Take note that when square rooting on both sides, must take both the positive and negative of a square root

- Take the square roots of both sides of the equation and solve for the values of x

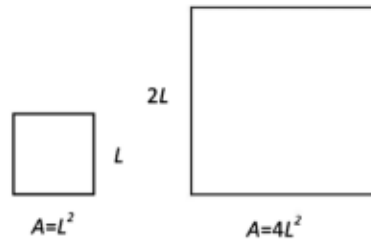
$$x = h + \sqrt{\frac{k}{a}} \quad x = h - \sqrt{\frac{k}{a}}$$

Similarity of 3D Figures

Remember - If the figures are similar, we do not need to find the dimensions of the figure, nor use area/volume formulas to find the area and volume!

Area of similar planar figures

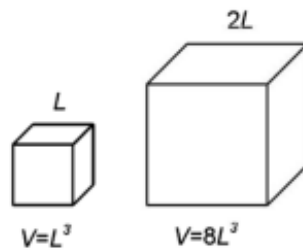
If 2 figures are similar, then the ratio of their areas is equal to the square of the ratio of the lengths of any pairs of corresponding sides.



$$\frac{A_1}{A_2} = \left(\frac{I_1}{I_2}\right)^2 = \frac{(I_1)^2}{(I_2)^2}$$

Volume of similar planar figures

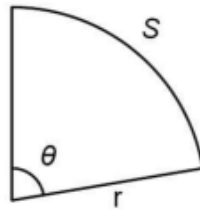
If 2 solids are similar, then the ratio of their volumes is equal to the cube of the ratio of the lengths of any pairs of corresponding sides



$$\frac{V_1}{V_2} = \left(\frac{I_1}{I_2}\right)^3 = \frac{(I_1)^3}{(I_2)^3}$$

Circular Measure

The shape below is known as a sector, which is cutting a fraction out from a circle. Using fractions, we have the following formulas.



$$\text{Arc length} = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Area of sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

Where $2\pi r$ and πr^2 gives the circumference of the circle and area of circle respectively.

Using **radians** to measure the angle instead of degrees, since $180^\circ = \pi$ radians, we have,

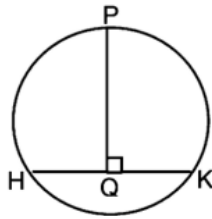
$$\text{Arc length} = \frac{\theta}{2\pi} \times 2\pi r = r\theta$$

$$\text{Area of sector} = \frac{\theta}{2\pi} \times \pi r^2 = \frac{1}{2}r^2\theta$$

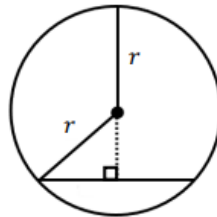
These formulas allow us to calculate the arc length and area of a sector much more easily. Remember however, that the angle has to be measured in radians instead of degrees!

2 Common (but difficult) figures in exams!

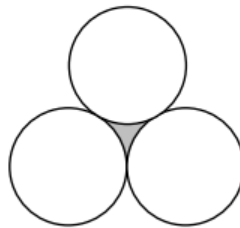
1. Find the radius of the following figure (given lengths HK and PQ)



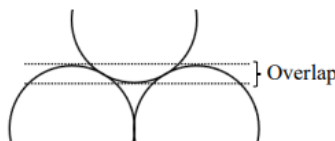
- **Concept:** Recall that any line from the centre of the circle to the circumference is the radius. A right-triangle can be drawn in the figure and, by Pythagoras' Theorem, the radius can be found



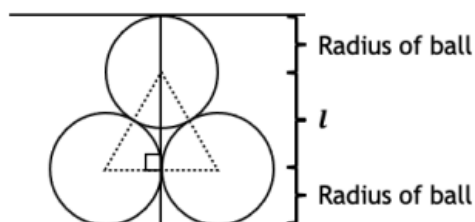
2. Find the height of the following figure.



- **Common mistake:** Since there is a portion that overlaps (shown below), the height of the figure is not simply 2 times of the length of the diameter.



- To find the height, we must inscribe a triangle within the 3 circles where the sides of the triangles are made up with 2 radii of the circle.





**END OF YEAR MOCK EXAMINATION
SECONDARY 3
BASED ON 2024 SEAB SYLLABUS**

MATHEMATICS

Paper 1

4048/01

September 2024

75 minutes

READ THESE INSTRUCTIONS FIRST

Write in dark blue or black pen.

You may use HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** the questions.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

You are expected to use an approved scientific calculator.

Unsupported answers from a scientific calculator are allowed unless a question specifically states otherwise.

Where unsupported answers from a scientific calculator are not allowed in a question, you are required to present the mathematical steps using mathematical notations and not calculator commands.

You are reminded of the need for clear presentation in your answers.

The number of marks is given in brackets [] at the end of each question or part question.

1. a. Rearrange the formula $c = \frac{d^2+5}{d^2-3}$ to make d the subject. [3]
[PHS 2022 Prelim Exam P2 Q1]

- b. Write as a single fraction in its simplest form $\frac{3}{(x-2)^2} - \frac{1}{2-x}$. [2]

c. Solve these simultaneous equations.

$$5x + 3y = 14$$

$$3x + 5y = 18$$

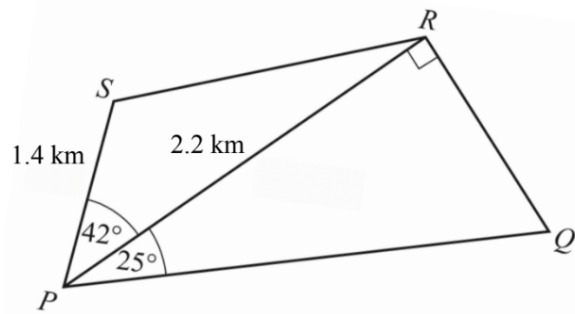
You must show all your working clearly.

[3]

d. Solve the equation $\frac{2x-1}{5x-6} = \frac{1}{2x-3}$.

[3]

2. The diagram shows a plot of land that is in the shape of a quadrilateral $PQRS$ where $PR = 2.2$ km and $PS = 1.4$ km. Angle $PRQ = 90^\circ$, angle $RPQ = 25^\circ$ and angle $SPR = 42^\circ$.
[SST 2020 Prelim Exam P2 Q5]



- a. Calculate the length of QR . [2]

- b. Calculate the area of the plot of land. [3]

- c. Determine whether it is possible to build a circular fence such that points P , Q , R and S lie on the circumference of a circle.
Justify your decision and show your calculations clearly. [4]

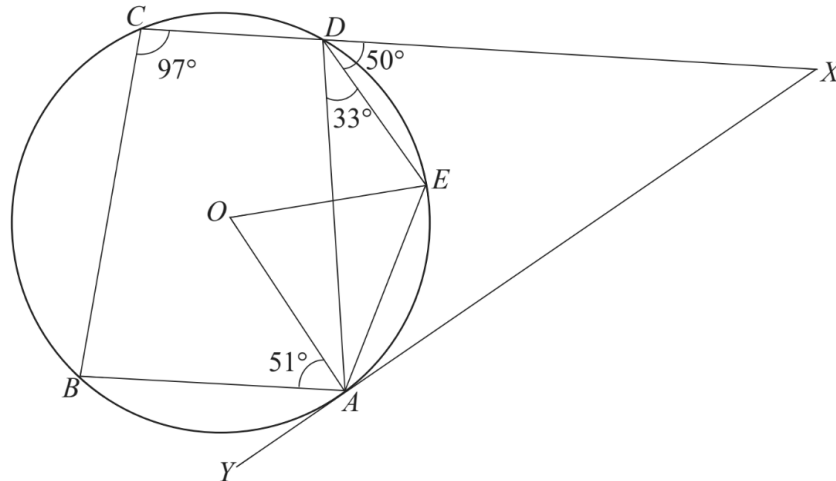
3. The diagram shows a circle $ABCDE$ with centre O .

XY is a tangent to the circle at A .

CDX is a straight line.

Angle $ADE = 33^\circ$, angle $BAO = 51^\circ$, angle $BCD = 97^\circ$ and angle $EDX = 50^\circ$.

[CGS 2022 Prelim Exam P2 Q6]



a. Find angle AOE . State the reason clearly.

[1]

b. Find angle XAE .

Give a reason for each step of your working.

[2]

- c. Explain why BA is parallel to CX .
Give a reason for each step of your working. [2]

- d. Hence, or otherwise, find angle AXD . State the reasons clearly. [3]

4. The variables x and y are connected by the equation $y = \frac{x^2}{5} + \frac{4}{x}$.

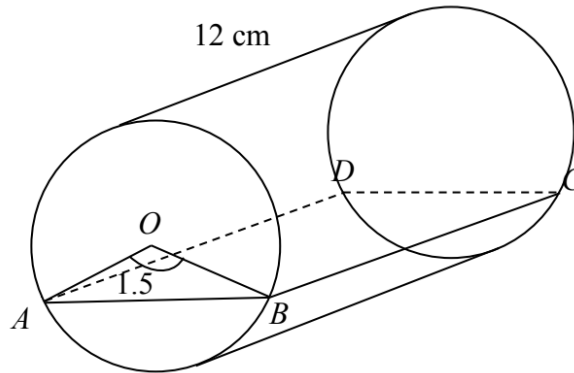
The table below shows some corresponding values of x and of y , correct to 2 decimal places.

[PHS 2023 Prelim Exam P2 Q3]

x	0.5	1	1.5	2	2.5	3	4	5
y	8.05	4.20	3.12	2.80	2.85	3.13	4.20	5.80

- a. On a piece of graph paper, draw the graph of $y = \frac{x^2}{5} + \frac{4}{x}$ for $0.5 \leq x \leq 5$.
Plot the points given in the table and join them with a smooth curve. [3]
- b. By drawing a tangent, find the gradient of the curve at $x = 3$. [2]
- c. i. On the same grid, draw the line $y = 7 - \frac{1}{2}x$ for $0 \leq x \leq 5$. [1]
- ii. Write down the x -coordinates of the points where the line intersects the curve. [2]
- iii. Find the equation, in the form $2x^3 + ax^2 + bx + c = 0$, which is satisfied by the values of x found in (c)(ii). [2]
- d. Use your graph to find the values of x in the range $0 \leq x \leq 5$ for which $0.2x^2 + \frac{4}{x} - 2 = 3$. [2]

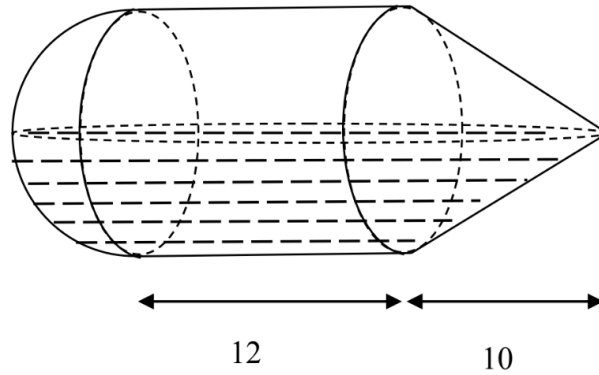
5. a. The figure below shows a cylindrical container of length 12 cm. The circular end of the container has a centre O . 240 cm^3 of water is poured into the cylindrical container to fill the container up to the level such that $\angle AOB = 1.5$ radians. [CHIJ SJC 2022 Prelim Exam P2 Q7]



- i. Show that the radius of the cylindrical container is 8.92 cm. [3]

- ii. Calculate the surface area of the water that is exposed inside the container. [3]

- b. The container is modified as shown below with a cone and hemisphere attached at the two ends of the container. Water is poured into the container up to the level shown in Figure 2, which is exactly at the halfway level. Calculate the area of the container that is in contact with water. [4]





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Bukit Timah	Saturday	12PM-2PM
Jurong East	Saturday	4PM - 6PM

Pure Physics

Kovan	Monday	5PM-7PM
Marine Parade	Tuesday	5PM - 7PM
Tampines	Thursday	7.30PM - 9.30PM
Jurong East	Saturday	11AM - 1PM
Bukit Timah	Saturday	2PM-4PM

Pure Biology

Tampines	Tuesday	5PM - 7PM
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Kovan	Sunday	10AM-12PM

E-Math

Kovan	Tuesday	7PM-9PM
Tampines	Thursday	7.30PM - 9.30PM
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Jurong East	Friday	7.30PM - 9.30PM
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Bukit Timah	Saturday	5PM-7PM