## 2022-2023-S4 2nd TERM EXAM-MATH-CP 1

2022-2023 S4 $2^{\text {nd }}$ TERM EXAM MATH CP PAPER 1

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2022-2023
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S4 Second Term Examination

MATHEMATICS Compulsory Part

## PAPER 1

## Question-Answer Book

$12^{\text {th }}$ June, 2023
8:15 am - 9:45 am (1 hour 30 minutes)
This paper must be answered in English

## INSTRUCTIONS

1. Write your name, class and class number in the spaces provided on this cover.
2. This paper consists of THREE sections, $\mathrm{A}(1)$, $\mathrm{A}(2)$ and B .
3. Attempt ALL questions in this paper. Write your answers in the spaces provided in this Question - Answer Book. Do not write in the margins. Answers written in the margins will not be marked.
4. Unless otherwise specified, all working must be clearly shown.
5. Unless otherwise specified, numerical answers should be either exact or correct to 3 significant figures.
6. The diagrams in this paper are not necessarily drawn to scale

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| Sections | Marks |
| :---: | :--- |
| $\mathrm{A}(1-4)$ |  |
| $\mathrm{A}(5-10)$ |  |
| A Total | $/ \mathbf{/ 2 2}$ |
| B Total |  |
| TOTAL |  |

## Section A(1) (23 marks)

1. Simplify $\frac{\left(3 a^{3} b^{-4} c^{0}\right)^{2}}{a^{2} b^{-2}}$ and express your answer with positive indices.
2. Factorize
(a) $2 a b+4 b$,
(b) $6 a^{2}+8 a-8$,
(c) $2 a b+4 b-6 a^{2}-8 a+8$.
3. Make $y$ the subject of the formula $p y=-q(3+r y)$.
4. The marked price of a painting is $\$ 1200$. In the clearance sale, the painting is sold at a discount of $70 \%$ on its marked price.
(a) Find the selling price of the painting.
(b) If the loss percentage is $10 \%$, find the cost of the painting.
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5. Consider the equation $3 x^{2}+9 x+k=2$ which has two distinct real roots.
(a) Find the largest integral value of $k$.
(b) Using the value of $k$ obtained in (a), solve the equation.
6. In the figure, $O$ is the centre of the circle. It is given that $\angle O B A=50^{\circ}$ and $\angle O C A=20^{\circ}$. Find $x, y$ and $z$.


## Section A(2) (25 marks)

7. The figure shows the graph of $y=f(x)=x^{2}+a x+b$. It cuts the $x$-axis at $A(p, 0)$ and $B(q, 0)$ where $p>q$ and cuts the $y$-axis at $D(0,-12)$. The graph passes through the point $(-5,-7)$.

(a) Find the values of $a$ and $b$.
(2 marks)
(b) If a horizontal line passes through the $y$-intercept and cuts the graph of $y=f(x)$ at
(b) If a horizontal line passes through the $y$-intercept a
another point $C$, find the area of the trapezium $A B C D$.
8. In the figure, circles $C_{1}$ and $C_{2}$ intersect at $A$ and $D . F A B$ and $E D C$ are straight lines. $A E$ and $F D$ intersect at $G$ such that $\angle A G D=94^{\circ}$. If $\angle A B C=102^{\circ}$ and $\angle A E D=40^{\circ}$, find $\angle B C D$.

9. Let $f(x)=4 x^{3}+a x+b$, where $a$ and $b$ are constants. It is given that $2 x-1$ is a factor of $f(x)$. When $f(x)$ is divided by $x-2$, the remainder is $28-5 b$.
(a) Find the values of $a$ and $b$.
(b) Simon claims that the equation $f(x)=4 x-2$ has 3 distinct real roots. Do you agree? Explain your answer.
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Answers written in the margins will not be marked
10. The straight line $L_{1}: 2 x+y-10=0$ cuts the $x$-axis and the $y$-axis at $A$ and $B$ respectively. The straight line $L_{2}$ cuts the $x$-axis at $C$. $L_{2}$ passes through $B$ and is perpendicular to $L_{1}$. A straight line perpendicular to $L_{2}$ from the origin $O$ is drawn to meet $L_{2}$ at $D$.

(a) Write down the coordinates of $A$ and $B$.
(b) Find the equation of $L_{2}$.
(c) Find the ratio of the area of $\triangle O D C$ to the area of quadrilateral $O A B D$.
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## Section B (22 marks)

11. Solve the logarithmic equation $\log _{2}(x+1)+\log _{2}(3 x-2)=3$.
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12. Solve the equation $3^{2 x}+2\left(3^{x}\right)=3$.
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Answers written in the margins will not be marked
13. The graph below shows the linear relation between $\log _{9} x$ and $\log _{3} y$. The slope and the intercept on the horizontal axis of the graph are $\frac{4}{9}$ and 9 respectively. Express $y$ in terms of $x$.

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14. In the figure, the circles $A B Q$ and $C D Q$ touch externally at $Q$ and $P Q R$ is a common tangent to the two circles. The straight line $P C S$ is the tangent to circle $C D Q$ at $C . O$ is the centre of circle $A B Q . P A O B$ and $B Q C$ are straight lines and $\angle A B Q=30^{\circ}$.

(a) Find $\angle B P Q$.
(b) Prove the $\triangle P Q C$ is an equilateral triangle.
(c) Prove that $A, Q, C$ and $P$ are concyclic.
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15. (a) Simplify $\frac{1-2 i}{3+i}$ and express the answer in the form of $a+b i$.
(b) Hence solve the equation $2 i+(3+i) z=5-8 i$.
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