

MATHEMATICS Compulsory Part PAPER 1

## Question-Answer Book

$4^{\text {th }}$ January, 2022
8:15 am - 9:15 am (1 hour)
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. dawn


| Section | Marks |
| :---: | ---: |
| A $(1-3)$ |  |
| A $(4-8)$ | $/ 37$ |
| A Total | $/ \mathbf{1 3}$ |
| B Total |  |
| TOTAL |  |

Section A(1) (16 marks)

1. Simplify $\frac{\left(2 x^{5} y\right)^{3}}{\left(x y^{4}\right)^{6}}$ and express your answer with positive indices.
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2. Make $h$ the subject of the formula $\frac{7 h-11}{h+5 k}=4$.
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3. Simplify $\frac{4 x-16}{x^{2}-16} \times \frac{x^{2}+2 x-8}{6}$.
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4. Simplify $(\sqrt{27 k}-6 \sqrt{2})(\sqrt{3 k}+\sqrt{8})$.
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5. When $2 x^{3}+11 x^{2}+3 x-3$ is divided by $x^{2}+3 x-1$, the quotient and the remainder are $2 x+k$ and $r x+2$ respectively. Find the values of $k$ and $r$.
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## Section A(2) (21 marks)

6. Let $f(x)=6 x^{3}+m x^{2}+n x-6$, where $m$ and $n$ are constants. $f(x)$ is divisible by $x+3$. When $f(x)$ is divided by $x-1$, the remainder is 12 .
(a) Find the values of $m$ and $n$.
(b) Someone claims that all the roots of the equation $f(x)=0$ are rational numbers. Do you agree? Explain your answer.
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7. It is given that the quadratic equation $x^{2}-6 x+39=10 k$ has two distinct real roots, where $k$ is a constant.
(a) Find the range of the values of $k$. (3 marks)
(b) Take the smallest possible integral value of $k$ from the result of (a). Solve the quadratic equation and express the answers in surd form.
8. In Figure 1, the straight line passing through $A$ and $B$ is perpendicular to the straight line passing through $A$ and $C$, where $C$ is a point lying on the $y$-axis.
(a) Find the equation of the straight line passing through $A$ and $B$. (2 marks)
(b) Find the coordinates of $C$.
(c) Find the area of $\triangle A B C$. (3 marks)
(d) A straight line passing through $A$ cuts the line segment $B C$ at $D$ such that the area of $\triangle A B D$ is 50 square units. Find $B D: D C$.
(2 marks)


Figure 1
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## Section B (13 marks)

9. The equation of the parabola $\Gamma$ is $y=x^{2}+4 x-k^{2}$, where $k$ is a real constant.
(a) Does $\Gamma$ cut the $x$-axis? Explain your answer. (2 marks)
(b) Let $P$ be the vertex of $\Gamma$. Express the coordinates of $P$ in terms of $k$. (2 marks)
(c) Denote the straight line $2 x+y+9=0$ by $L$. If $\Gamma$ and $L$ intersect at $M$ and $N$, find the coordinates of the mid-point of $M N$.
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10. Let $\alpha$ and $\beta$ be the roots of the quadratic equation $2 x^{2}+4 x+7=0$.
(a) Without finding the values of $\alpha$ and $\beta$, find the value of $\alpha^{2}+\beta^{2}$.
(b) Form a quadratic equation in $x$ with roots $\frac{2 \beta}{\alpha}$ and $\frac{2 \alpha}{\beta}$.
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## END OF PAPER

