
$6^{\text {th }}$ January, 2020.
8:15 a.m. - 9:15 a.m. (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.


| Section | Marks |
| :---: | :---: |
| $\mathrm{A}(1-3)$ |  |
| $\mathrm{A}(4-8)$ | $/ \mathbf{3 5}$ |
| A Total | $/ \mathbf{1 5}$ |
| B Total |  |
| TOTAL |  |

Section A(1) (19 marks)

1. Simplify $\frac{\left(a^{2} b\right)^{-3}}{a^{-4} b}$ and express your answer with positive indices.
2. Make $p$ the subject of the formula $2 m=\frac{4 n+5 p}{3 p}$.
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3. Factorize
(a) $2 a^{2}-9 a b+9 b^{2}$,
(b) $2 a^{2}-9 a b+9 b^{2}-4 a+6 b$.
4. Solve the quadratic equation $(y+2)(y+3)=5$ and express your answers in surd form if necessary.
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5. It is given that $h(x)=x^{2}-9 x+k$ and $h(4)=-2$, where $k$ is a constant.
(a) Find the value of $k$.
(b) Find the value(s) of $a$ such that $h(a)=10$.
6. Simplify $\frac{4}{2 x-7}-\frac{3}{3 x-2}$.
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## Section A(2) (16 marks)

7. In the figure, the coordinates of $A$ and $C$ are $(6,18)$ and $(30,0)$ respectively.
(a) Find the equation of the straight line $A C$. (2 marks)
(b) If $B(0, b)$ is a point on the $y$-axis such that $A B \perp A C$. Find the value of $b$.
(c) Find the area of $\triangle A B C$.
(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 120 square units. Find $B D: D C$.
(2 marks)


Figure 1
8. 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 $a$ and $b$ (3 marks)
(b) Tracy claims that the equation $f(x)=4 x-2$ has 3 distinct real roots. Do you agree? Explain your answer.
(4 marks)

Section B ( 15 marks)
9. (a) Let $f(x)=x^{2}-42 x+882$. Using the method of completing the square, find the coordinates of the vertex of the graph of $y=f(x)$.
(2 marks)
(b) The length of a piece of rope is 168 cm . Sam cuts the rope into two parts. Each part is used to enclose a region in the shape of square and the total area of these two regions is $W \mathrm{~cm}^{2}$ as shown in the figure.

(i) Express $W$ in terms of $x$.
(ii) Tracy claims that the total area of these two regions is less than $885 \mathrm{~cm}^{2}$. Do you agree? Explain your answer.
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10. (a) If the quadratic equation $4 x^{2}-3(2 x+1)=k-x$ has two distinct real roots, find the range of values of $k$.
(3 marks)
(b) Suppose $k$ takes the least positive integral value. If $\alpha$ and $\beta$ are roots of the equation $4 x^{2}-3(2 x+1)=k-x$.
(i) Find the value of $\frac{\alpha}{\beta}+\frac{\beta}{\alpha}$.
(ii) Find the quadratic equation in $x$ with roots $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$.

