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Mathematics

9709/12

Paper 1 Pure Mathematics 1

May/June 2021

Question No (1)

**1 (a)** Express  $16x^2 - 24x + 10$  in the form  $(4x + a)^2 + b$ .

**(b)** It is given that the equation  $16x^2 - 24x + 10 = k$ , where  $k$  is a constant, has exactly one root.

Find the value of this root.

Solution:

**(a)**

$$16x^2 - 24x + 10$$

$$(4x)^2 - 24x + 10$$

$$(4x)^2 - 2(4x)(3) + 9 + 1 \quad \because a^2 - 2ab + b^2 = (a - b)^2$$

$$(4x - 3)^2 + 1$$

$$(4x + (-3))^2 + 1$$

**(b)**

$$16x^2 - 24x + 10 = k$$

$$16x^2 - 24x + 10 - k = 0 \quad \rightarrow \quad (1)$$

As this is quadratics equation, so  $a = 16, b = -24$  and  $c = 10 - k$

For only one root

$$b^2 - 4ac = 0$$

$$\Rightarrow (-24)^2 - 4(16)(10 - k) = 0$$

$$576 - 64(10 - k) = 0$$

$$576 - 640 + 64k = 0$$

$$64k = 64$$

$$k = 1$$

Put  $k = 1$  in equation (1)

$$16x^2 - 24x + 10 - 1 = 0$$

$$16x^2 - 24x + 9 = 0$$

*Using the quadratic formula*

$$\begin{aligned}x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\&= \frac{-(-24) \pm \sqrt{(-24)^2 - 4(16)(9)}}{2 \times 16} \\&= \frac{24 \pm \sqrt{576 - 576}}{32} \\&= \frac{24 + 0}{32} \\&= \frac{24}{32}\end{aligned}$$

$$x = \frac{3}{4} \quad \text{or } 0.75$$