Exercise 10B

Question 16:

The given equation is $15x^2 - 28 = x \Rightarrow 15x^2 - x - 28 = 0$

Comparing it with $ax^2 + bx + c = 0$, we get

$a = 15, b = -1, c = -28$

$$\therefore D = \left(b^2 - 4ac\right) = \left[(-1)^2 - 4 \times 15 \times (-28)\right] = (1 + 1680)$$

$$D = 1681 > 0$$

Hence the given equation has real roots, we get

$$\alpha = \frac{-b + \sqrt{D}}{2a} = \frac{1 + \sqrt{1681}}{2 \times 15} = \frac{1 + 41}{30} = \frac{42}{30} = \frac{7}{5}$$

$$\beta = \frac{-b - \sqrt{D}}{2a} = \frac{1 - \sqrt{1681}}{2 \times 15} = \frac{1 - 41}{30} = \frac{-40}{30} = \frac{-4}{3}$$

Hence, $\frac{7}{5}$ and $\frac{-4}{3}$ are the roots of the given equation

Question 17:

The given equation is $4 - 11x = 3x^2 \Rightarrow 3x^2 + 11x - 4 = 0$

Comparing it with $ax^2 + bx + c = 0$, we get

$a = 3, b = 11, c = -4$

$$\therefore D = \left(b^2 - 4ac\right) = \left[11^2 - 4 \times 3 \times (-4)\right] = (121 + 48) = 169 > 0$$

Hence, the given equation has real roots, given by

$$\alpha = \frac{-b + \sqrt{D}}{2a} = \frac{-11 + \sqrt{169}}{2 \times 3} = \frac{-11 + 13}{6} = \frac{1}{3}$$

$$\beta = \frac{-b - \sqrt{D}}{2a} = \frac{-11 - \sqrt{169}}{2 \times 3} = \frac{-11 - 13}{6} = -4$$

Hence, $\frac{1}{3}$ and -4 are the roots of given equation

Question 18:

The given equation $16x^2 = 24x + 1 \Rightarrow 16x^2 - 24x - 1 = 0$

Comparing it with $ax^2 + bx + c = 0$, we get

$a = 16, b = -24, c = -1$

$$\therefore D = \left(b^2 - 4ac\right) = \left[(-24)^2 - 4 \times 16 \times (-1)\right] = (576 + 63) = 640 > 0$$

Hence, the given equation has real roots, given by

$$\alpha = \frac{-b + \sqrt{D}}{2a} = \frac{24 + \sqrt{640}}{2 \times 16} = \frac{24 + 8\sqrt{10}}{32} = \frac{3 + \sqrt{10}}{4}$$
$$\beta = \frac{-b - \sqrt{D}}{2a} = \frac{24 - \sqrt{640}}{2 \times 16} = \frac{24 - 8\sqrt{10}}{32} = \frac{3 - \sqrt{10}}{4}$$

Hence, $\frac{3 + \sqrt{10}}{4}$ and $\frac{3 - \sqrt{10}}{4}$ are the roots of the given equation

Question 19:

The given equation is $3x^2 + 2\sqrt{5}x - 5 = 0$

Comparing it with $ax^2 + bx + c = 0$, we get

$a = 3, b = 2\sqrt{5}, c = -5$

$$\therefore D = \left(b^2 - 4ac\right) = \left[\left(2\sqrt{5}\right)^2 - 4 \times 3 \times (-5)\right] = (20 + 60)$$
$$= 80 > 0$$

Hence, the given equation has real roots, given by

$$\alpha = \frac{-b + \sqrt{D}}{2a} = \frac{-2\sqrt{5} + \sqrt{80}}{2 \times 3} = \frac{-2\sqrt{5} + 4\sqrt{5}}{6} = \frac{2\sqrt{5}}{6} = \frac{\sqrt{5}}{3}$$
$$\beta = \frac{-b - \sqrt{D}}{2a} = \frac{-2\sqrt{5} + -\sqrt{80}}{2 \times 3} = \frac{-2\sqrt{5} - 4\sqrt{5}}{6} = \frac{-6\sqrt{5}}{6} = -\sqrt{5}$$

Hence, $\frac{\sqrt{5}}{3}$ and $-\sqrt{5}$ are the roots of given equation

Question 20:

The given equation is $2x^2 - 2\sqrt{6}x + 3 = 0$

Comparing it with $ax^2 + bx + c = 0$, we get

$a = 2, b = -2\sqrt{6}, c = 3$

$$\therefore D = \left(b^2 - 4ac\right) = \left[\left(-2\sqrt{6}\right)^2 - 4 \times 2 \times 3\right] = (24 - 24) = 0$$

Hence the given equation has real roots given by

$$\alpha = \frac{-b + \sqrt{D}}{2a} = \frac{2\sqrt{6} + 0}{2 \times 2} = \frac{\sqrt{6}}{2}$$
$$\beta = \frac{-b - \sqrt{D}}{2a} = \frac{2\sqrt{6} - 0}{2 \times 2} = \frac{\sqrt{6}}{2}$$

Hence, $\frac{\sqrt{6}}{2}, \frac{\sqrt{6}}{2}$ are the roots of the given equation

Question 21:

The given equation is $\sqrt{3}x^2 + 10x - 8\sqrt{3} = 0$

Comparing it with $ax^2 + bx + c = 0$, we get

$a = \sqrt{3}, b = 10, c = -8\sqrt{3}$

$$\therefore D = \left(b^2 - 4ac\right) = \left[(10)^2 - 4 \times \sqrt{3} \times \left(-8\sqrt{3}\right)\right] = (100 + 96) = 196 > 0$$

Hence, the given equation has real roots, given by

$$\alpha = \frac{-b + \sqrt{D}}{2a} = \frac{-10 + \sqrt{196}}{2 \times \sqrt{3}} = \frac{-10 + 14}{2\sqrt{3}} = \frac{4}{2\sqrt{3}} = \left(\frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}\right) = \frac{2\sqrt{3}}{3}$$

$$\beta = \frac{-b - \sqrt{D}}{2a} = \frac{-10 - \sqrt{196}}{2\sqrt{3}} = \frac{-10 - 14}{2\sqrt{3}} = \frac{-24}{2\sqrt{3}} = \left(\frac{-12}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}\right)$$
$$= -4\sqrt{3}$$

Hence, $\frac{2\sqrt{3}}{3}$ and $-4\sqrt{3}$ are the roots of the given equation.

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