



(iv) We have been given, $3x^2 - 2x + 2 = 0$

Now we also know that for an equation $ax^2 + bx + c = 0$, the discriminant is given by the following equation:

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

Now, according to the equation given to us, we have, $a = 3$, $b = -2$ and $c = 2$.

Therefore, the discriminant is given as,

$$\begin{aligned} D &= (-2)^2 - 4(3)(2) \\ &= 4 - 24 \\ &= -20 \end{aligned}$$

Since, in order for a quadratic equation to have real roots, $D \geq 0$. Here we find that the equation does not satisfy this condition, hence it does not have real roots.

(v) We have been given, $2x^2 - 2\sqrt{6}x + 3 = 0$

Now we also know that for an equation $ax^2 + bx + c = 0$, the discriminant is given by the following equation:

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

Now, according to the equation given to us, we have, $a = 2$, $b = -2\sqrt{6}$ and $c = 3$.

Therefore, the discriminant is given as,

$$\begin{aligned} D &= (-2\sqrt{6})^2 - 4(2)(3) \\ &= 24 - 24 \\ &= 0 \end{aligned}$$

Since, in order for a quadratic equation to have real roots, $D \geq 0$. Here we find that the equation satisfies this condition, hence it has real and equal roots.

Now, the roots of an equation is given by the following equation,

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

Therefore, the roots of the equation are given as follows,

$$\begin{aligned} x &= \frac{-(2\sqrt{6}) \pm 0}{2(2)} \\ &= \frac{-\sqrt{6}}{2} \\ &= -\sqrt{\frac{3}{2}} \end{aligned}$$

Therefore, the roots of the equation are real and equal and its value is $\boxed{-\sqrt{\frac{3}{2}}}$.

(vi) We have been given, $3a^2x^2 + 8abx + 4b^2 = 0$

Now we also know that for an equation $ax^2 + bx + c = 0$, the discriminant is given by the following equation:

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

Now, according to the equation given to us, we have, $a = 3a^2$, $b = 8ab$ and $c = 4b^2$.

Therefore, the discriminant is given as,

$$\begin{aligned}
 D &= (8ab)^2 - 4(3a^2)(4b^2) \\
 &= 64a^2b^2 - 48a^2b^2 \\
 &= 16a^2b^2
 \end{aligned}$$

Since, in order for a quadratic equation to have real roots, $D \geq 0$. Here we find that the equation satisfies this condition, hence it has real roots.

Now, the roots of an equation is given by the following equation,

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

Therefore, the roots of the equation are given as follows,

$$\begin{aligned}
 x &= \frac{-(8ab) \pm \sqrt{16a^2b^2}}{2(3a^2)} \\
 &= \frac{-8ab \pm 4ab}{6a^2} \\
 &= \frac{-4b \pm 2b}{3a}
 \end{aligned}$$

Now we solve both cases for the two values of x. So, we have,

$$\begin{aligned}
 x &= \frac{-4b + 2b}{3a} \\
 &= -\frac{2b}{3a}
 \end{aligned}$$

Also,

$$\begin{aligned}
 x &= \frac{-4b - 2b}{3a} \\
 &= -\frac{2b}{a}
 \end{aligned}$$

Therefore, the roots of the equation are $-\frac{2b}{3a}$ and $-\frac{2b}{a}$.

(vii) We have been given, $3x^2 + 2\sqrt{5}x - 5 = 0$

Now we also know that for an equation $ax^2 + bx + c = 0$, the discriminant is given by the following equation:

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

Now, according to the equation given to us, we have, $a = 3$, $b = 2\sqrt{5}$ and $c = -5$.

Therefore, the discriminant is given as,

$$\begin{aligned}
 D &= (2\sqrt{5})^2 - 4(3)(-5) \\
 &= 20 + 60 \\
 &= 80
 \end{aligned}$$

Since, in order for a quadratic equation to have real roots, $D \geq 0$. Here we find that the equation satisfies this condition, hence it has real roots.

Now, the roots of an equation is given by the following equation,

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

Therefore, the roots of the equation are given as follows,

$$\begin{aligned}
 x &= \frac{-(2\sqrt{5}) \pm \sqrt{80}}{2(3)} \\
 &= \frac{-2\sqrt{5} \pm 4\sqrt{5}}{2(3)} \\
 &= \frac{-\sqrt{5} \pm 2\sqrt{5}}{3}
 \end{aligned}$$

Now we solve both cases for the two values of x. So, we have,

$$\begin{aligned}
 x &= \frac{-\sqrt{5} + 2\sqrt{5}}{3} \\
 &= \frac{\sqrt{5}}{3}
 \end{aligned}$$

Also,

$$\begin{aligned}
 x &= \frac{-\sqrt{5} - 2\sqrt{5}}{3} \\
 &= -\sqrt{5}
 \end{aligned}$$

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

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