

Problems involving the use of the discriminant $b^2 - 4ac$

7. Determine the range of values of p if the quadratic equation $2x^2 - 1 = 5x + p$ has two different roots.

Ans: $2x^2 - 1 = 5x + p$
 $2x^2 - 5x - (p + 1) = 0$
 $a = 2, b = -5, c = -(p + 1)$
 $b^2 - 4ac = (-5)^2 - 4(2)[-(p + 1)]$
 $= 25 + 8(p + 1)$
 $= 25 + 8p + 8$

For two different roots, $b^2 - 4ac > 0$

$$33 + 8p > 0$$

$$p > -\frac{33}{8}$$

8. Find the value of q if the quadratic equation $2x^2 + 12x = 2q - 9$ has two equal roots.

Ans: $2x^2 + 12x = 2q - 9$
 $2x^2 + 12x + 9 - 2q = 0$
 $a = 2, b = 12, c = 9 - 2q$
 $b^2 - 4ac = (12)^2 - 4(2)(9 - 2q)$
 $= 144 - 72 + 16q$
 $= 72 + 16q$

For two equal roots, $b^2 - 4ac = 0$

$$72 + 16q = 0$$

$$q = -\frac{9}{2}$$

9. If the quadratic equation $4mx^2 - 3nx + m = 0$ has two equal roots, find the ratio $n : m$. Hence, solve the equation.

Ans: $4mx^2 - 3nx + m = 0$
 $b^2 - 4ac = (-3n)^2 - 4(4m)(m)$
 $= 9n^2 - 16m^2$

For two equal roots, $b^2 - 4ac = 0$

$$9n^2 - 16m^2 = 0$$

$$9n^2 = 16m^2$$

$$\left(\frac{n}{m}\right)^2 = \frac{16}{9}$$

$$\frac{n}{m} = \frac{4}{3}$$

$$n : m = 4 : 3$$

For $\frac{n}{m} = \frac{4}{3}$, $3n = 4m$

Substitute $3n = 4m$ into the equation.

$$4mx^2 - 4mx + m = 0$$

$$m(4x^2 - 4x + 1) = 0$$

$$4x^2 - 4x + 1 = 0$$

$$(2x - 1)^2 = 0$$

$$2x - 1 = 0$$

$$x = \frac{1}{2}$$

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