Solution or roots of equation, FACTORISATION

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① Determine whether $x=\frac{-1}{2}$, $x=\frac{1}{3}$ are the solutions of the given eqn $6x^2-x-2=0$ or not.

Ans $P(x)=6x^2-x-2$

$P\left(\frac{-1}{2}\right)=6\left(\frac{-1}{2}\right)^2-\left(\frac{-1}{2}\right)-2$

$=6\left(\frac{1}{4}\right)+\frac{1}{2}-2$

$=\frac{\cancel{6}\,3}{\cancel{4}\,2}+\frac{1}{2}-2$

$=\frac{3+1-4}{2}=\frac{0}{2}=0$

$\therefore P\left(-\frac{1}{2}\right)=0$

So $x=-\frac{1}{2}$ is a solution of given equation

Put $x=\frac{1}{3}$

$P(x)=6x^2-x-2$

$P\left(\frac{1}{3}\right)=6\left(\frac{1}{3}\right)^2-\frac{1}{3}-2$

$=\frac{\cancel{6}\,2\times1}{\cancel{9}\,3\times1}-\frac{1}{3}-2$

$=\frac{2-1-6}{3}$

$=\frac{-5}{3}\neq 0$

$P\left(\frac{1}{3}\right)\neq 0$

$\therefore x=\frac{1}{3}$ is not a solution of the given equation.

② In each of the following equations determine the value of k for which the given value is a solution of the equation.

(i) $kx^2+2x-3=0$, $x=2$

put $x=2$ in eqn

$k(2)^2+2(2)-3=0$

$4k+4-3=0$

$4k+1=0$

$4k=-1$

$\boxed{\therefore k=\frac{-1}{4}}$

(ii) $x^2+2ax-k=0$, $\boxed{x=-a}$

$(-a)^2+2a(-a)-k=0$

$a^2+(-2a^2)-k=0$

$-a^2-k=0$

$\boxed{-a^2=k}$

$\boxed{\therefore k=-a^2}$

$\boxed{x=-a}$

$x^2+2ax-k=0$

$(-a)^2+2a(-a)-k=0$

$a^2-2a^2-k=0$

$-1a^2-k=0$

$-1a^2=k$

$\boxed{k=-1a^2}$

③ If $x=2$ and $x=3$ are roots of the equation $3x^2-2ax+2b=0$ find the value of a and b

Given $3x^2-2ax+2b=0 \rightarrow$ ①

Put $x=2$ and $x=3$ in eqn①.

$x=2$,

$3(2)^2-2a(2)+2b=0$

$3(4)-4a+2b=0$

$-4a+2b=-12$

$4a-2b=12 \quad \div 2$

$\boxed{2a-b=6} \rightarrow$ ②

$x=3$,

$3(3)^2-2a(3)+2b=0$

$27-6a+2b=0$

$\Rightarrow 6a-2b=27 \quad$ ③

$2a-b=6 \quad \times 2$

$6a-2b=27 \quad \times 1$

$4a-\cancel{2b}=12$

$6a-\cancel{2b}=27$

$- \quad + \quad -$

$-2a=-15$

$2a=15$

$\boxed{a=\frac{15}{2}}$ sub in eq ②

$\cancel{2}\left(\frac{15}{\cancel{2}}\right)-b=6$

$-b=6-15$

$\boxed{b=9}$

∴ Required values are $\boxed{a=\frac{15}{2}}$ $\boxed{b=9}$

Q) Solve the following quadratic equations by factorization method

i) $3x^2+34x+11=0$

Sol: $3x^2+34x+11=0$

$\therefore 3x^2+x+33x+11=0$

$\therefore x(3x+1)+11(3x+1)=0$

$\therefore (3x+1)(x+11)=0$

$\therefore 3x+1=0$ or $x+11=0$

$\therefore 3x=-1$ or $x=-11$

$\therefore x=-\frac{1}{3}$ or $x=-11$

33

+1 +33

To factorise by splitting middle term

Find product of 3rd no. with 1st no.

Find two factors of 33 in such a way that by adding factors we get middle no.

Since, last sign is + Give middle sign to both factors.

∴ The roots of the given quadratic equations are −11 and $-\frac{1}{3}$

Q) Solve the following quadratic equations by factorization method

iii) $2m^2 + 19m + 30 = 0$

$ax^2 + bx + c = 0$

$\{2m^2 + 30 + 19m = 0\}$

$2m^2 = -19m - 30$

Bring it to standard form

$(x+2)(x+3) = 3$

$x^2 + 3x + 2x + 6 = 3$

$x^2 + 5x + 3 = 0$

$2m^2 + 19m + 30 = 0$

$2 \times 30 = 60$

60x 19

15m 4m

2 | 60
2 | 30
1 | 15

$\cancel{45 \times 4 = 60}$

$15 + 4 = 19$

$2m^2 + 15m + 4m + 30 = 0$

$m(2m+15) + 2(2m+15) = 0$

$(2m+15)(m+2) = 0$

$\Rightarrow 2m + 15 = 0, \quad m + 2 = 0$

$2m = -15, \quad m = -2$

$m = \frac{-15}{2}, \quad m - 2$

$\therefore$ The roots of given quadratic eqn are $\frac{-15}{2}$ and -2

Q) Solve the following quadratic equations by factorization method

iv) $x^2 - x - 132 = 0$

$x^2 \pm x - 132 = 0$

11 | 132
12

-132: $11, -12$, $\boxed{-1}$

-132: $-11, +12$, $\boxed{+1}$

$x^2 + 11x - 12x - 132 = 0$

$x(x+11) - 12(x+11) = 0$

$(x+11)(x-12) = 0$

$(x+11) = 0 \quad (x-12) = 0$

$\boxed{x = -11}, \boxed{x = 12}$

Solve the following by using formula method

i) $3q^2 = 2q + 8$

Sol : $3q^2 = 2q + 8$

$\therefore 3q^2 - 2q - 8 = 0$

On comparing with $ax^2 + bx + c = 0$,

we get, $a = 3$, $b = -2$ & $c = -8$

$b^2 - 4ac = (-2)^2 - 4(3)(-8)$

$= 4 + 96$

$= 100$

$D > 0$

$b^2 - 4a$

$\Rightarrow D$

$\Rightarrow$ Discriminant

$\therefore q = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$\therefore q = \frac{-(-2) \pm \sqrt{100}}{2(3)}$

$\therefore q = \frac{2 \pm 10}{6}$

$$q = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

$\therefore q = \frac{2+10}{6}$ or $q = \frac{2-10}{6}$

$\therefore q = \frac{12}{6}$ or $q = \frac{-8}{6}$

$\therefore q = 2$ or $q = \frac{-4}{3}$

$\therefore$ The roots of the given quadratic equations are 2 and $-\frac{4}{3}$

$D = -1 < 0$

$D \geq 0$

$D > 0$

$D = 0$

Relationship between discriminant and nature of the roots

Case (1) $\Rightarrow$

Case (2) $\Rightarrow$

Case (3) $\Rightarrow$

When $D = 0 \Rightarrow b^2 - 4ac = 0 \Rightarrow$ Two equal real roots

$D > 0$: $b^2 - 4ac > 0 \Rightarrow$ Two distinct real roots

$D < 0$: $b^2 - 4ac < 0 \Rightarrow$ No real roots or roots case ② $\Rightarrow$

case ③ $\Rightarrow$ $\boxed{D < 0}$ $b^2 - 4ac < 0 \Rightarrow$ No real roots or imaginary roots.

Doubt

Assume Lingest

$\sqrt{n+1} + \sqrt{n-1} = r$ (where r is rational)

squaring on both sides

$$\left(\sqrt{n+1} + \sqrt{n-1}\right)^2 = r^2$$

$(a+b)^2 = a^2 + b^2 + 2ab$

$$(n+\cancel{1}) + (n-\cancel{1}) + 2\sqrt{(n+1)(n-1)} = r^2$$

$(a+b)(a-b) = a^2 - b^2$

$$2n + 2\sqrt{n^2-1} = r^2$$

$$2\sqrt{n^2-1} = r^2 - 2n$$

Since RHS is rational $\sqrt{n^2-1}$ must be rational

So $n^2 - 1 = k^2$ for some integer k.

$$n^2 - k^2 = 1 \Rightarrow (n-k)(n+k) = 1$$

$n = 1$

$n - \cancel{k} = 1$
$n + \cancel{k} = 1$ add
$2n = 2$
$\boxed{n=1}$

But for $n = 1$

$$\sqrt{n+1} + \sqrt{n-1} = \sqrt{1+1} + \sqrt{1-1}$$

$$\sqrt{2} + 0$$

$= \sqrt{2}$ is irrational

This is contradiction.

$\therefore$ There is no positive integer n for which $\sqrt{n+1} + \sqrt{n-1}$ is rational