EXERCISE 2.2

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Q.1 Find the zeroes of the following quadratic polynomials and veryfy the relationship between the zeroes and the coefficients:

(i) $x^2 - 2x - 8$ (ii) $4s^2 - 4s + 1$
(iii) $6x^2 - 3 - 7x$ (iv) $4u^2 + 8u$
(v) $t^2 - 15$ (vi) $3x^2 - x - 4$

Ans.
(i) $x^2 - 2x - 8$
$= x^2 - 4x + 2x - 8$
$= x(x-4) + 2(x-4)$
$= (x-4)(x+2)$

The value of $x^2 - 2x - 8$ is zero
If $(x-4) = 0$ or $(x+2) = 0$
$x = 4$ or $x = -2$

Therefore, zeroes of $x^2 - 2x - 8$ are -2 and 4. Ans.

Sum of zeroes $= -2 + 4 = 2$

$$= \frac{-(-2)}{1} = \frac{-(\text{coefficient of } x)}{\text{coefficient of } x^2}$$

Product of zeroes $= (-2) \times 4 = -8$

$$= \frac{-8}{1} = \frac{\text{Constant term}}{\text{Coefficient of } x^2}$$

Hence relationship between the zeroes and the coefficient are verified.

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(ii) $4s^2 - 4s + 1$

$= 4s^2 - 2s - 2s + 1$

$= 2s(2s-1) - 1(2s-1)$

$= (2s-1)(2s-1)$

The value of $4s^2 - 4s + 1$ is zero

$(2s-1) = 0$ or $(2s-1) = 0$

$s = \frac{1}{2}$ or $s = \frac{1}{2}$

Therefore, zeroes of $4s^2 - 4s + 1$ are $\frac{1}{2}$ and $\frac{1}{2}$

Ans.

Now, sum of zeroes $= \frac{1}{2} + \frac{1}{2} = 1$

$$\frac{-(-4)}{4} = \frac{-(\text{coefficient of } s)}{(\text{coefficient of } s^2)}$$

Product of zeroes $= \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

$$= \frac{\text{constant term}}{\text{Coefficient of } s^2}$$

Hence, relation between the zeroes and the coefficients are verified.

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(iii) $6x^2 - 3 - 7x$

$= 6x^2 - 7x - 3$

$= 6x^2 - 9x + 2x - 3$

$= 3x(2x - 3) + 1(2x - 3)$

$= (2x - 3)(3x + 1)$

The value of $6x^2 - 3 - 7x$ is zero

$(2x - 3) = 0$ or $(3x + 1) = 0$

$x = \frac{3}{2}$ or $x = -\frac{1}{3}$

Therefore zeroes of $6x^2 - 3 - 7x$ are $\frac{3}{2}$ and $-\frac{1}{3}$ Ans.

Sum of zeroes $= \frac{3}{2} + \left(-\frac{1}{3}\right)$

$= \frac{9 - 2}{6} = \frac{7}{6}$

$= \frac{-(-7)}{6} = \frac{-(\text{Coefficient of } x)}{\text{Coefficient of } x^2}$

Product of zeroes $= \left(\frac{3}{2}\right)\left(-\frac{1}{3}\right)$

$= -\frac{3}{6} = \frac{\text{Constant term}}{\text{Coefficient of } x^2}$

Hence, relationship between the zeroes and the coefficient are verified.

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(iv) $4u^2 + 8u = 4u(u+2)$

The value of $4u^2 + 8u$ is zero

$4u(u+2) = 0$

$4u = 0$ or $u+2 = 0$, $u = 0$ or $u = -2$

Therefore sum of zeroes $= 0 + (-2)$ Ans.

$= -2 = \frac{-8}{4} = \frac{-(\text{Coefficient of } u)}{\text{Coefficient of } u^2}$

Product of zeroes $= (0)(-2) = 0$

$= \frac{0}{4} = \frac{\text{Constant term}}{\text{Coefficient of } x^2}$

Hence, relationship between the zeroes and the coefficient are verified.

(v)

$t^2 - 15 = t^2 - (\sqrt{15})^2 = (t + \sqrt{15})(t - \sqrt{15})$

The value of $t^2 - 15$ is zero

$t + \sqrt{15} = 0$ or $t - \sqrt{15} = 0$, $t = \sqrt{15}$ or $t = -\sqrt{15}$

Therefore, zeroes of $t^2 - 15$ are $-\sqrt{15}$ and $\sqrt{15}$ Ans.

Now sum of zeroes $= -\sqrt{15} + \sqrt{15}$

$= 0 = \frac{0}{1} = \frac{-(\text{coefficient of } t)}{\text{Coefficient of } t^2}$

Product of zeroes $= (-\sqrt{15})(\sqrt{15})$

$= -15 = \frac{-15}{1} = \frac{\text{constant term}}{\text{Coefficient of } t^2}$

Hence, relationship between the zeroes and the coefficient are verified.

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(vi) $3x^2 - x - 4$

$= 3x^2 - 4x + 3x - 4$

$= x(3x-4) + 1(3x-4)$

$= (3x-4)(x+1)$

The value of $3x^2 - x - 4$ is zero

$3x - 4 = 0$ or $x + 1 = 0$

$x = \frac{4}{3}$ or $x = -1$

Therefore zeroes of $3x^2 - x - 4$ are -1 and $\frac{4}{3}$ Ans.

Now sum of zeroes

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

$= \frac{-(-1)}{3} = \frac{-(\text{Coefficient of } x)}{\text{Coefficient of } x^2}$

Product of zeroes

$= (-1)\left(\frac{4}{3}\right) = \frac{-4}{3} = \frac{\text{constant term}}{\text{Coefficient of } x^2}$

Hence, relationship between the zeroes and the coefficients are verified.

EXERCISE 2.2

Q.2. Find a quadratic polynomial each with the given numbers as the sum and product of its zeroes respectively.

(i) $\frac{1}{4}, -1$ (ii) $\sqrt{2}, \frac{1}{3}$

(iii) $0, \sqrt{5}$ (iv) $1, 1$

(v) $-\frac{1}{4}, \frac{1}{4}$ (vi) $4, 1$

Ans.

(i) $\frac{1}{4}, -1$

Let the quadratic polynomial be ax^2+bx+c and its zeroes be k and β.

∴ Sum of zeroes $= k+\beta = \frac{1}{4}$

And $k\beta$ = product of zeroes $= -1$

$ax^2+bx+c = k(x-k)(x-\beta)$

Where k is any constant

$= k[x^2-(k+\beta)x+k\beta]$

$= k[x^2-\frac{1}{4}x+(-1)]$

$= k[x^2-\frac{1}{4}x-1]$

For different value of k, we get different quadratic polynomials.

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(ii) $\sqrt{2}, \frac{1}{3}$

Let the quadratic polynomial be ax^2+bx+c and its zeroes be k and β.

$\therefore$ Sum of zeroes $= k+\beta = \sqrt{2}$

And product of zeroes $= k\beta = \frac{1}{3}$

$ax^2+bx+c = k(x-k)(x-\beta)$

Where k is any constant

$= k[x^2-(k+\beta)x+k\beta]$

$= k[x^2-\sqrt{2}x+\frac{1}{3}]$

For different values of k, we get different quadratic polynomial.

(iii) $0, \sqrt{5}$

Let the quadratic polynomial be ax^2+bx+c and its zeroes be k and β.

$\therefore$ Sum of zeroes $= k+\beta = 0$

And product of zeroes $= k\beta = \sqrt{5}$

$ax^2+bx+c = k(x-k)(x-\beta)$

Where k is any constant

$= k[x^2-(k+\beta)x+k\beta]$

$= k[x^2-0x+\sqrt{5}]$

$= k(x^2+\sqrt{5})$

For different values of k, we get different quadratic polynomials.