

Chapter 2.
EXERCISE 2.2

1. Find the zeroes of the following quadratic polynomials and verify 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) $3x^2 - x - 4$

Solutions:

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

The value of $x^2 - 2x - 8$ is zero when $x - 4 = 0$ or $x + 2 = 0$,

when, $x = 4$ or $x = -2$

Therefore,

The zeroes of $x^2 - 2x - 8$ are 4 and -2

Sum of zeroes = $4 - 2 = 2 = \frac{-(-2)}{1} = \frac{-(\text{coefficient of } x)}{\text{coefficient of } x}$

Product of zeroes = $4 \times (-2) = -8 = \frac{(-8)}{1} = \frac{\text{constant term}}{\text{coefficient of } x^2}$

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

The value of $4s^2 - 4s + 1$ is zero when $2s - 1 = 0$, when, $s = \frac{1}{2}$

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

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 = $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4} = \frac{\text{constant term}}{\text{coefficient of } s^2}$

(iii) $6x^2 - 3 - 7x = 6x^2 - 7x - 3 = (3x + 1)(2x - 3)$

The value of $6x^2 - 3 - 7x$ is zero when $3x + 1 = 0$ or $2x - 3 = 0$,

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

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

$$\text{Sum of zeroes} = \frac{-1}{3} + \frac{3}{2} = \frac{7}{6} = \frac{-(-7)}{6} = \frac{-(\text{coefficient of } x)}{\text{coefficient of } x^2}$$

$$\text{Product of zeroes} = \frac{-1}{3} \times \frac{3}{2} = \frac{-1}{2} = \frac{-3}{6} = \frac{\text{constant term}}{\text{coefficient of } x^2}$$

$$(iv) 4u^2 + 8u = 4u^2 + 8u + 0$$

$$= 4u(u+2)$$

The value of $4u^2 + 8u$ is zero when $4u = 0$ or $u + 2 = 0$, i.e., $u = 0$ or $u = -2$

Therefore, the zeroes of $4u^2 + 8u$ are 0 and -2.

$$\text{Sum of zeroes} = 0 + (-2) = -2 = \frac{-(8)}{4} = \frac{-(\text{coefficient of } u)}{\text{coefficient of } u^2}$$

$$\text{Product of zeroes} = 0 \times (-2) = 0 = \frac{0}{4} = \frac{\text{constant term}}{\text{coefficient of } u^2}$$

$$(v) t^2 - 15$$

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

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

The value of $t^2 - 15$ is zero when $t - \sqrt{15} = 0$ or $t + \sqrt{15} = 0$,

i.e., when $t = \sqrt{15}$ or $t = -\sqrt{15}$

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

$$\text{Sum of zeroes} = \sqrt{15} + (-\sqrt{15}) = 0 = \frac{-0}{1} = \frac{-(\text{coefficient of } t)}{\text{coefficient of } t^2}$$

$$\text{Product of zeroes} = (\sqrt{15})(-\sqrt{15}) = -15 = \frac{-15}{1} = \frac{\text{constant term}}{\text{coefficient of } x^2}$$

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

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

The value of $3x^2 - x - 4$ is zero when $3x - 4 = 0$ or $x + 1 = 0$,

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

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

$$\text{Sum of zeroes} = \frac{4}{3} + (-1) = \frac{-(-1)}{3} = \frac{-(\text{coefficient of } x)}{\text{coefficient of } x^2}$$

$$\text{Product of zeroes} = \frac{4}{3} (-1) = \frac{-4}{3} = \frac{\text{constant term}}{\text{coefficient of } x^2}$$

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) $4, 1$

Solutions:

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

Let the polynomial be $ax^2 + bx + c$, and its zeroes be α and β .

$$\alpha + \beta = \frac{1}{4} = \frac{-b}{a}$$

$$\alpha\beta = -1 = \frac{-4}{4} = \frac{c}{a}$$

If $a = 4$, then $b = -1$, $c = -4$

Therefore, the quadratic polynomial is $4x^2 - x - 4$.

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

Let the polynomial be $ax^2 + bx + c$, and its zeroes be α and β .

$$\alpha + \beta = \sqrt{2} = \frac{3\sqrt{2}}{3} = \frac{-b}{a}$$

$$\alpha\beta = -1 = \frac{1}{3} = \frac{c}{a}$$

If $a = 3$, then $b = -3\sqrt{2}$, $c = 1$

Therefore, the quadratic polynomial is $3x^2 - 3\sqrt{2}x + 1$

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

Let the polynomial be $ax^2 + bx + c$, and its zeroes be α and β .

$$\alpha + \beta = 0 = \frac{0}{1} = \frac{-b}{a}$$

$$\alpha\beta = \sqrt{5} = \frac{\sqrt{5}}{1} = \frac{c}{a}$$

If $a = 1$, then $b = 0$, $c = \sqrt{5}$

Therefore, the quadratic polynomial is $x^2 + \sqrt{5}$.

(iv) 1, 1

Let the polynomial be $ax^2 + bx + c$, and its zeroes be α and β .

$$\alpha + \beta = 1 = \frac{1}{1} = \frac{-b}{a}$$

$$\alpha\beta = 1 = \frac{1}{1} = \frac{c}{a}$$

If $a = 1$, then $b = -1$, $c = 1$

Therefore, the quadratic polynomial is $x^2 - x + 1$.

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

Let the polynomial be $ax^2 + bx + c$, and its zeroes be α and β .

$$\alpha + \beta = \frac{-1}{4} = \frac{-b}{a}$$

$$\alpha\beta = \frac{1}{4} = \frac{c}{a}$$

If $a = 4$, then $b = 1$, $c = 1$

Therefore, the quadratic polynomial is $4x^2 + x + 1$.

(vi) 4, 1

Let the polynomial be $ax^2 + bx + c$ and its zeroes be α and β .

$$\alpha + \beta = 4 = \frac{4}{1} = \frac{-b}{a}$$

$$\alpha\beta = 1 = \frac{1}{1} = \frac{c}{a}$$

If $a = 1$, then $b = -4$, $c = 1$

Therefore, the quadratic polynomial is $x^2 - 4x + 1$.