**Mathematics**  
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*(Chapter – 2) (Polynomials)*  
*(Class X)*

**Exercise 2.2**

**Question 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) \(3x^2 - x - 4\)

**Answer 1:**

(i) \(x^2 - 2x - 8\)

\[= x^2 - 4x + 2x - 8\]

\[= x(x - 4) + 2(x - 4)\]

\[= (x + 2)(x - 4)\]

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

\[\Rightarrow x = -2 \text{ or } x = 4\]

Therefore, the zeroes of \(x^2 - 2x - 8\) are -2 and 4. Now

**Sum of zeroes** \(= -2 + 4 = 2\)

\[= \frac{-(-2)}{1} = \frac{-8}{1} \text{ (Coefficient of } x)\]

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

\[= \frac{1}{1} \text{ (Coefficient of } x^2)\]

(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 if \(2s - 1 = 0\) \(\Rightarrow s = \frac{1}{2}\)

Therefore, the zeroes of \(4s^2 - 4s + 1\) are \(\frac{1}{2}\) and \(\frac{1}{2}\). Now

**Sum of zeroes** \(= \frac{1}{2} + \frac{1}{2} = 1\)

\[= \frac{-(-4)}{4} = \frac{-8}{4} \text{ (Coefficient of } s)\]

**Product of zeroes** \(= \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}\)

\[= \frac{1}{4} \text{ (Coefficient of } s^2)\]

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

\[= 6x^2 - 7x - 3\]

\[= 6x^2 - 9x + 2x - 3\]

\[= 3x(2x - 3) + 1(2x - 3)\]

\[= (3x + 1)(2x - 3)\]

The value of \(6x^2 - 7x - 3\) is zero if \(3x + 1 = 0\) or \(2x - 3 = 0\).

\[\Rightarrow x = -\frac{1}{3} \text{ or } x = \frac{3}{2}\]

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

**Sum of zeroes** \(= \frac{-1}{3} + \frac{3}{2} = \frac{2 + 9}{6} = \frac{11}{6}\)

\[= \frac{-(-7)}{6} = \frac{-42}{6} \text{ (Coefficient of } x)\]

**Product of zeroes** \(= \left(-\frac{1}{3}\right) \times \frac{3}{2} = -\frac{1}{2} = -\frac{3}{6}\)

\[= \frac{1}{2} \text{ (Coefficient of } x^2)\]
(iv) \(4u^2 + 8u\)
\[= 4u^2 + 8u\]
\[= 4u(u + 2)\]
The value of \(4u^2 + 8u\) is zero if \(4u = 0\) or \(u + 2 = 0\).
\[\Rightarrow u = 0 \quad \text{or} \quad u = -2.\]
Therefore, the zeroes of \(4u^2 + 8u\) are 0 and -2. Now
Sum of zeroes = \(0 + (-2) = -2 = \frac{-8}{4} = -\frac{(\text{Coefficient of } u)}{\text{Coefficient of } u^2}\)
Product of zeroes = \(0 \times (-2) = 0 = \frac{4}{4} = \frac{\text{Constant term}}{\text{Coefficient of } u^2}\)

(v) \(t^2 - 15\)
\[= t^2 - (\sqrt{15})^2\]
\[= (t + \sqrt{15})(t - \sqrt{15})\]
The value of \(t^2 - 15\) is zero if \(t + \sqrt{15} = 0\) or \(t - \sqrt{15} = 0\).
\[\Rightarrow t = -\sqrt{15} \quad \text{or} \quad t = \sqrt{15}.\]
Therefore, the zeroes of \(t^2 - 15\) are \(-\sqrt{15}\) and \(\sqrt{15}\). 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 = \((-\sqrt{15}) \times \sqrt{15} = -15 = \frac{15}{1} = \frac{\text{Constant term}}{\text{Coefficient of } t^2}\)

(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 if \(3x - 4 = 0\) or \(x + 1 = 0\).
\[\Rightarrow x = \frac{4}{3} \quad \text{or} \quad x = -1.\]
Therefore, the zeroes of \(3x^2 - x - 4\) are \(\frac{4}{3}\) and \(-1\). Now
Sum of zeroes = \(\frac{4}{3} + (-1) = \frac{4 - 3}{3} = \frac{1}{3} = \frac{-(-1)}{\text{Coefficient of } x}\)
Product of zeroes = \(\frac{4}{3} \times (-1) = -\frac{4}{3} = \frac{-4}{\text{Coefficient of } x^2}\)

Question 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). \(-1, \frac{1}{4}\)   (vi). 4, 1

Answer 2
(i) Let \(\alpha\) and \(\beta\) are the zeroes of the polynomial \(ax^2 + bx + c\), then we have
\[\alpha + \beta = \frac{1}{4} = -\frac{b}{a}\]
On comparing,
\[ a = 4, \quad b = -1 \text{ and } c = -4 \]
Hence, the required quadratic polynomial is \(4x^2 - x - 4\).

(ii) Let \(\alpha\) and \(\beta\) are the zeroes of the polynomial \(ax^2 + bx + c\), then we have
\[
\alpha + \beta = \sqrt{2} = \frac{3\sqrt{2}}{3} = \frac{-b}{a} \quad \text{On comparing,}
\]
\[
\alpha\beta = \frac{1}{3} = \frac{c}{a}
\]
Hence, the required quadratic polynomial is \(3x^2 - 3\sqrt{2}x + 1\).

(iii) Let \(\alpha\) and \(\beta\) are the zeroes of the polynomial \(ax^2 + bx + c\), then we have
\[
\alpha + \beta = 0 = \frac{0}{1} = \frac{-b}{a} \quad \text{On comparing,}
\]
\[
\alpha\beta = \sqrt{5} = \frac{\sqrt{5}}{1} = \frac{c}{a}
\]
Hence, the required quadratic polynomial is \(x^2 + 0.x + \sqrt{5}\).

(iv) Let \(\alpha\) and \(\beta\) are the zeroes of the polynomial \(ax^2 + bx + c\), then we have
\[
\alpha + \beta = 1 = \frac{1}{1} = \frac{-b}{a} \quad \text{On comparing,}
\]
\[
\alpha\beta = 1 = \frac{1}{1} = \frac{c}{a}
\]
Hence, the required quadratic polynomial is \(x^2 - x + 1\).

(v) Let \(\alpha\) and \(\beta\) are the zeroes of the polynomial \(ax^2 + bx + c\), then we have
\[
\alpha + \beta = -1 = \frac{-1}{4} = \frac{-b}{a} \quad \text{On comparing,}
\]
\[
\alpha\beta = \frac{1}{4} = \frac{c}{a}
\]
Hence, the required quadratic polynomial is \(4x^2 + x + 1\).

(vi) Let \(\alpha\) and \(\beta\) are the zeroes of the polynomial \(ax^2 + bx + c\), then we have
\[
\alpha + \beta = 4 = \frac{4}{1} = \frac{-b}{a} \quad \text{On comparing,}
\]
\[
\alpha\beta = 1 = \frac{1}{1} = \frac{c}{a}
\]
Hence, the required quadratic polynomial is \(x^2 - 4x + 1\).