EX-2.2

Q1. Find the zeros of the following quadratic polynomials and verify the relationship between the zeros 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) $3x^2 - x - 4$

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

$= x(x - 4) + 2(x - 4) = (x + 2)(x - 4)$

Zeroes are – 2 and 4.

Sum of the zeros

$= (-2) + (4) = 2 = \frac{-(-2)}{1} = \frac{-(\text{Coefficient of } x)}{(\text{Coefficient of } x^2)}$

Product of the zeros

$= (-2)(4) = -8 = \frac{(-8)}{1} = \frac{(\text{Constant term})}{(\text{Coefficient of } x^2)}$

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

The two zeros are $\frac{1}{2}, \frac{1}{2}$

Sum of the two zeros

$= \frac{1}{2} + \frac{1}{2} = 1 = \frac{-(-4)}{4} = \frac{-(\text{Coefficient of } x)}{(\text{Coefficient of } x^2)}$

Product of two zeros

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

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

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

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

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

zeros are $\frac{3}{2}, \frac{-1}{3}$

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

$= \frac{9-2}{6} = \frac{7}{6} = \frac{-(-7)}{6} = \frac{-(\text{coefficient of } x)}{(\text{coefficient of } x^2)}$

Product of zeros

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

$= \frac{(\text{constant term})}{(\text{coefficient of } x^2)}$

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

zeros are 0, –2

Sum of zeros

$= 0 + (-2) = -2 = \frac{-(8)}{4}$

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

Product of zeros

$= 0 \times (-2) = 0 = \frac{0}{4}$

$= \frac{\text{constant term}}{\text{coefficient of } u^2}$

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

zeros are $\sqrt{15}, -\sqrt{15}$

sum of zeros

$= \sqrt{15} + (-\sqrt{15}) = 0 = \frac{0}{1}$

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

Product of zeros

$= \left(\sqrt{15}\right)\left(-\sqrt{15}\right) = -15 = \frac{-15}{1}$

$= \frac{\text{constant term}}{\text{coefficient of } t^2}$

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

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

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

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

zeros are $\frac{4}{3}, -1$

Sum of zeros

$= \frac{4}{3} - 1 = \frac{1}{3} = -\frac{(-1)}{3}$

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

Product of zeros $= \frac{4}{3} \times (-1) = -\frac{4}{3}$

$= \frac{(\text{constant term})}{\text{coefficient of } x^2}$

Q2. Find a quadratic polynomial each with the given numbers as the sum and product of its zeros 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

Sol. (i) Required polynomial =
x^2 – (sum of zeros) x + product of zeros

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

$= \frac{1}{4}(4x^2 - x - 1)$.

(ii) Required polynomial =
x^2 – (sum of zeros) x + product of zeros

$= x^2 - \sqrt{2}\,x + \frac{1}{3}$

$= \frac{1}{3}(3x^2 - 3\sqrt{2}\,x + 1)$.

(iii) Required polynomial =
x^2 – (sum of zeros) x + product of zeros
$= x^2 - 0\,x + \sqrt{5}$
$= x^2 + \sqrt{5}$.

(iv) Required polynomial =
x^2 – (sum of zeros) x + product of zeros
$= x^2 - 1\,x + 1$
$= x^2 - x + 1$.

(v) Required polynomial =
x^2 – (sum of zeros) x + product of zeros

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

$= x^2 + \frac{1}{4}x + \frac{1}{4}$

$= \frac{1}{4}(4x^2 + x + 1)$.

(vi) Required polynomial =
x^2 – (sum of zeros) x + product of zeros $= x^2 - 4x + 1$.