

**RD SHARMA**  
**Solutions**  
**Class 10 Maths**  
**Chapter 2**  
**Ex 2.2**

**Q.1: Verify that the numbers given alongside of the cubic polynomials below are their zeroes. Also, verify the relationship between the zeroes and coefficients in each of the following cases:**

(i)  $f(x)=2x^3+x^2-5x+2$ ;  $12, 1, -2$   $f(x) = 2x^3 + x^2 - 5x + 2$ ;  $\frac{1}{2}, 1, -2$

(ii)  $g(x)=x^3-4x^2+5x-2$ ;  $2, 1, 1$   $g(x) = x^3 - 4x^2 + 5x - 2$ ;  $2, 1, 1$

**Sol:**

(i)  $f(x)=2x^3+x^2-5x+2$ ;  $12, 1, -2$   $f(x) = 2x^3 + x^2 - 5x + 2$ ;  $\frac{1}{2}, 1, -2$

(a) By putting  $x = 12 \frac{1}{2}$  in the above equation, we will get

$$f(12)=2(12)^3+(12)^2-5(12)+2f(\frac{1}{2}) = 2(\frac{1}{2})^3 + (\frac{1}{2})^2 - 5(\frac{1}{2}) + 2$$

$$= f(12)=2(18)+14-52+2f(\frac{1}{2}) = 2(\frac{1}{8}) + \frac{1}{4} - \frac{5}{2} + 2$$

$$= f(12)=14+14-52+2f(\frac{1}{2}) = \frac{1}{4} + \frac{1}{4} - \frac{5}{2} + 2 = 0$$

(b) By putting  $x = 1$  in the above equation, we will get

$$f(1)=2(1)^3+(1)^2-5(1)+2f(1) = 2(1)^3 + (1)^2 - 5(1) + 2$$

$$= 2 + 1 - 5 + 2 = 0$$

(c) By putting  $x = -2$  in the above equation, we will get

$$f(-2)=2(-2)^3+(-2)^2-5(-2)+2f(-2) = 2(-2)^3 + (-2)^2 - 5(-2) + 2$$

$$= -16 + 4 + 10 + 2 = -16 + 16 = 0$$

Now,

$$\text{Sum of zeroes} = \alpha + \beta + \gamma \quad \alpha + \beta + \gamma = -\frac{b}{a}$$

$$\Rightarrow 12 + 1 - 2 = -12 \Rightarrow \frac{1}{2} + 1 - 2 = \frac{-1}{2} \quad -12 = -12 \frac{-1}{2} = \frac{-1}{2}$$

$$\text{Product of the zeroes} = \alpha\beta + \beta\gamma + \alpha\gamma \quad \alpha\beta + \beta\gamma + \alpha\gamma = \frac{c}{a}$$

$$\frac{1}{2} \times 1 + 1 \times (-2) + (-2) \times 12 = -52 \quad \frac{1}{2} \times 1 + 1 \times (-2) + (-2) \times \frac{1}{2} = \frac{-5}{2}$$

$$\frac{1}{2} - 2 - 1 = \frac{-5}{2} \quad -52 = -52 \quad \frac{-5}{2} = \frac{-5}{2}$$

$$12 - 2 - 1 = -52$$

Hence, verified.

(ii)  $g(x) = x^3 - 4x^2 + 5x - 2$ ; 2, 1, 1  $g(x) = x^3 - 4x^2 + 5x - 2$ ; 2, 1, 1

(a) By putting  $x = 2$  in the given equation, we will get

$$g(2) = (2)^3 - 4(2)^2 + 5(2) - 2$$

$$g(2) = (2)^3 - 4(2)^2 + 5(2) - 2$$

$$= 8 - 16 + 10 - 2 = 18 - 18 = 0$$

(b) By putting  $x = 1$  in the given equation, we will get

$$g(1) = (1)^3 - 4(1)^2 + 5(1) - 2$$

$$g(1) = (1)^3 - 4(1)^2 + 5(1) - 2$$

$$= 1 - 4 + 5 - 2 = 0$$

Now,

$$\text{Sum of zeroes} = \alpha + \beta + \gamma = -\frac{b}{a}$$

$$\Rightarrow 2 + 1 + 1 = -(-4) \Rightarrow 2 + 1 + 1 = -(-4)$$

$$4 = 4$$

$$\text{Product of the zeroes} = \alpha\beta + \beta\gamma + \alpha\gamma = \frac{c}{a}$$

$$2 \times 1 + 1 \times 1 + 1 \times 2 = 5 \quad 2 \times 1 + 1 \times 1 + 1 \times 2 = 5$$

$$2 + 1 + 2 = 5$$

$$5 = 5$$

$$\alpha\beta\gamma = -(-2) \quad \alpha\beta\gamma = -(-2)$$

$$2 \times 1 \times 1 = 2 \quad 2 \times 1 \times 1 = 2$$

$$2 = 2$$

Hence, verified.

**Q.2: Find a cubic polynomial with the sum, sum of the product of its zeroes is taken two at a time, and product of its zeroes as 3, -1 and -3 respectively.**

**Sol:**

Any cubic polynomial is of the form  $ax^3+bx^2+cx+d$  :  $ax^3 + bx^2 + cx + d$

$=x^3 - (\text{sum of the zeroes})x^2 + (\text{sum of the products of its zeroes})x - (\text{product of the zeroes})$

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

$$= k[x^3 - 3x^2 - x - 3]$$

k is any non-zero real numbers.

**Q.3: If the zeroes of the polynomial  $f(x)=2x^3-15x^2+37x-30$  , find them.**

**Sol:**

Let,  $\alpha = a-d, \beta = a$  and  $\gamma = a+d$  be the zeroes of the polynomial.

$$f(x) = 2x^3 - 15x^2 + 37x - 30 \quad \alpha + \beta + \gamma = -(-15/2) = 15/2$$

$$\alpha\beta\gamma = -(-30/2) = 15$$

$$a - d + a + a + d = 15/2 \quad \text{and} \quad a(a-d)(a+d) = 15$$

$$\text{So, } 3a = 15/2$$

$$a = 5/2$$

$$\text{And, } a(a^2+d^2) = 15 \quad a^2 + d^2 = 15/a = 6$$

$$d^2 = 6 - a^2 = 6 - 25/4 = 1/4 \quad d = 1/2$$

$$\text{Therefore, } \alpha = 5/2 - 1/2 = 2$$

$$\beta = 5/2$$

$$\gamma = 5/2 + 1/2 = 3$$

**Q.4: Find the condition that the zeroes of the polynomial  $f(x)=x^3+3px^2+3qx+r$  may be in A.P.**

**Sol:**

$$f(x)=x^3+3px^2+3qx+r$$

Let,  $a - d, a, a + d$  be the zeroes of the polynomial.

Then,

$$\text{The sum of zeroes} = -\frac{b}{a}$$

$$a + a - d + a + d = -3p$$

$$3a = -3p$$

$$a = -p$$

Since,  $a$  is the zero of the polynomial  $f(x)$ ,

$$\text{Therefore, } f(a) = 0$$

$$f(a)=a^3+3pa^2+3qa+r$$

$$\text{Therefore, } f(a)=0$$

$$\Rightarrow a^3+3pa^2+3qa+r=0 \Rightarrow a^3 + 3pa^2 + 3qa + r = 0$$

$$\Rightarrow (-p)^3+3p(-p)^2+3q(-p)+r=0 \Rightarrow (-p)^3 + 3p(-p)^2 + 3q(-p) + r = 0$$

$$= -p^3+3p^3-pq+r=0 \Rightarrow -p^3 + 3p^3 - pq + r = 0$$

$$= 2p^3-pq+r=0 \Rightarrow 2p^3 - pq + r = 0$$

**Q.5: If zeroes of the polynomial  $f(x)=ax^3+3bx^2+3cx+d$  are in A.P., prove that  $2b^3-3abc+a^2d=0$ .**

**Sol:**

$$f(x)=x^3+3px^2+3qx+r$$

Let,  $a - d, a, a + d$  be the zeroes of the polynomial.

Then,

$$\text{The sum of zeroes} = -ba \frac{-b}{a}$$

$$a + a - d + a + d = -3ba \frac{-3b}{a}$$

$$\Rightarrow 3a = -3ba \Rightarrow 3a = -\frac{3b}{a} \Rightarrow a = -\frac{3b}{3a} = \frac{-b}{a} \quad \text{Since, } f(a) = 0$$

$$\text{Since, } f(a) = 0 \Rightarrow a(a^2) + 3b(a)^2 + 3c(a) + d = 0$$

$$\Rightarrow a(a^2) + 3b(a)^2 + 3c(a) + d = 0 \Rightarrow a(-ba)^3 + 3b^2a^2 - 3bca + d = 0$$

$$\Rightarrow a\left(\frac{-b}{a}\right)^3 + \frac{3b^2}{a^2} - \frac{3bc}{a} + d = 0 \quad 2b^3a^2 - 3bca + d = 0 \quad \frac{2b^3}{a^2} - \frac{3bc}{a} + d = 0 \quad 2b^3 - 3abc + a^2da^2 = 0$$

$$\frac{2b^3 - 3abc + a^2d}{a^2} = 0 \quad 2b^3 - 3abc + a^2d = 0 \quad 2b^3 - 3abc + a^2d = 0$$

**Q.6: If the zeroes of the polynomial  $f(x) = x^3 - 12x^2 + 39x + k$  are in A.P., find the value of k.**

**Sol:**

$$f(x) = x^3 - 12x^2 + 39x + k$$

Let,  $a-d, a, a+d$  be the zeroes of the polynomial  $f(x)$ .

$$\text{The sum of the zeroes} = 12$$

$$3a = 12$$

$$a = 4$$

Now,

$$f(a) = 0$$

$$f(a) = a^3 - 12a^2 + 39a + k \quad f(4) = 4^3 - 12(4)^2 + 39(4) + k = 0$$

$$f(4) = 4^3 - 12(4)^2 + 39(4) + k = 0$$

$$64 - 192 + 156 + k = 0$$

$$k = -28$$