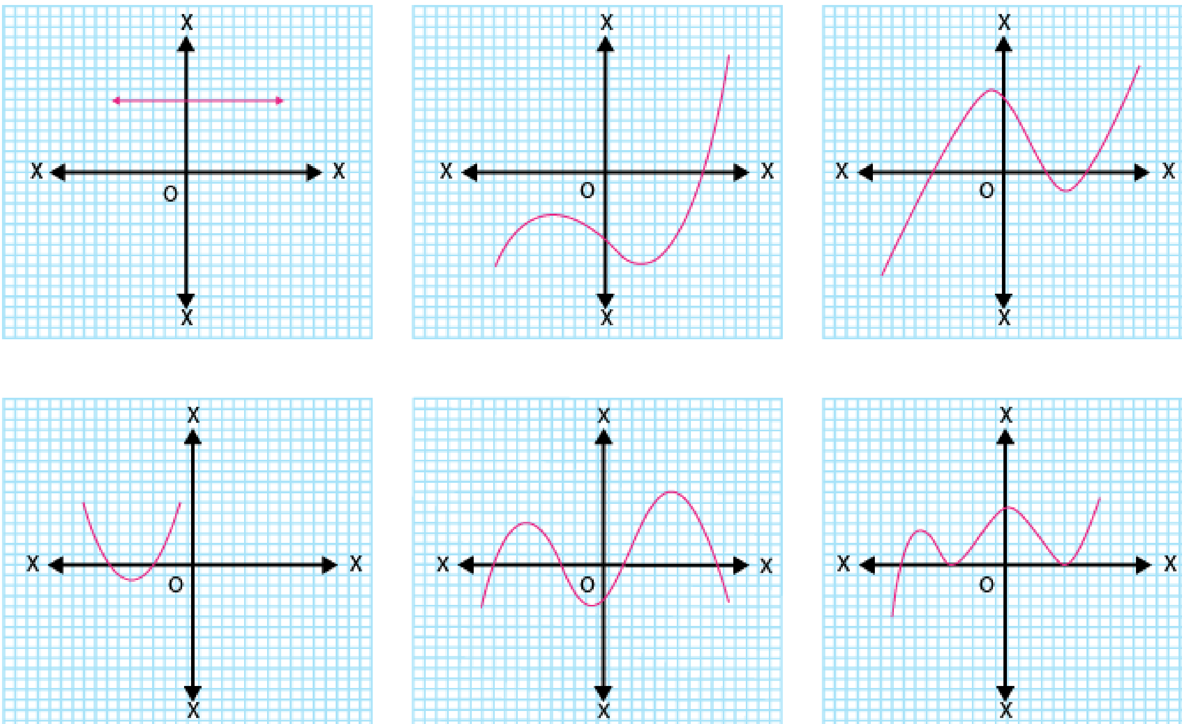
## EXERCISE 2.1 PAGE: 28

**1. The graphs of y = p(x) are given in Fig. 2.10 below, for some polynomials p(x). Find the number of zeroes of p(x), in each case.**




**Solutions:**

**Graphical method to find zeroes:-**

Total number of zeroes in any polynomial equation = total number of times the curve intersects x-axis.

(i) In the given graph, the number of zeroes of p(x) is 0 because the graph is parallel to x-axis does not cut it at any point.

(ii) In the given graph, the number of zeroes of p(x) is 1 because the graph intersects the x-axis at only one point.

(iii) In the given graph, the number of zeroes of p(x) is 3 because the graph intersects the x-axis at any three points.

(iv) In the given graph, the number of zeroes of p(x) is 2 because the graph intersects the x-axis at two points.

(v) In the given graph, the number of zeroes of p(x) is 4 because the graph intersects the x-axis at four points.

(vi) In the given graph, the number of zeroes of p(x) is 3 because the graph intersects the x-axis at three points.

## EXERCISE 2.2 PAGE: 33

**1. Find the zeroes of the following quadratic polynomials and verify the relationship between the zeroes and the coefficients.**

**Solutions:**

**(i) $x^2$–2x –8**

⇒$x^2$– 4x+2x–8 = x(x–4)+2(x–4) = (x-4)(x+2)

Therefore, zeroes of polynomial equation $x^2$–2x–8 are (4, -2)

Sum of zeroes = 4–2 = 2 = -(-2)/1 = -(Coefficient of x)/(Coefficient of $x^2$)

Product of zeroes = 4×(-2) = -8 =-(8)/1 = (Constant term)/(Coefficient of $x^2$)

**(ii) 4$s^2$–4s+1**

⇒4$s^2$–2s–2s+1 = 2s(2s–1)–1(2s-1) = (2s–1)(2s–1)

Therefore, zeroes of polynomial equation 4$s^2$–4s+1 are (1/2, 1/2)

Sum of zeroes = (½)+(1/2) = 1 = -(-4)/4 = -(Coefficient of s)/(Coefficient of $s^2$)

Product of zeros = (1/2)×(1/2) = 1/4 = (Constant term)/(Coefficient of $s^2$ )

**(iii) 6$x^2$–3–7x**

⇒6$x^2$–7x–3 = 6$x^2$– 9x + 2x – 3 = 3x(2x – 3) +1(2x – 3) = (3x+1)(2x-3)

Therefore, zeroes of polynomial equation 6$x^2$–3–7x are (-1/3, 3/2)

Sum of zeroes = -(1/3)+(3/2) = (7/6) = -(Coefficient of x)/(Coefficient of $x^2$)

Product of zeroes = -(1/3)×(3/2) = -(3/6) = (Constant term) /(Coefficient of $x^2$ )

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

⇒ 4u(u+2)

Therefore, zeroes of polynomial equation 4$u^2$ + 8u are (0, -2).

Sum of zeroes = 0+(-2) = -2 = -(8/4) = = -(Coefficient of u)/(Coefficient of $u^2$)

Product of zeroes = 0×-2 = 0 = 0/4 = (Constant term)/(Coefficient of $u^2$ )

**(v) $t^2$–15**

⇒ $t^2$ = 15 or t = ±√15

Therefore, zeroes of polynomial equation $t^2$ –15 are (√15, -√15)

Sum of zeroes =√15+(-√15) = 0= -(0/1)= -(Coefficient of t) / (Coefficient of $t^2$)

Product of zeroes = √15×(-√15) = -15 = -15/1 = (Constant term) / (Coefficient of $t^2$ )

**(vi) 3$x^2$–x–4**

⇒ 3$x^2$–4x+3x–4 = x(3x-4)+1(3x-4) = (3x – 4)(x + 1)

Therefore, zeroes of polynomial equation3$x^2$ – x – 4 are (4/3, -1)

Sum of zeroes = (4/3)+(-1) = (1/3)= -(-1/3) = -(Coefficient of x) / (Coefficient of $x^2$)

Product of zeroes=(4/3)×(-1) = (-4/3) = (Constant term) /(Coefficient of $x^2$ )

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

**(i) 1/4 , -1**

**Solution:**

From the formulas of sum and product of zeroes, we know,

Sum of zeroes = $\alpha+\beta$

Product of zeroes = $\alpha\ \beta$

Sum of zeroes = $\alpha+\beta$ = 1/4

Product of zeroes = $\alpha\ \beta$ = -1

∴ If α and β are zeroes of any quadratic polynomial, then the quadratic polynomial equation can be written directly as:-

$x^2-(\alpha+\beta)x+\alpha\beta = 0$

$x^2-(1/4)x+(-1) = 0$

$4x^2-x-4 = 0$

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

**(ii)**√2, 1/3

**Solution:**

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

Product of zeroes = $\alpha\ \beta$ = 1/3

∴ If α and β are zeroes of any quadratic polynomial, then the quadratic polynomial equation can be written directly as:-

$x^2-(\alpha+\beta)x+\alpha\beta = 0$

$x^2-(\sqrt{2})x+(1/3) = 0$

$3x^2-3\sqrt{2}x+1 = 0$

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

(iii) 0, √5

**Solution:**

Given,

Sum of zeroes = $\alpha+\beta$ = 0

Product of zeroes = $\alpha\ \beta = \sqrt{5}$

∴ If α and β are zeroes of any quadratic polynomial, then the quadratic polynomial equation can be written directly as:-

$x^2-(\alpha+\beta)x+\alpha\beta = 0$

$x^2-(0)x+\sqrt{5}= 0$

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

(iv) 1, 1

**Solution:**

Given,

Sum of zeroes = $\alpha+\beta = 1$

Product of zeroes = $\alpha \beta = 1$

∴ If α and β are zeroes of any quadratic polynomial, then the quadratic polynomial equation can be written directly as:-

$x^2-(\alpha+\beta)x + \alpha\beta = 0$

$x^2-x+1 = 0$

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

(v) -1/4, 1/4

**Solution:**

Given,

Sum of zeroes = $\alpha+\beta = -1/4$

Product of zeroes = $\alpha \beta = 1/4$

∴ If α and β are zeroes of any quadratic polynomial, then the quadratic polynomial equation can be written directly as:-

$x^2-(\alpha+\beta)x + \alpha\beta = 0$

$x^2-(-1/4)x + (1/4) = 0$

$4x^2+x+1 = 0$

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

(vi) 4, 1

**Solution:**

Given,

Sum of zeroes = $\alpha+\beta = 4$

Product of zeroes = $\alpha\beta = 1$

∴ If α and β are zeroes of any quadratic polynomial, then the quadratic polynomial equation can be written directly as:-

$x^2-(\alpha+\beta)x+\alpha\beta = 0$

$x^2-4x+1 = 0$

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

## EXERCISE 2.3 PAGE: 36

**1. Divide the polynomial p(x) by the polynomial g(x) and find the quotient and remainder in each of the following:**

**(i) $p(x) = x^3-3x^2+5x-3$ , $g(x) = x^2-2$**

**Solution:**

Given,

Dividend = $p(x) = x^3-3x^2+5x-3$

Divisor = $g(x) = x^2-2$

$$
\begin{array}{r|rrrr}
 & x & -3 & & \\
\hline
x^2-2 & x^3 & -3x^2 & +5x & -3 \\
- & x^3 & +0x^2 & -2x & \\
\hline
 & & -3x^2 & +7x & -3 \\
 & - & -3x^2 & +0x & +6 \\
\hline
 & & & 7x & -9
\end{array}
$$

Therefore, upon division we get,

Quotient = $x-3$

Remainder = $7x-9$

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

**Solution:**

Given,

Dividend = $p(x) = x^4-3x^2+4x+5$

Divisor = $g(x) = x^2+1-x$

$$
\begin{array}{r|rrrrr}
 & x^2 & +x & -3 & & \\
\hline
x^2-x+1 & x^4 & +0x^3 & -3x^2 & +4x & +5 \\
 & - & & & & \\
 & x^4 & -x^3 & +x^2 & & \\
\hline
 & & x^3 & -4x^2 & +4x & +5 \\
 & & - & & & \\
 & & x^3 & -x^2 & +x & \\
\hline
 & & & -3x^2 & +3x & +5 \\
 & & & - & & \\
 & & & -3x^2 & +3x & -3 \\
\hline
 & & & & & 8
\end{array}
$$

Therefore, upon division we get,

Quotient = $x^2 + x-3$

Remainder = 8

**(iii) p(x) =$x^4-5x+6$, g(x) = $2-x^2$**

**Solution:**

Given,

Dividend = p(x) =$x^4 - 5x + 6 = x^4+0x^2-5x+6$

Divisor = g(x) = $2-x^2 = -x^2+2$

$$
\begin{array}{r|rrrrr}
 & -x^2 & -2 & & & \\
\hline
-x^2+2 & x^4 & +0x^3 & +0x^2 & -5x & +6 \\
 & - & & & & \\
 & x^4 & +0x^3 & -2x^2 & & \\
\hline
 & & & 2x^2 & -5x & +6 \\
 & & & - & & \\
 & & & 2x^2 & +0x & -4 \\
\hline
 & & & & -5x & +10
\end{array}
$$

Therefore, upon division we get,

Quotient = $-x^2-2$

Remainder = $-5x + 10$

**2. Check whether the first polynomial is a factor of the second polynomial by dividing the second polynomial by the first polynomial:**

**(i) $t^2-3$, $2t^4+3t^3-2t^2-9t-12$**

**Solutions:**

Given,

First polynomial = $t^2-3$

Second polynomial = $2t^4+3t^3-2t^2-9t-12$

$$
\begin{array}{r|rrrrr}
 & 2t^2 & +3t & +4 & & \\
\hline
t^2-3 & 2t^4 & +3t^3 & -2t^2 & -9t & -12 \\
- & 2t^4 & +0t^3 & -6t^2 & & \\
\hline
 & & 3t^3 & +4t^2 & -9t & -12 \\
 & - & 3t^3 & +0t^2 & -9t & \\
\hline
 & & & 4t^2 & +0t & -12 \\
 & & - & 4t^2 & +0t & -12 \\
\hline
 & & & & & 0
\end{array}
$$

As we can see, the remainder is left as 0. Therefore, we say that, $t^2-3$ is a factor of $2t^4+3t^3-2t^2-9t-12$.

**(ii) $x^2+3x+1$ , $3x^4+5x^3-7x^2+2x+2$**

**Solutions:**

Given,

First polynomial = $x^2+3x+1$

Second polynomial = $3x^4+5x^3-7x^2+2x+2$

$$\begin{array}{r|rrrrr}
 & 3x^2 & -4x & +2 & & \\
\hline
x^2+3x+1 & 3x^4 & +5x^3 & -7x^2 & +2x & +2 \\
 & - & & & & \\
 & 3x^4 & +9x^3 & +3x^2 & & \\
\hline
 & & -4x^3 & -10x^2 & +2x & +2 \\
 & & - & & & \\
 & & -4x^3 & -12x^2 & -4x & \\
\hline
 & & & 2x^2 & +6x & +2 \\
 & & & - & & \\
 & & & 2x^2 & +6x & +2 \\
\hline
 & & & & & 0
\end{array}$$

As we can see, the remainder is left as 0. Therefore, we say that, $x^2 + 3x + 1$ is a factor of $3x^4+5x^3-7x^2+2x+2$.

**(iii) $x^3-3x+1$, $x^5-4x^3+x^2+3x+1$**

**Solutions:**

Given,

First polynomial = $x^3-3x+1$

Second polynomial = $x^5-4x^3+x^2+3x+1$

$$\begin{array}{r|rrrrrr}
 & x^2 & -1 & & & & \\
\hline
x^3-3x+1 & x^5 & +0x^4 & -4x^3 & +x^2 & +3x & +1 \\
 & - & & & & & \\
 & x^5 & +0x^4 & -3x^3 & +x^2 & & \\
\hline
 & & & -x^3 & +0x^2 & +3x & +1 \\
 & & & - & & & \\
 & & & -x^3 & +0x^2 & +3x & -1 \\
\hline
 & & & & & & 2
\end{array}$$

As we can see, the remainder is not equal to 0. Therefore, we say that, $x^3-3x+1$ is not a factor of $x^5-4x^3+x^2+3x+1$ .

**3. Obtain all other zeroes of $3x^4+6x^3-2x^2-10x-5$, if two of its zeroes are $\sqrt{(5/3)}$ and – $\sqrt{(5/3)}$.**

**Solutions:**

Since this is a polynomial equation of degree 4, hence there will be total 4 roots.

**√(5/3) and – √(5/3)** are zeroes of polynomial f(x).

∴ (x –√**(5/3)**) (x+√**(5/3)** = $x^2$-(5/3) = 0

**($3x^2$−5)=0,** is a factor of given polynomial f(x).

Now, when we will divide f(x) by ($3x^2$−5) the quotient obtained will also be a factor of f(x) and the remainder will be 0.

$$
\begin{array}{r|l}
 & x^2 + 2x + 1 \\
\hline
3x^2-5 & 3x^4 + 6x^3 - 2x^2 - 10x - 5 \\
 & 3x^4 \qquad\quad - 5x^2 \\
 & (-) \qquad\qquad (+) \\
\hline
 & \quad + 6x^3 + 3x^2 - 10x - 5 \\
 & \quad - 6x^3 \qquad\quad - 10x \\
 & \quad (+) \qquad\qquad (-) \\
\hline
 & \qquad\qquad 3x^2 \qquad\quad -5 \\
 & \qquad\qquad 3x^2 \qquad\quad -5 \\
 & \qquad\qquad (-) \qquad\quad (+) \\
\hline
 & \qquad\qquad\qquad 0
\end{array}
$$

Therefore, $3x^4+6x^3-2x^2-10x-5 = (3x^2-5)$**($x^2$+2x+1)**

Now, on further factorizing ($x^2$+2x+1) we get,

**$x^2$+2x+1** = $x^2$+x+x+1 = 0

x(x+1)+1(x+1) = 0

**(x+1)(x+1) = 0**

So, its zeroes are given by: **x= −1** and **x = −1.**

Therefore, all four zeroes of given polynomial equation are:

**√(5/3),- √(5/3) , −1 and −1.**

Hence, is the answer.

**4. On dividing $x^3$-$3x^2$+x+2 by a polynomial g(x), the quotient and remainder were x–2 and –2x+4, respectively. Find g(x).**

**Solution:**

Given,

Dividend, $p(x) = x^3-3x^2+x+2$

Quotient = x-2

Remainder = –2x+4

We have to find the value of Divisor, g(x) =?

As we know,

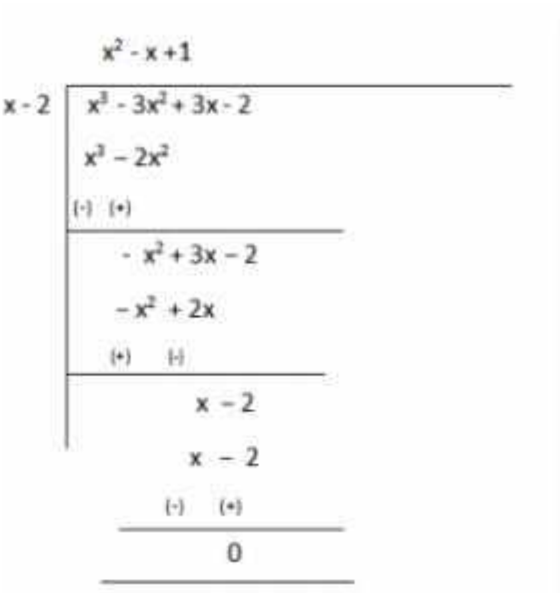
Dividend = Divisor × Quotient + Remainder

$\therefore x^3-3x^2+x+2 = g(x)\times(x-2) + (-2x+4)$

$x^3-3x^2+x+2-(-2x+4) = g(x)\times(x-2)$

Therefore, $g(x) \times (x-2) = x^3-3x^2+3x-2$

Now, for finding g(x) we will divide $x^3-3x^2+3x-2$ with (x-2)




Therefore, $\mathbf{g(x) = (x^2–x+1)}$

**5. Give examples of polynomials p(x), g(x), q(x) and r(x), which satisfy the division algorithm and**

**(i) deg p(x) = deg q(x)**

**(ii) deg q(x) = deg r(x)**

**(iii) deg r(x) = 0**

**Solutions:**

According to the division algorithm, dividend p(x) and divisor g(x) are two polynomials, where $g(x)\neq0$. Then we can find the value of quotient q(x) and remainder r(x), with the help of below given formula;

Dividend = Divisor × Quotient + Remainder

$\therefore p(x) = g(x)\times q(x)+r(x)$

Where r(x) = 0 or degree of r(x)< degree of g(x).

Now let us proof the three given cases as per division algorithm by taking examples for each.

**(i) deg p(x) = deg q(x)**

Degree of dividend is equal to degree of quotient, only when the divisor is a constant term.

Let us take an example, $p(x) = 3x^2+3x+3$ is a polynomial to be divided by $g(x) = 3$.

So, $(3x^2+3x+3)/3 = x^2+x+1 = q(x)$

Thus, you can see, the degree of quotient q(x) = 2, which also equal to the degree of dividend p(x).

Hence, division algorithm is satisfied here.

**(ii) deg q(x) = deg r(x)**

Let us take an example, $p(x) = x^2 + 3$ is a polynomial to be divided by $g(x) = x – 1$.

So, $x^2 + 3 = (x – 1)\times(x) + (x + 3)$

Hence, quotient $q(x) = x$

Also, remainder $r(x) = x + 3$

Thus, you can see, the degree of quotient q(x) = 1, which is also equal to the degree of remainder r(x).

Hence, division algorithm is satisfied here.

**(iii) deg r(x) = 0**

The degree of remainder is 0 only when the remainder left after division algorithm is constant.

Let us take an example, $p(x) = x^2 + 1$ is a polynomial to be divided by $g(x) = x$.

So, $x^2 + 1 = (x)\times(x) + 1$

Hence, quotient $q(x) = x$

And, remainder $r(x) = 1$

Clearly, the degree of remainder here is 0.

Hence, division algorithm is satisfied here.

## EXERCISE 2.4



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

**(i) $2x^3+x^2-5x+2$; -1/2, 1, -2**

**Solution:**

Given, $p(x) = 2x^3+x^2-5x+2$

And zeroes for p(x) are = 1/2, 1, -2

$\therefore p(1/2) = 2(1/2)^3+(1/2)^2-5(1/2)+2 = (1/4)+(1/4)-(5/2)+2 = 0$

$p(1) = 2(1)^3+(1)^2-5(1)+2 = 0$

$p(-2) = 2(-2)^3+(-2)^2-5(-2)+2 = 0$

Hence, proved 1/2, 1, -2 are the zeroes of $2x^3+x^2-5x+2$.

Now, comparing the given polynomial with general expression, we get;

$\therefore ax^3+bx^2+cx+d = 2x^3+x^2-5x+2$

a=2, b=1, c= -5 and d = 2

As we know, if α, β, γ are the zeroes of the cubic polynomial $ax^3+bx^2+cx+d$ , then;

$\alpha+\beta+\gamma = –b/a$

$\alpha\beta+\beta\gamma+\gamma\alpha = c/a$

$\alpha\beta\gamma = – d/a$.

Therefore, putting the values of zeroes of the polynomial,

$\alpha+\beta+\gamma = ½+1+(-2) = -1/2 = –b/a$

$\alpha\beta+\beta\gamma+\gamma\alpha = (1/2\times1)+(1\times-2)+(-2\times1/2) = -5/2 = c/a$

$\alpha\beta\gamma = ½\times1\times(-2) = -2/2 = -d/a$

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

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

**Solution:**

Given, $p(x) = x^3-4x^2+5x-2$

And zeroes for p(x) are 2,1,1.

$\therefore p(2)= 2^3-4(2)^2+5(2)-2 = 0$

$p(1) = 1^3-(4\times1^2)+(5\times1)-2 = 0$

Hence proved, 2, 1, 1 are the zeroes of $x^3-4x^2+5x-2$

Now, comparing the given polynomial with general expression, we get;

∴ $ax^3+bx^2+cx+d = x^3-4x^2+5x-2$

a = 1, b = -4, c = 5 and d = -2

As we know, if α, β, γ are the zeroes of the cubic polynomial $ax^3+bx^2+cx+d$ , then;

$\alpha + \beta + \gamma = -b/a$

$\alpha\beta + \beta\gamma + \gamma\alpha = c/a$

$\alpha \beta \gamma = - d/a$.

Therefore, putting the values of zeroes of the polynomial,

$\alpha +\beta+\gamma = 2+1+1 = 4 = -(-4)/1 = -b/a$

$\alpha\beta+\beta\gamma+\gamma\alpha = 2\times1+1\times1+1\times2 = 5 = 5/1= c/a$

$\alpha\beta\gamma = 2\times1\times1 = 2 = -(-2)/1 = -d/a$

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

**2. Find a cubic polynomial with the sum, sum of the product of its zeroes taken two at a time, and the product of its zeroes as 2, –7, –14 respectively.**

**Solution:**

Let us consider the cubic polynomial is $ax^3+bx^2+cx+d$ and the values of the zeroes of the polynomials be α, β, γ.

As per the given question,

$\alpha+\beta+\gamma = -b/a = 2/1$

$\alpha\beta +\beta\gamma+\gamma\alpha = c/a = -7/1$

$\alpha \beta\gamma = -d/a = -14/1$

Thus, from above three expressions we get the values of coefficient of polynomial.

a = 1, b = -2, c = -7, d = 14

Hence, the cubic polynomial is $x^3-2x^2-7x+14$

**3. If the zeroes of the polynomial $x^3-3x^2+x+1$ are a – b, a, a + b, find a and b.**

**Solution:**

We are given with the polynomial here,

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

And zeroes are given as a – b, a, a + b

Now, comparing the given polynomial with general expression, we get;

∴$px^3+qx^2+rx+s = x^3-3x^2+x+1$

p = 1, q = -3, r = 1 and s = 1

Sum of zeroes = a – b + a + a + b

-q/p = 3a

Putting the values q and p.

-(-3)/1 = 3a

a=1

Thus, the zeroes are 1-b, 1, 1+b.

Now, product of zeroes = 1(1-b)(1+b)

$-s/p = 1-b^2$

$-1/1 = 1-b^2$

$b^2 = 1+1 = 2$

$b = \pm\sqrt{2}$

Hence, $1-\sqrt{2}$, 1, $1+\sqrt{2}$ are the zeroes of $x^3-3x^2+x+1$.

**4. If two zeroes of the polynomial $x^4-6x^3-26x^2+138x-35$ are $2 \pm\sqrt{3}$, find other zeroes.**

**Solution:**

Since this is a polynomial equation of degree 4, hence there will be total 4 roots.

Let $f(x) = x^4-6x^3-26x^2+138x-35$

Since $2+\sqrt{3}$ and $2-\sqrt{3}$ are zeroes of given polynomial f(x).

$\therefore [x-(2+\sqrt{3})]\,[x-(2-\sqrt{3})] = 0$

$(x-2-\sqrt{3})(x-2+\sqrt{3}) = 0$

On multiplying the above equation we get,

$x^2-4x+1$, this is a factor of a given polynomial f(x).

Now, if we will divide f(x) by g(x), the quotient will also be a factor of f(x) and the remainder will be 0.

$$
\begin{array}{r|l}
 & x^2-2x-35 \\
\hline
x^2-4x+1 & x^4-6x^3-26x^2+138x-35 \\
 & x^4-4x^3+x^2 \\
 & (-)\ (+)\ (-) \\
\hline
 & -2x^3-27x^2+138x-35 \\
 & -2x^3+8x^2-2x \\
 & (+)\ (-)\ (+) \\
\hline
 & -35x^2+140x-35 \\
 & -35x^2+140x-35 \\
 & (+)\ (-)\ (+) \\
\hline
 & 0
\end{array}
$$

So, $x^4-6x^3-26x^2+138x-35 = (x^2-4x+1)(x^2-2x-35)$

Now, on further factorizing ($x^2$–2x−35) we get,

$x^2$**–(7−5)x −35** = $x^2$– 7x+5x+35 = 0

x(x −7)+5(x−7) = 0

**(x+5)(x−7) = 0**

So, its zeroes are given by:

x= −5 and x = 7.

Therefore, all four zeroes of given polynomial equation are: 2+√**3** , 2-√**3**, **−5 and 7.**

**Q.5: If the polynomial $x^4 – 6x^3 + 16x^2 – 25x + 10$ is divided by another polynomial $x^2 – 2x + k$, the remainder comes out to be x + a, find k and a.**

**Solution:**

Let's divide $x^4 – 6x^3 + 16x^2 – 25x + 10$ by $x^2 – 2x + k$.

$$x^2 - 2x + k \;)\; x^4 - 6x^3 + 16x^2 - 25x + 10 \;(\; x^2 - 4x + (8 - k)$$

$$\underset{-}{x^4} \underset{+}{-} 2x^3 \underset{-}{+} kx^2$$

$$-4x^3 + (16 - k)x^2 - 25x$$

$$\underset{+}{-4x^3} \underset{-}{+} 8x^2 \underset{+}{-} 4kx$$

$$(8 - k)x^2 + (4k - 25)x + 10$$

$$\underset{-}{(8 - k)x^2} \underset{+}{-} 2(8 - k)x \underset{-}{+} k(8 - k)$$

$$(4k - 25 + 16 - 2k)x + [10 - k(8 - k)]$$

Given that the remainder of the polynomial division is x + a.

(4k – 25 + 16 – 2k)x + [10 – k(8 – k)] = x + a

(2k – 9)x + (10 – 8k + $k^2$) = x + a

Comparing the coefficients of the above equation, we get;

2k – 9 = 1

2k = 9 + 1 = 10

k = 10/2 = 5

And

10 – 8k + $k^2$ = a

10 – 8(5) + $(5)^2$ = a [since k = 5]

10 – 40 + 25 = a

a = -5

Therefore, k = 5 and a = -5.