POLYNOMIALS - CHAPTER 2

EXERCISE 2A

Answer 1:

(i) $x^5 - 2x^3 + \text{x} + \sqrt{3}$ is an expression having only non-negative integral powers of *x.* So, it is a polynomial. Also, the highest power of x is 5, so, it is a polynomial of degree 5.

(ii) $y^3 + \sqrt{3}\text{y}$ is an expression having only non-negative integral powers of *y.* So, it is a polynomial. Also, the highest power of y is 3, so, it is a polynomial of degree 3.

(iii) $t^2 - \frac{2}{5}\text{t} + \sqrt{5}$ is an expression having only non-negative integral powers of *t.* So, it is a polynomial. Also, the highest power of t is 2, so, it is a polynomial of degree 2.

(iv) $x^{100} - 1$ is an expression having only non-negative integral power of *x.* So, it is a polynomial. Also, the highest power of x is 100, so, it is a polynomial of degree 100.

(v) $\frac{1}{\sqrt{2}}x^2 - \sqrt{2}x + 2$ is an expression having only non-negative integral powers of *x.* So, it is a polynomial. Also, the highest power of x is 2, so, it is a polynomial of degree 2.

(vi) $x^{-2} + 2x^{-1} + 3$ is an expression having negative integral powers of *x.* So, it is not a polynomial.

(vii) Clearly, 1 is a constant polynomial of degree 0.

(viii) Clearly, $-\frac{3}{5}$ is a constant polynomial of degree 0.

(ix) $\frac{x^2}{2} - 2x^2 = \frac{x^2}{2} - 2x^{-2}$
This is an expression having negative integral power of x i.e. -2. So, it is not a polynomial.

(x) $\sqrt[3]{2}x^2 - 8$ is an expression having only non-negative integral power of *x.* So, it is a polynomial. Also, the highest power of x is 2, so, it is a polynomial of degree 2.

(xi) $\frac{1}{2x^2} = \frac{1}{2}x^{-2}$ is an expression having negative integral power of *x.* So, it is not a polynomial.

(xii) $\frac{1}{\sqrt{5}}\,x^{\frac{1}{2}} + 1$
In this expression, the power of x is $\frac{1}{2}$ which is a fraction. Since it is an expression having fractional power of *x,* so, it is not a polynomial.

(xiii) $\frac{3}{5}x^2 - \frac{7}{3}x + 9$ is an expression having only non-negative integral powers of *x.* So, it is a polynomial. Also, the highest power of x is 2, so, it is a polynomial of degree 2.

(xiv) $x^4 - x^{\frac{3}{2}} + \text{x} - 3$

In this expression, one of the powers of x is $\frac{3}{2}$ which is a fraction. Since it is an expression having fractional power of *x,* so, it is not a polynomial.

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

In this expression, one of the powers of x is $\frac{1}{2}$ which is a fraction. Since it is an expression having fractional power of *x,* so, it is not a polynomial.

Answer 2:

(i) $-7 + x$ is a polynomial with degree 1.
it is a linear polynomial.

(ii) $6y$ is a polynomial with degree 1.
it is a linear polynomial.

(iii) $-z^3$ is a polynomial with degree 3.
it is a cubic polynomial.

(iv) $1 - y - y^3$ is a polynomial with degree 3.
it is a cubic polynomial.

(v) $x - x^3 + x^4$ is a polynomial with degree 4.
it is a quartic polynomial.

(vi) $1 + x + x^2$ is a polynomial with degree 2.
it is a quadratic polynomial.

(vii) $-6x^2$ is a polynomial with degree 2.
it is a quadratic polynomial.

(viii) -13 is a polynomial with degree 0.
it is a constant polynomial.

(ix) $-p$ is a polynomial with degree 1.
it is a linear polynomial.

ANSWER 3. i) In $x + 3x^2 - 5x^3 + x^4$ the coefficient of x^3 is -5.

ii) In $\sqrt{3} - 2\sqrt{2}x + 6x^2$ the coefficient of x is $-2\sqrt{2}$.

iii) $2x - 3 + x^3$ can be written as $x^3 + 0x^2 + 2x - 3$.
In $x^3 + 0x^2 + 2x - 3$ the coefficient of x^2 is 0.

iv) In $\frac{3}{8}x^2 - \frac{2}{7}x + \frac{1}{6}$ the coefficient of x is $-\frac{2}{7}$.

v) In $\frac{\pi}{2}x^2 + 7x - \frac{2}{5}\pi$ the constant term is $-\frac{2}{5}\pi$.

ANSWER 4. i) $\frac{4x-5x^2+6x^3}{2x}$

We can write it separately as

$= \frac{4x}{2x} - \frac{5x^2}{2x} + \frac{6x^3}{2x}$

On further simplification we get

$= 2 - \frac{5}{2}x + 3x^2$

The degree of given expression is 2.

ii) $y^2 (y - y^3)$

By multiplying the terms

We get

$= y^3 - y^5$

The degree of the given expression is 5.

iii) $(3x-2)(2x^3 + 3x^2)$

By multiplying the terms

We get

$6x^4+9x^3 - 4x^3 - 6x^2$

On further simplification

$= 6x^4 + 5x^3 - 6x^2$

The degree of the given expression is 4.

iv) $-\frac{1}{2}x + 3$

The degree of the given expression is 1.

v) -8

The given expression is a constant polynomial of degree is zero .

vi) $x^{-2}(x^4 + x^2)$

By taking common terms out

$= x^{-2}.x^2(x^2 + 1)$

On further simplification

$= x^{-2+2}(x^2 + 1)$

So we get

$= x^0(x^2 + 1)$
$= x^2 + 1$

The degree of the expression is 2.

ANSWER 5. i) Example of a monomial of degree 5 is $4x^5$.

ii) Example of a binomial of degree 8 is $x - 4x^8$.

iii) Example of a trinomial of degree 4 is $1 + 3x + x^4$.

iv) Example of a monomial of degree 0 is 1.

ANSWER 6. i) $x - 2x^2 + 8 + 5x^3$ in standard form is written as $5x^3 - 2x^2 + x + 8$.

ii) $\frac{2}{3} + 4y^2 - 3y + 2y^3$ in standard form is written as $2y^3 + 4y^2 - 3y + \frac{2}{3}$.

iii) $6x^3 + 2x - x^5 - 3x^2$ in standard form is written as $-x^5 + 6x^3 - 3x^2 + 2x$.

iv) $2 + t - 3t^3 + t^4 - t^2$ in standard form is written as $t^4 - 3t^3 - t^2 + t + 2$.

EXERCISE-2B

ANSWER1)
$p(x) = 5 - 4x + 2x^2$

(i) $p(0) = 5 - 4 \times 0 + 2 \times 02 = 5$

(ii) $p(3) = 5 - 4 \times 3 + 2 \times 32$
$= 5 - 12 + 18$
$= 23 - 12 = 11$

(iii) $p(-2) = 5 - 4(-2) + 2(-2)^2$
$= 5 + 8 + 8 = 21$

Answer 2) $p(y) = 4 + 3y - y^2 + 5y^2$

(i) $p(0) = 4 + 3 \times 0 - 02 + 5 \times 03$
$= 4 + 0 - 0 + 0 = 4$

(ii) $p(2) = 4 + 3 \times 2 - 22 + 5 \times 23$
$= 4 + 6 - 4 + 40$
$= 10 - 4 + 40 = 46$

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

Answer 3) $f(t) = 4t^2 - 3t + 6$

(i) $f(0) = 4 \times 02 - 3 \times 0 + 6$
$= 0 - 0 + 6 = 6$

(ii) $f(4) = 4(4)2 - 3 \times 4 + 6$
$= 64 - 12 + 6 = 58$

(iii) $f(-5) = 4(-5)^2 - 3(-5) + 6$
$= 100 + 15 + 6 = 121$

Answer 4)

$p(x) = x^3 - 3x^2 + 2x$
Thus, we have
$p(0) = 0^3 - 3(0)^2 + 2(0) = 0$
$p(1) = 1^3 - 3(1)^2 + 2(1) = 1 - 3 + 2 = 0$
$p(2) = 2^3 - 3(2)^2 + 2(2) = 8 - 12 + 4 = 0$
Hence, 0, 1 and 2 are the zeros of the polynomial $p(x) = x^3 - 3x^2 + 2x$.

Answer5)

$p(x) = x^3 + x^2 - 9x - 9$
Thus, we have
$p(0) = 0^3 + 0^2 - 9(0) - 9 = -9$
$p(3) = 3^3 + 3^2 - 9(3) - 9 = 27 + 9 - 27 - 9 = 0$
$p(-3) = (-3)^3 + (-3)^2 - 9(-3) - 9 = -27 + 9 + 27 - 9 = 0$
$p(-1) = (-1)^3 + (-1)^2 - 9(-1) - 9 = -1 + 1 + 9 - 9 = 0$
Hence, 0, 3 and -3 are the zeros of p(x).
Now, 0 is not a zero of p(x) since $p(0) \neq 0$.

Answer 6)
i) $p(x) = x - 4$
Then, $p(4) = 4 - 4 = 0$
$\Rightarrow$ 4 is a zero of the polynomial p(x).

ii) $q(x) = x + 3$

Then, $q(-3) = -3 + 3 = 0$
$\Rightarrow$ -3 is not a zero of the polynomial p(x).

iii) $p(x) = 2 - 5x$
Then,

$\Rightarrow \frac{2}{5}$ is a zero of the polynomial p(x).

iv) $p(y) = 2y + 1$
Then,
is $\Rightarrow \frac{-1}{2}$ a zero of the polynomial p(y).

Answer 7)

i) $p(x) = x2 - 3x + 2$

$p(x)= (x - 1)(x - 2)$
Then,$p(1)= (1 - 1)(1 - 2) = 0 \times -1 = 0$

$\Rightarrow$ 1 is a zero of the polynomial p(x).

Also, $p(2) = (2 - 1)(2 - 2) = 1 \times 0 = 0$

⇨ 2 is a zero of the polynomial p(x).
Hence,1 and 2 are the zeroes of the polynomial p(x).

ii) $q(x) = x2 + x - 6$

Then, $q(2) = 22 + 2 - 6$
$= 4 + 2 - 6$
$= 6 - 6 = 0$
⇨ 2 is a zero of the polynomial p(x).
Also, $q(-3) = (-3)2 - 3 - 6$
$= 9 - 3 - 6 = 0$
⇨ -3 is a zero of the polynomial p(x).
Hence, 2 and -3 are the zeroes of the polynomial p(x).

iii) $r(x) = x2 - 3x$.

Then,$p(0) = 02 - 3 \times 0 = 0$

$r(3) = (3)2 - 3 \times 3 = 9 - 9 = 0$

⇨ 0 and 3 are the zeroes of the polynomial p(x).

Answer8)

(i) $p(x) = 0$

⇨ $x - 5 = 0$
⇨ $x = 5$
⇨ 5 is the zero of the polynomial p(x).

(ii) $q(x) = 0$
⇨ is a zero of the polynomial p(y).
⇨ $x + 4 = 0$
⇨ $x= -4$
⇨ -4 is the zero of the polynomial q(x).

(iii) $r(x) = 2x + 5$
Now, $r(x) = 0$
$\Rightarrow 2x + 5 = 0$
$\Rightarrow 2x = -5$

$\Rightarrow x = -\frac{5}{2}$

$\therefore -\frac{5}{2}$ is a zero of the polynomial r(x).

(iv) f(x) = 0

$\Rightarrow$ 3x + 1= 0

$\Rightarrow$ 3x=-1

$\Rightarrow$ x = $\frac{-1}{3}$

$\Rightarrow$ x = $\frac{-1}{3}$ is the zero of the polynomial f(x).

(v) g(x) = 0

$\Rightarrow$ 5 - 4x = 0

$\Rightarrow$ -4x = -5

$\Rightarrow$ x = $\frac{5}{4}$

$\Rightarrow$ x = $\frac{5}{4}$ is the zero of the polynomial g(x).

(vi) h(x) = 6x - 2

Now, h(x) = 0

$\Rightarrow$ 6x - 2 = 0

$\Rightarrow$ 6x = 2

$\Rightarrow x = \frac{2}{6} = \frac{1}{3}$

$\therefore \frac{1}{3}$ is a zero of the polynomial h(x).

(vii) p(x) = 0

$\Rightarrow$ ax = 0

$\Rightarrow$ x = 0

$\Rightarrow$ 0 is the zero of the polynomial p(x).

(viii) q(x) = 0

$\Rightarrow$ 4x = 0

$\Rightarrow$ x = 0

⇨ 0 is the zero of the polynomial q(x).

9) $f(x) = 2x^3 - 5x^2 + ax + b$

Now, 2 is a zero of f(x).

$\Rightarrow f(2) = 0$

$\Rightarrow 2(2)^3 - 5(2)^2 + a(2) + b = 0$

$\Rightarrow 16 - 20 + 2a + b = 0$

$\Rightarrow 2a + b - 4 = 0$ ....(i)

Also, 0 is a zero of f(x).

$\Rightarrow f(0) = 0$

$\Rightarrow 2(0)^3 - 5(0)^2 + a(0) + b = 0$

$\Rightarrow 0 - 0 + 0 + b = 0$

$\Rightarrow b = 0$

Substituting b = 0 in (i), we get

$2a + 0 - 4 = 0$

$\Rightarrow 2a = 4$

$\Rightarrow a = 2$

Thus, a = 2 and b = 0

EXERCISE 2C

ANSWER 1. We can write (x^4+1) as $(x^4+0x^3+0x^2+0x+1)$

$x-1)\ x^4+0x^3+0x^2+0x+1\ (x^3+x^2+x+1$

$x^4 - x^3$

$-\quad +$

x^3+0x^2+0x+1

$x^3 - x^2$

$-\quad +$

x^2+0x+1

x^2-x

$-\quad +$

$x+1$

$x-1$

$-\quad +$

2

quotient $=(x^3+x^2+x+1)$ and remainder $=2$.

By verification:

$f(x)= x^4+1$

By substituting 1 in the place of x

$f(1)=1^4+1$

$f(1)=1+1$

so we get

$f(1)= 2$, which is remainder.

ANSWER 2. $x+2)\ 2x^4-6x^3 +2x^2 -x +2\ (2x^3 -10x^2 +22x -45$

$2x^4+4x^3$

$-\quad -$

$-10x^3+2x^2$

$-10x^3- 20x^2$

$+\quad +$

$22x^2 -x$

$22x^2-44x$

$-\quad +$

$-45x+2$

$-45x-90$

$+\quad +$

92

We know that ,

$(x+2)(2x^3-10x^2 +22x -45) + 92$

So we get ,

$=2x^4-10x^3 +22x^2 -45x +4x^3 -20x^2 +44x -90 +92$

$=2x^4 - 6x^3 +2x^2 - x +2$

$=p(x)$

Therefore ,the division algorithm is verified.

ANSWER 3. Given,

$p(x) = x^3 - 6x^2 + 9x + 3$

To find the value of x,

Consider,

g(x) = 0

x-1 = 0

So we get

x =1

According to the remainder theorem,

p(x) divided by (x-1) obtains the remainder as g(1).

Calculating g(1)

$= 1^3 - 6(1)^2 + 9(1) + 3$

On further simplification

= 1 – 6 + 9 + 3

So we get

= (-5) +12

= 7

Therefore , the remainder of the given expression is 7.

ANSWER 4. Given,

$p(x) = 2x^3 - 7x^2 + 9x - 13$

To find the value of x,

Consider,

g(x) = 0

x – 3 =0

so we get

x = 3

According to the remainder theorem,

p(x) divided by (x-3) obtains the remainder as g(3).

Calculating g(3)

$= 2(3)^3 - 7(3)^2 + 9(3) - 13$

On further simplification
= 2 (27) – 7 (9) + 27 – 13

So we get
= 54 – 63 + 27 – 13
= 5

Therefore , the remainder of the given expression is 5.

ANSWER 5. Given,
$p(x) = 3x^4 - 6x^2 - 8x - 2$

To find the value of x,
Consider,
g(x) = 0

x- 2 =0

so we get
x = 2
According to the remainder theorem,
p(x) divided by (x-2) obtains the remainder as g(2).

Calculating g(2)
$= 3(2)^4 - 6(2)^2 - 8(2) - 2$

On further simplification
=3 (16) – 6(4) – 16 – 2

So we get
=48 – 24 – 16 – 2
= 6

Therefore , the remainder of the given expression is 6.

ANSWER 6. Given,
$p(x)= 2x^3 - 9x^2 + x + 15$

To find the value of x,
Consider,
g(x) = 0

2x-3 = 0

so we get

2x= 3

By dividing

x= $\frac{3}{2}$

According to the remainder theorem,

p(x) divided by (2x-3) obtains the remainder as g($\frac{3}{2}$).

Calculating g($\frac{3}{2}$)

$= 2(\frac{3}{2})^3 - 9(\frac{3}{2})^2 + (\frac{3}{2}) + 15$

On further simplification

$=2 (\frac{27}{8}) – 9(\frac{9}{4}) +(\frac{3}{2}) + 15$

$= \frac{27}{4} - \frac{81}{4} + \frac{3}{2} + 15$

$= \frac{27-81+6+60}{4}$

So we get

$= \frac{12}{4}$

= 3

Therefore , the remainder of the given expression is 3.

ANSWER 7. Given,

$p(x)= x^3 - 2x^2 - 8x – 1$

To find the value of x,

Consider,

g(x) = 0

x +1 = 0

so we get

x = -1

According to the remainder theorem,

p(x) divided by (x+ 1) obtains the remainder as g(- 1).

Calculating g(-1)

$= (-1)^3 - 2(-1)^2 - 8(-1) – 1$

On further simplification
= - 1 – 2 + 8 – 1

So we get
= - 3 +7
= 4

Therefore , the remainder of the given expression is 4.

ANSWER 8. Given,
$p(x)= 2x^3 + x^2 - 15x -12$

To find the value of x,
Consider,
g(x) = 0

x + 2= 0

So we get

x= (-2)
According to the remainder theorem,
p(x) divided by (x+ 2) obtains the remainder as g(- 2).

Calculating g(-2)
$= 2 (-2)^3 + (-2)^2 - 15(-2) – 12$

On further simplification
= - 16 + 4 +30 – 12

So we get
= -12 +18
= 6

Therefore , the remainder of the given expression is 6.

ANSWER 9. Given,
$p(x)= 6x^3 + 13x^2 + 3$

To find the value of x,
Consider,
g(x) = 0

3x+2 = 0

So we get

x = $(\frac{-2}{3})$

According to the remainder theorem,
p(x) divided by (3x+ 2) obtains the remainder as g$(\frac{-2}{3})$.

Calculating g$(\frac{-2}{3})$
= $6\,(\frac{-2}{3})^3 + 13\,(\frac{-2}{3})^2 + 3$

On further simplification
= $6(\frac{-8}{27}) + 13\,(\frac{4}{9}) + 3$

= $\frac{-48}{27} + \frac{52}{9}$ +3

=$\frac{-16}{9} + \frac{52}{9}$ +3

So we get
= $\frac{63}{9}$

= 7

Therefore , the remainder of the given expression is 7.

ANSWER 10. Given,
p(x)= $x^3 - 6x^2 + 2x - 4$

To find the value of x,
Consider,
g(x) = 0

1 -$\frac{3}{2}$x = 0

So we get

x= $\frac{2}{3}$
According to the remainder theorem,
p(x) divided by(1 -$\frac{3}{2}$x) obtains the remainder as g$(\frac{2}{3})$.

Calculating g($\frac{2}{3}$)

= ($\frac{2}{3}$)³ - 6 ($\frac{2}{3}$)² + 2 ($\frac{2}{3}$) – 4

On further simplification

= $\frac{8}{27}$ - 6($\frac{4}{9}$) +$\frac{4}{3}$ - 4

= $\frac{8}{27}$ - $\frac{8}{3}$ + $\frac{4}{3}$ – 4

= $\frac{8-72+36-108}{27}$

So we get
= $\frac{-136}{27}$

Therefore , the remainder of the given expression is ($\frac{-136}{27}$).

ANSWER 11. Given,
p(x)= $2x^3 + 3x^2 - 11x - 3$

To find the value of x,
Consider,
g(x) = 0

x+ $\frac{1}{2}$ = 0

So we get

x = $\frac{-1}{2}$
According to the remainder theorem,
p(x) divided by(x+ $\frac{1}{2}$) obtains the remainder as g($\frac{-1}{2}$).

Calculating g($\frac{-1}{2}$)

= 2($\frac{-1}{2}$)³ + 3($\frac{-1}{2}$)² - 11($\frac{-1}{2}$) – 3

On further simplification

$= 2\left(\frac{-1}{8}\right) + 3\left(\frac{1}{4}\right) + \frac{11}{2} - 3$

$= -\frac{1}{4} + \frac{3}{4} + \frac{11}{2} - 3$

$= \frac{-1+3+22-12}{2}$

So we get

$= \frac{12}{4}$

= 3

Therefore , the remainder of the given expression is 3 .

ANSWER 12. Given,

$p(x) = x^3 - ax^2 + 6x - a$

To find the value of x,

Consider,

g(x) = 0

x – a = 0

So we get

x = a

According to the remainder theorem,

p(x) divided by(x+ a) obtains the remainder as g(a).

Calculating g(a),

$= a^3 - a(a)^2 + 6a - a$

On further simplification

$= a^3 - a^3 + 5a$

So we get

= 5a

Therefore , the remainder of the given expression is 5a .

ANSWER 13. Consider $p(x) = (2x^3 + x^2 - ax + 2)$ and $q(x) = (2x^3 - 3x^2 - 3x + a)$

When p(x) and q(x) are divided by (x-2) the remainder obtained is p(2) and q(2).

To find a ,

Let us take

$p(2) = q(2)$

$2x^3 + x^2 - ax + 2 = 2x^3 - 3x^2 - 3x + a$
By substituting 2 in the place of x

⇒ $2(2)^3 + (2)^2 - a(2) + 2 = 2(2)^3 - 3(2)^2 - 3(2) + a$

On further calculation:
⇒ $2(8) + 4 – 2a + 2 = 2(8) – 3(4) - 6 + a$
⇒ $16 + 4 – 2a + 2 = 16 – 12 – 6 + a$

So we get
⇒ $22 - 2a = -2 + a$
⇒ $22 + 2 = 2a + a$
⇒ $24 = 3a$

By dividing
$a = 8$

Thus, the value of a is 8.

ANSWER 14. Given,
$p(x) = x^4 - 2x^3 + 3x^2 - ax + b$

Consider $(x-1) = 0$ where $x = 1$ and the remainder is 5
$p(1) = 5$

by substituting 1 in the place of x

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

So we get
$2 – a + b = 5$ ………….(1)

Consider $(x + 1) = 0$ where $x = -1$ and the remainder is 19 .
$p(-1) = 19$

by substituting (-1) in the place of x

$(-1)^4 - 2(-1)^3 + 3(-1)^2 - a + b = 19$

So we get
$1 + 2 + 3 – a + b = 19$
$6 – a + b = 19$ ……………(2)

By adding equation (1) and (2)

8 + 2b = 24
2b = 24 – 8

By dividing 16 by 2 we get
b = 8 ………………..(3)

Now applying (3) in (1)

2 – a + 8 = 5

So we get

10 – a = 5
a = 5

Substituting the value of a and b in p(x) when divided by (x-2)
$p(x) = x^4 - 2x^3 + 3x^2 - ax + b$

by substituting 2 in the place of x

$p(2) = 2^4 - 2(2)^3 + 3(2)^2 - (5)(2) + 8$

On further calculation:
p(2) = 16 – 16 + 12 – 10 + 8

p(2) = 10

Therefore , the remainder when p(x) is divided by (x-2) is 10 .

ANSWER 15. Consider,
g(x) = 0

which means
x-2 = 0

x = 2
Now applying x= 2 in p (x) , we obtain
$p(x) = x^3 - 5x^2 + 4x – 3$

By substituting the value 2 in the place of x

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

On further calculation:

p(2)= 8-20 + 8 – 3

So we get

p(2)= -4 -3

p(2)= - 7 ≠ 0

Therefore, it is proved that p(x) is not a multiple of g(x).

ANSWER 16. Consider,

g(x) = 0

2x + 1 = 0

So we get

2x = - 1

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

Now apply x = $\frac{-1}{2}$ in p(x)

p (x) = $2x^3 - 11x^2 - 4x + 5$

By substituting $\frac{-1}{2}$ in the place of x

p ($\frac{-1}{2}$) = 2($\frac{-1}{2}$)^3 - 11($\frac{-1}{2}$)^2 - 4 ($\frac{-1}{2}$) + 5

So we get

p($\frac{-1}{2}$) = $\frac{-1}{4}$ - $\frac{11}{2}$ + 7

p($\frac{-1}{2}$) = $\frac{-1-11+28}{4}$

by dividing 16 by 4

p($\frac{-1}{2}$) = ($\frac{16}{4}$)

So we get

$p(\frac{-1}{2}) = 4 \neq 0$

Hence , it is shown that g(x) is not a factor of p (x).

EXERCISE 2D

Answer 1

g(x)= x- 2

⇒ x = 2

Then, p(x) = $x^3 - 8 = 2^3 - 8 = 0$ (given x=2)

Yes, g(x) is factor of p(x)

Answer 2

g(x)= x – 3

⇒ x = 3

Then, p(x) = $2x^3 + 7x^2 - 24x - 45 = 2(3^3) + 7(3^2) - 24 \times 3 - 45$

⇒ 54 + 63 – 72 – 45 = 0

Yes, g(x) is factor of p(x)

Answer 3

g(x)= x -1

⇒ x = 1

Then, p(x) = $2x^4 + 9x^3 + 6x^2 - 11x - 6 = 2 \times 1^4 + 9 \times 1^3 + 6 \times 1^2 - 11 \times 1 - 6$

= 2 +9+6 -11 – 6

= 0

Yes, g(x) is factor of p(x)

Answer 4

g(x)= x +2

⇒ x = -2

Then, p(x) = $x^4 - x^2 - 12 = (-2)^4 - (-2)^2 - 12$

= 16 – 4 -12 = 0

Yes, g(x) is factor of p(x)

Answer 5

g(x) = x +3

⇒ x = -3

Then, p(x) = $69 + 11x - x^2 + x^3 = 69 + 11(-3) - (-3)^2 + (-3)^3$

⇒ 69 - 33 – 9 – 27 = 0

Yes, g(x) is factor of p(x)

Answer 6

g(x) = x+5

⇒ x = -5

Then, p(x) = $2x^3 + 9x^2 - 11x - 30 = 2(-5)^3 + 9(-5)^2 - 11(-5) - 30$

= -250 + 45 + 55 -30

= -180

Yes, g(x) is not factor of p(x)

Answer7

g(x) = 2x-3

$\Rightarrow x = \frac{3}{2}$

Then, p(x) $= 2x^4 + x^3 - 8x^2 - x + 6 = 2(\frac{3}{2})^4 + (\frac{3}{2})^3 - 8(\frac{3}{2})^2 - \frac{3}{2} + 6$

$= \left(2\ \frac{81}{16}\right) + \frac{27}{8} - (8\ \frac{9}{4}) - \frac{3}{2} + 6$

$= \frac{81}{8} + \frac{27}{8} - \frac{144}{8} - \frac{12}{8} + \frac{48}{8}$

$= 0$

Yes, g(x) is factor of p(x)

Answer 8

g(x)= 3x-2

$\Rightarrow$ x $= \frac{2}{3}$

Then, p(x) $= 3x^3 + x^2 - 20x + 12 = 3(\frac{2}{3})^3 + (\frac{2}{3})^2 - 20\frac{2}{3} + 12$

$= \left(3\ \frac{8}{27}\right) + \frac{4}{9} - (20\frac{2}{3}) + 12$

$= \frac{8}{9} + \frac{4}{9} - \frac{120}{9} + \frac{108}{9}$

$= 0$

Yes, g(x) is factor of p(x)

Answer 9

g (x) $= x = \sqrt{2}$

$\Rightarrow$ x $= \sqrt{2}$

Then, p(x) $= 7x^2 - 4\sqrt{2}x - 6 = 7(\sqrt{2})^2 - 4(\sqrt{2} \times \sqrt{2}) - 6$

$\Rightarrow$ (7 x 2)-(4 x 2) – 6 = 14 – 8 – 6 = 0

Answer 10

g(x) $= x + \sqrt{2}$

$\Rightarrow x = -\sqrt{2}$

Then , p(x) $= 2\sqrt{2}x^2 + 5x + \sqrt{2} = 2\sqrt{2}(-\sqrt{2})^2 + 5 \times (-\sqrt{2}) + \sqrt{2}$

$= 4\sqrt{2} - 5\sqrt{2} + \sqrt{2}$

$= 0$

Answer11

Let g(p) $= (p^{10} - 1)$ and

And h(p) $= (p^{11} - 1)$

Let f(p) = (p-1)
then, ⇒ p – 1 = 0
⇒ p = 1

Now, g(1) = $[(p^{10} - 1)] = (1^{10} - 1)$
= (1-1) = 0
Hence, f(p-1) is factor of g(p)
h(p) = $(p^{11} - 1)$
h(1) = $[(p^{11} - 1)] = (1^{11} - 1) = (1 - 1) = 0$
hence, f(p-1) is also factor of h(p)

Answer12
Here f(x) = x-1
⇒ x = 1
Now, given p(x) = $2x^3 + 9x^2 + x + k$
⇒ $= 2(1)^3 + 9(1)^2 + 1 + k$
$k = -2 - 9 - 1 = -12$

Answer13
Here f(x) = x – 4
⇒ x = 4
Now, given p(x) = $2x^3 - 3x^2 - 18x + a$
⇒ $= 2(4^3) - 3(4^2) - 18(4) + a$
$= 2 \times 64 - 48 - 72 + a$
a = - 8

Answer14
Here, f(x) = x + 1
⇒ x = -1
Now, given p(x) = $ax^3 + x^2 - 2x + 4a - 9$
$= a(-1)^3 + (-1)^2 - 2(-1) + 4a - 9$
$a - 4a = 1 + 2 - 9$
$\Rightarrow 3a = 6$
⇒a = 2

Answer15
Here, f(x) = x+ 2a
⇒ x = -2a
Now, given p(x) = $x^5 - 4a^2x^3 + 2x + 2a + 3$
$= (-2a)^5 - 4a^2(-2a)^3 + 2(-2a) + 2a + 3$
$= -32a^5 + 32a^5 - 4a + 2a + 3$
$2a = 3$
$a = \frac{3}{2}$

Answer16
Here, f(x) = 2x-1

$\Rightarrow \qquad x = \frac{1}{2}$

Now, given p(x) $= 8x^4 + 4x^3 - 16x^2 + 10x + m$

$= 8(\frac{1}{2})^4 + 4\left(\frac{1}{2}\right)^3 - 16(\frac{1}{2})^2 + 10\left(\frac{1}{2}\right) + m$

$-m = \left(8 \times \frac{1}{16}\right) + \left(4 \times \frac{1}{8}\right) - \left(16 \times \frac{1}{4}\right) + \left(10 \times \frac{1}{2}\right)$

$-m \Rightarrow \frac{1}{2} + \frac{1}{2} - 4 + 5 = \frac{4}{2}$

m= -2

Answer17

Here, f(x) = x+3

$\Rightarrow$ x= -3

Now, given p(x) $= x^4 - x^3 - 11x^2 - x + a$

$-a = (-3)^4 - (-3)^3 - 11(-3)^2 - (-3)$

$-a \Rightarrow 81 + 27 - 99 + 3 = 12$

a = -12

Answer18

Here, f(x)= $x^2 + 2x - 3$

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

Now, p(x) will be divisible by f(x) only when it is divisible by (x-1) as well as by (x+3)

Now, (x – 1 = 0 ⇒ x = 1) and (x+3 ⇒ x = -3)

By the factor theorem, p(x) will be divisible by f(x) , if p(1) = 0 and p(-3) = 0

p(x)= $x^3 - 3x^2 - 13x + 15$

p(1) =$(1)^3 - 3(1)^2 - 13(1) + 15 = 1 - 3 - 13 + 15 = 0$

p(-3) = $(-3)^3 - 3(-3)^2 - 13(-3) + 15 = -27 - 27 + 39 + 15 = 0$

Answer19

p(x) = $x^3 + ax^2 + bx + 6$, g(x) = x -2 and h(x) = x -3 , then,

g(x) = 0 ⇒ x -2 = 0 ⇒ x = 2

h(x) = 0 ⇒ x – 3 = 0 ⇒ x = 3

(x-2) is factor of p(x) ⇒ p(2) = 0

Now, p(2) = 0 ⇒ $[(2)^3 + a(2)^2 + b(2) + 6] = 8 + 4a + 2b + 6$

$\Rightarrow 4a + 2b = -14$……..(1)

Since, it is given that factor (x-3) leaves the remainder 3

Now, p(3) = 3 ⇒ $[(3)^3 + a(3)^2 + b(3) + 6] = 27 + 9a + 3b + 6$

⇒ 9a + 3b = - 30…….(2)

Solving both equation,

4a+2b = -14…..(divide each term by 2)

9a +3b = -30…(divide each term by 3)

We get, 2a + b = - 7…..(3)

3a + b = - 10……(4)

On solving (3) and (4) we get, a = -3 and b=-1

Answer20

Here, f(x)= x-1 and x – 2
⇒ x = 1 and x= 2
Now, p(x) will be divisible by both (x-1) and (x-2)
p(x) $= x^3 - 10x^2 + ax + b$
p(1)= $(1)^3 - 10(1)^2 + a(1) + b$
= (1) – 10 +a+b
a +b=9 ……………(1)

$$p(2) \;=\; (2)^3 - 10(2)^2 + a(2) + b$$
$$= \; 8 - 40 + 2a + b$$

2a +b = 32…………..(2)
Solving (1) and (2)

a+ b = 9
2a +b = 32

By subtracting , we get
⇒ a = 32 -9 = 23
And another equation is ⇒ b = 9-23 = -14

Answer 21
p(x)= $(x^4 + ax^3 - 7x^2 - 8x + b)$
g(x)=(x+2)
h(x)=(x+3)
since g(x) and h(x) both are exactly divisible, these are the factor of p(x)
so,
p(x)=p(-2)=$(-2^4) + a(-2^3) - 7(-2^2) - 8(-2) + b$=0
p(x)=16+a(-8)-7(4)+16+b=0
p(x)=8a-b=4…..(1)
and now,

p(x)=p(-3)=$(-3^4) + \; a(-3^3) - 7(-3^2) - 8(-3) + b = 0$
p(x)=81-27a-63+24+b=0
p(x)=27a-b=42…..(2)
on solving equation (1) and (2) we get,

8a-b = 4
27a – b =42

On subtracting equation, we get

⇒ 19a = 38
⇒ a = $\frac{38}{19}$ = 2
b = 8a – 4 = 8(2) – 4 = 12
a=2 and b=12

Answer22
Let g(x) = (x-2)
⇒ x = 2
And h(x) = $\left(x - \frac{1}{2}\right)$
⇒ x = $\frac{1}{2}$

And p(x) = $px^2 + 5x + r$
Put the value p(2)= 0 ⇒ $p(2)^2 + 5(2) + r$
⇒ 4p + r = -10..........(1)
P($\frac{1}{2}$) = 0 ⇒ $p(\frac{1}{2})^2 + 5\left(\frac{1}{2}\right) + r$
⇒ $\frac{p}{4} + \frac{5}{2} + r$
⇒ $\frac{p}{4} + r = -\frac{5}{2}$
⇒ p+4r = -10...............(2)
Solving equation 1 and 2
4p +r = -10
p + 4r = - 10
hence , 4p +r = p+4r
⇒ 3p = 3r
⇒ p = r

Answer23
Here, f(x)= $x^2 - 3x + 2$
$= (x^2 - 2x - x + 2) = (x-2)(x-1)$
Now, p(x) will be divisible by f(x) only when it is divisible by (x-2) as well as by (x-1)
Now, (x – 2 = 0 ⇒ x = 2) and (x-1 ⇒ x = 1)
By the factor theorem, p(x) will be divisible by f(x) , if p(2) = 0 and p(1) = 0
p(x)= $2x^4 - 5x^3 - 2x^2 - x + 2$

p(2) =$2(2)^4 - 5(2)^3 + 2(2)^2 - (2) + 2 = 32 - 40 + 8 - 2 + 2 = 0$
p(-3) = $2(1)^4 - 5(1)^3 + 2(1)^2 - (1) + 2 = 2 - 5 + 2 - 1 + 2 = 0$

Answer24
Here, f(x)= x- 2
⇒ x = 2
And p(x) = $2x^4 - 5x^3 + 2x^2 - x - 3 = 2(2)^4 - 5(2)^3 + 2(2)^2 - 2 - 3$
⇒ 32 – 40+ 8-2-3 = 5
Hence, 5 be added to exactly divisible.

Answer25
When, the given polynomial is divided by a quadratic polynomial, then the remainder is a liner expression, say (ax+b)
Let, p(x)= $(x^4 + 2x^3 - 2x^2 + 4x + 6)$ –(ax-b) and f(x)= $x^2 + 2x - 3$
Then, p(x) = $(x^4 + 2x^3 - 2x^2 + (4-a)x + (6+b)$
f(x)= $x^2 + 2x - 3$
then, $= (x^2 + 3x - x - 3) = (x+3)(x-1)$
Now, p(x) will be divisible by f(x) only when it is divisible by (x-1) as well as by (x+3)
Now, (x – 1 = 0 ⇒ x = 1) and (x+3 ⇒ x = -3)
By the factor theorem, p(x) will be divisible by f(x) , if p(1) = 0 and p(-3) = 0
p(x)= $x^4 + 2x^3 - 2x^2 + (4-a)x + (6+b)$

p(1) =$(1)^4 + 2(1)^3 - 2(1)^2 + (4-a)(1) + (6+b) = 1 + 2 - 2 + 4 + 6 - a + b$
⇒ a +b = 11.....(1)

p(-3) = $(-3)^4 + 2(-3)^3 - 2(-3)^2 + (4-a)(-3) + (6+b) = 81 - 54 - 18 - 12 + 3a + 6 + b$

⇒ 3a - b = -3.....(2)

Solve 1 and 2 equations

a = 11-b

then, 3(11-b)-b = -3

⇒ -4b = -33-3 = -36

⇒ b =9

And a ⇒ 11-b = 11-9 = 2

Hence, the required expression is (2x- 9)

Answer26

Let f(x)= (x+a)

⇒ x= - a

Then, p(x) = $x^n + a^n$, where n is positive odd integer

Now, p(-a) = 0

p(-a) ⇒ $(-a)^n + a^n = [(-1)^n a^n + a^n] = [(-1)^n + 1]a^n$

⇒ $(-1 + 1)a^n = 0$.......[∵ n being odd, $(-1)^n = -1$]

Hence proved.

MULTIPLE CHOICE QUESTION

Answer 1:

(c) $\sqrt{2}\,x2 - \sqrt{3}x + 6$
Clearly, $\sqrt{2}\,x2 - \sqrt{3}x + 6$ is a polynomial in one variable because it has only non-negative integral powers of x.

Answer 2:

(d) $x^2+2\frac{x^{\frac{3}{2}}}{\sqrt{x}}+6$
We have:
$x^2+2\frac{x^{\frac{3}{2}}}{\sqrt{x}}+6= x^2+2\,x^{\frac{3}{2}}x^{-\frac{1}{2}}+6$
$= x^2+2x+6$
It a polynomial because it has only non-negative integral powers of x.

Answer 3:

(c) y
y is a polynomial because it has a non-negative integral power 1.

Answer 4:

(d) -4
-4 is a constant polynomial of degree zero.

Answer 5:

(d) 0
0 is a polynomial whose degree is not defined.

Answer 6:

(d) $x^2 + 5x + 4$
x^2+5x+4 is a polynomial of degree 2. So, it is a quadratic polynomial.

Answer 7:

(b) $x + 1$
Clearly, x+1 is a polynomial of degree 1. So, it is a linear polynomial.

Answer 8:

(b) $x^2 + 4$
Clearly, x^2+4 is an expression having two non-zero terms. So, it is a binomial.

Answer 9:

(d) 0
$\sqrt{3}$ is a constant term, so it is a polynomial of degree 0.

Answer 10:

(c) not defined
Degree of the zero polynomial is not defined.

Answer 11:

(d) not defined
Zero of the zero polynomial is not defined.

Answer 12:

(d) 8
Let:
p(x)=(x+4)
∴ p(-x)=(-x)+4 = -x+4
Thus, we have:
p(x)+p(-x)={(x+4)+(-x+4)}

$= 4 + 4$
$= 8$

Answer 13:

(b) 1
$p(x) = x^2 - 2\sqrt{2}x + 1$

$\therefore p(2\sqrt{2}) = (2\sqrt{2})^2 - 2\sqrt{2} \times (2\sqrt{2}) + 1$
$= 8 - 8 + 1$
$= 1$

Answer 14:
$p(x) = 5x - 4x^2 + 3$
Putting $x = -1$ in $p(x)$, we get
$p(-1) = 5 \times (-1) - 4 \times (-1)^2 + 3 = -5 - 4 + 3 = -6$
Hence, the correct answer is option (d).

Answer 15:
Let $f(x) = x^{51} + 51$
By remainder theorem, when $f(x)$ is divided by $(x + 1)$, then the remainder = $f(-1)$.
Putting $x = -1$ in $f(x)$, we get
$f(-1) = (-1)^{51} + 51 = -1 + 51 = 50$
$\therefore$ Remainder = 50
Thus, the remainder when $(x^{51} + 51)$ is divided by $(x + 1)$ is 50.
Hence, the correct answer is option (d).

Answer 16:

(c) 2
$(x+1)$ is a factor of $2x^2 + kx$.

So, -1 is a zero of $2x^2 + kx$.

Thus, we have: $2\times(-1)^2 + k \times (-1) = 0 \Rightarrow k = 2$

Answer 17:

(d) 21
$x - 2 = 0 \Rightarrow x = 2$

By the remainder theorem, we know that when $p(x)$ is divided by $(x - 2)$, the remainder is $p(2)$.
Thus, we have:
$p(2)=2^4+2\times2^3-3\times2^2+2-1=21$

Answer 18:

(d) 4
$x+2=0 \Rightarrow x=-2$
By the remainder theorem, we know that when $p(x)$ is divided by $(x+2)$, the remainder is $p(-2)$.
Now, we have:
$p(-2)=(-2)^3-3\times(-2)^2+4\times(-2)+32=4$

Answer 19:

(c) -2
$2x-1=0 \Rightarrow x=\frac{1}{2}$
By the remainder theorem, we know that when $p(x)$ is divided by $(2x-1)$, the remainder is $p(\frac{1}{2})$
Now, we have:
$p(\frac{1}{2})=4\times(\frac{1}{2})3-12\times(\frac{1}{2})2+11\times(\frac{1}{2})-5=-2$

Answer 20:
By remainder theorem, when $p(x) = x^3 - ax^2 + x$ is divided by $(x - a)$, then the remainder $= p(a)$.
Putting $x = a$ in $p(x)$, we get
$p(a) = a^3 - a \times a^2 + a = a^3 - a^3 + a = a$
∴ Remainder $= a$
Hence, the correct answer is option (b).

Answer 21:

(c) $-a$
$x+a=0 \Rightarrow x=-a$
By the remainder theorem, we know that when $p(x)$ is divided by $(x+a)$, the remainder is $p(-a)$.
Thus, we have:
$p(-a)=(-a)^3+a\times(-a)^2+2\times(-a)+a$

$=-a^3+a^3-2a+a=-a$

Answer 22:

(c) $x^3 - 2x^2 - x - 2$

Let:
f(x)= $x^3 - 2x^2 - x - 2$
By the factor theorem, $(x + 1)$ will be a factor of $f(x)$ if $f(-1) = 0$.
We have:
f(-1)=$(-1)^3 - 2 \times (-1)^2 + (-1) + 2 \quad = -1 - 2 - 1 + 2 \quad = -2 \neq 0$
Hence, $(x + 1)$ is not a factor of f(x)= $x^3 - 2x^2 - x - 2$

Now,
Let:
f(x)= $x^3 - 2x^2 - x - 2$
By the factor theorem, $(x + 1)$ will be a factor of $f(x)$ if f(-1) = 0.
We have:
f(-1)= $(-1)^3 + 2 \times (-1)^2 + (-1) - 2 \;=\; -1 + 2 - 1 - 2 \;= -2 \neq 0$
Hence, $(x + 1)$ is not a factor of f(x)= $x^3 - 2x^2 - x - 2$

Now,
Let:
f(x)= $x^3 - 2x^2 - x - 2$
By the factor theorem, $(x + 1)$ will be a factor of $f(x)$ if f(-1) = 0.
We have:
f(-1)= $(-1)^3 + 2 \times (-1)^2 - (-1) - \;=\; -1 + 2 + 1 - 2 = 0$
Hence, $(x + 1)$ is a factor of f(x)= $x^3 - 2x^2 - x - 2$

Answer 23:
The zero of the polynomial $p(x)$ can be obtained by putting $p(x) = 0$.

p(x)=0

⇒2x+5=0

⇒2x= -5

⇒x= $-\frac{5}{2}$
Hence, the correct answer is option (b).

Answer 24:

The given polynomial is $p(x) = x^2 + x - 6$.

Putting $x = 2$ in $p(x)$, we get
$p(2) = 2^2 + 2 - 6 = 4 + 2 - 6 = 0$
Therefore, $x = 2$ is a zero of the polynomial $p(x)$.

Putting $x = -3$ in $p(x)$, we get
$p(-3) = (-3)^2 - 3 - 6 = 9 - 9 = 0$
Therefore, $x = -3$ is a zero of the polynomial $p(x)$.
Thus, 2 and −3 are the zeroes of the given polynomial $p(x)$.
Hence, the correct answer is option (c).

Answer 25:

The given polynomial is $p(x) = 2x^2 + 5x - 3$.

Putting $x=\frac{1}{2}$ in $p(x)$, we get
$p(\frac{1}{2})=2\times(\frac{1}{2})^2 + 5 \times \frac{1}{2} - 3 = 3 - 3 = 0$
Therefore, $x=\frac{1}{2}$ is a zero of the polynomial $p(x)$.

Putting $x = -3$ in $p(x)$, we get
$p(-3)=2\times(-3)^2 + 5 \times (-3) - 3 = 18 - 15 - 3 = 0$
Therefore, $x = -3$ is a zero of the polynomial $p(x)$.
Thus, $\frac{1}{2}$ and −3 are the zeroes of the given polynomial $p(x)$.
Hence, the correct answer is option (b).

Answer 26:

The given polynomial is $p(x) = 2x^2 + 7x - 4$.
Putting $x=\frac{1}{2}$ in $p(x)$, we get
$p(\frac{1}{2}) =2\times(\frac{1}{2})^2 + 7 \times \frac{1}{2} - 4 = 4 - 4 = 0$
Therefore, $x = \frac{1}{2}$ is a zero of the polynomial $p(x)$.
Putting $x = -4$ in $p(x)$, we get
$p(-4)=2\times(-4)^2 + 7 \times (-4) - 4 = 32 - 28 - 4 = 32 - 32 = 0$
Therefore, $x = -4$ is a zero of the polynomial $p(x)$.
Thus, $\frac{1}{2}$ and −4 are the zeroes of the given polynomial $p(x)$.
Hence, the correct answer is option (c).

Answer 27:

(b) 5
(x+5) is a factor of p(x)= $x^3 - 20x + 5k$.

$\therefore$ p(-5)=0$\Rightarrow(-5)^3 - 20 \times (-5) + 5k = 0 \Rightarrow -125 + 100 + 5k = 0 \Rightarrow 5k = 25 \Rightarrow k = 5$

Answer 28:

(b) $m = 7$, $n = -18$
Let: p(x)= $x^3 + 10x^2 + mx + n$
Now,
x+2=0⇒x=-2
$(x + 2)$ is a factor of $p(x)$.
So, we have $p(-2)=0$
$\Rightarrow(-2)^3 + 10 \times (-2)^2 + m \times (-2) + n = 0$

$\Rightarrow -8 + 40 - 2m + n = 0$

$\Rightarrow 32 - 2m + n = 0$

$\Rightarrow 2m - n = 32$ .....(i)
Now,
x-1= 0⇒x=1
Also,
$(x - 1)$ is a factor of $p(x)$.
We have: $p(1) = 0$
$\Rightarrow 1^3 + 10 \times 1^2 + m \times 1 + n = 0$

$\Rightarrow 1 + 10 + m + n = 0$

$\Rightarrow 11 + m + n = 0$

$\Rightarrow m + n = -11$ .....(ii)

From (i) and (ii), we get: 3m = 21 ⇒m = 7
By substituting the value of m in (i), we get $n = -18$.
$\therefore m = 7$ and $n = -18$

Answer 29:

(a) 1
Let: p(x)= $x^{100} + 2x^{99} + k$
Now,

$x + 1 = 0 \Rightarrow x = -1$
(x+1) is divisible by p(x).∴p(-1)=0⇒$(-1)^{100} + 2 \times (-1)^{99} + k = 0$

$$\Rightarrow 1 - 2 + k = 0$$

$$\Rightarrow -1 + k = 0$$

$$\Rightarrow k = 1$$

Answer 30:

(d) -3
Let: p(x)=$2x^3 - kx^2 + 3x + 10$
Now,
x+2=0⇒x=-2
p(x) is completely divisible by (x+2).∴ p(-2)=0⇒$2\times(-2)^3 - k \times (-2)^2 + 3 \times (-2) + 10 = 0$

$$\Rightarrow -16 - 4k - 6 + 10 = 0$$

$$\Rightarrow -12 - 4k = 0$$

$$\Rightarrow k = -3$$

Answer 31:

(b) 0, 3
Let: $p(x) = x^2 - 3x$
Now, we have:
p(x)=0⇒$x^2 - 3x = 0$
⇒x (x – 3) = 0

⇒x = 0 and x – 3 = 0

⇒ x = 0 and x = 3

Answer 32:

(d) $\frac{1}{\sqrt{3}}$ and $-\frac{1}{\sqrt{3}}$
Let: $p(x) = 3x^2 - 1$
To find the zeroes of p(x), we have : p(x) = 0 ⇒$3x^2 - 1 = 0$
$\Rightarrow 3x^2 = 1 \Rightarrow x = \pm \frac{1}{\sqrt{3}} \Rightarrow x = \frac{1}{\sqrt{3}}$ and $x = -\frac{1}{\sqrt{3}}$