of the GCF and the quotient of the given expression by the GCF.

Polynomials : An algebraic expression in which the variables involved have only non-negative integral powers, is called a polynomial.

Degree of a polynomial in one variable: In a polynomial in one variable, the highest power of the variable is called degree.

Degree of a polynomial in two variable: In a polynomial in more than one variable the sum of the powers of the variables in each term is computed and the highest sum so obtained is called the degree of the polynomial.

Constant Polynomial : A polynomial consisting of a constant term only is called a constant polynomial. The degree of a constant polynomial is zero.

Linear Polynomial : A polynomial of degree 1 is called a linear polynomial.

Quadratic Polynomial : A polynomial of degree 2 is called a quadratic polynomial.

Cubic Polynomial : A polynomial of degree 3 is called a cubic polynomial.

Biquadratic Polynomials : A polynomial of degree 4 is called a biquadratic polynomial.

Factorization of Quadratic Polynomials by using the method of completing the perfect square Procedure:

Step I Obtain the quadratic polynomial. Let the polynomial be $ax^2 + bx + c$, where $a \neq 0$.

Step II Make the coefficient of x^2 unity by dividing and multiplying throughout by it, if it is not unity i.e., write

$$ax^2 + bx + c = a\left(x^2 + \frac{b}{a}x + \frac{c}{a}\right)$$

Step III Add and subtract square of half of the coefficient of x i.e., write

$$ax^2 + bx + c = a\left(x^2 + \frac{b}{a}x + \frac{c}{a}\right)$$

$$= a\left\{x^2 + 2\left(\frac{b}{2a}\right)x + \left(\frac{b}{2a}\right)^2 - \left(\frac{b}{2a}\right)^2 + \frac{c}{a}\right\}$$

Step IV Write first three terms as the square of a binomial and simplify last two terms i.e., write $ax^2 + bx + c$

$$= a\left\{x^2 + 2\left(\frac{b}{2a}\right)x + \left(\frac{b}{2a}\right)^2 - \left(\frac{b}{2a}\right)^2 + \frac{c}{a}\right\}$$

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

Step V Factorize last step obtained in step IV by using $a^2 - b^2 = (a - b)(a + b)$ to get desired factors.

Factorization of Quadratic Polynomials of Theorem $ax^2 + bx + c$, $a \div 1$ Procedure:

Step I Obtain the quadratic trinomial $ax^2 + bx + c$

Step II Obtain a = coefficient of x^2, b = coefficient of x and c = constant terms.

Step III Find the product of the coefficient of x^2 and the constant term i.e. ac.

Step IV Split up the coefficient of x i.e. b into two parts whose sum is b and product ac and write the middle term as the sum of two terms.

Step V Factorize the expression obtained in step IV by grouping the term. Factors so obtained will be the required factors of the given quadratic trinomial.

Factorization of Quadratic Polynomials in one varibale Algorithm :

Step I Obtain the quadratic polynomial $x^2 + px + q$.

Step II Obtain p = coefficient of x and, q = constant term.

Step III Find the two numbers a and b such that $a + b = p$ and $ab = q$.

Step IV Split up the middle term as the sum of two terms ax and bx.

Step V Factorize the expression obtained in step IV by grouping the term.

(ii) $x^2 - 21x + 108$

(iii) $x^2 + 5x - 36$

Sol. (i) In order to factorize $x^2 - 23x + 132$, we have to find numbers p and q such that $p + q = -23$ and $pq = 132$.

Clealry, $-12 - 11 = -23$ and $-12 \times -11 = 132$.

We now split the middle term $-23x$ of $x^2 - 23x + 132$ as $-12x - 11x$

$\therefore x^2 - 23x + 132$

$= x^2 - 12x - 11x + 132$

$= (x^2 - 12x) - (11x - 132)$

$= x(x - 12) - 11(x - 12)$

$= (x - 12)(x - 11)$

(ii) In order to factorize $x^2 - 21x + 108$, we have to find two numbers such that their sum is -21 and the product 108. Clearly, $-21 = -12 - 9$ and $-12 \times -9 = 108$

So, we split the middle term $-21x$ as $-12x - 9x$

$\therefore x^2 - 21x + 108$

$= x^2 - 12x - 9x + 108$

$= (x^2 - 12x) - (9x - 108)$

$= x(x - 12) - 9(x - 12)$

$= (x - 12)(x - 9)$

(iii) In order to factorize $x^2 + 5x - 36$, we have to find two numbers p and q such that $p + q = 5$ and $pq = -36$. Clearly, $9 + (-4) = 5$ and $9 \times -4 = -36$.

So, we write the middle term $5x$ of $x^2 + 5x - 36$ as $9x - 4x$.

$\therefore x^2 - 5x - 36 = x^2 + 9x - 4x - 36$

$= (x^2 + 9x) - (4x + 36)$

$= x(x + 9) - 4(x + 9)$

$= (x + 9)(x - 4)$

Ex.6 Factorize:

(i) $2x^2 + 5x + 3$ (ii) $6x^2 + 5x - 6$

(iii) $6x^2 - 13x + 6$ (iv) $-2x^2 - 3x + 2$

Sol. (i)The given expression is $2x^2 + 5x + 3$

Here, coefficient of $x^2 = 2$, coeffcient of $x = 5$, and constant term = 3.

We shall now split up the coefficient of the middle term i.e. 5 into two parts such that their sum is 5 and product equal to the product of coefficient of x^2 and constant term i.e. $2 \times 3 = 6$. Clearly, $2 + 3 = 5$ and $2 \times 3 = 6$. So, we replace the middle term $5x$ by $2x + 3x$.

Thus, we have

$2x^2 + 5x + 3 = 2x^2 + 2x + 3x + 3$

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

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

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

(ii) The given expression is $6x^2 + 5x - 6$

Here, coefficient of $x^2 = 6$, coefficient of $x = 5$, constant term $= -6$

We shall now split up the coefficient of x i.e., 5 into two parts such that their sum is equal to coefficient of x i.e., 5 and product equal to the product of coefficient of x^2 and constant term i.e., $6 \times -6 = -36$.

Clearly, $9 + (-4) = 5$ and $9 \times -4 = -36$. So, we replace the middle term $5x$ by $9x - 4x$.

Thus, we have

$6x^2 + 5x - 6 = 6x^2 + 9x - 4x - 6$

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

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

(iii) The given expression is $6x^2 - 13x + 6$.

Here, coefficient of $x^2 = 6$, coefficient of $x = -13$, and constant term = 6.

We shall now split up the coefficient of x i.e. -13 into two parts whose sum is -13 and product equal to product of the coefficient of x^2 and constant term i.e, $6 \times 6 = 36$. Clearly, $-4, -9 = -13$ and $-4 \times -9 = 36$. So, we write the middle term $-13x$ as $-4x - 9x$

Thus, we have

$6x^2 - 13x + 6 = 6x^2 - 4x - 9x + 6$

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

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

(iv) The given expression is $-2x^2 - 3x + 2$.

Here, coefficient of $x^2 = -2$, coefficient of $x = -3$ and constant term = 2.

We shall now split up the coefficient of the middle term i.e. -3 into two parts such that their sum is -2 and the product is equal to the product of the coefficient of x^2 and constant term i.e. $-2 \times 2 = -4$.

Clearly, $-4 + 1 = -3$ and $-4 \times 1 = -4$.

So, we write the middle term $-3x$ as $-4x + x$.

Thus, we have

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

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

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

Ex.7 Factorize:

(i) $12x^2 - 23xy + 10y^2$

(ii) $12x^2 + 7xy - 10y^2$

$= -2\left\{\left(x+\frac{1}{4}\right)^2-\frac{49}{16}\right\}$

$= -2\left\{\left(x+\frac{1}{4}\right)^2-\left(\frac{7}{4}\right)^2\right\}$

$= -2\left\{\left(x+\frac{1}{4}\right)-\frac{7}{4}\right\}\left\{\left(x+\frac{1}{4}\right)+\frac{7}{4}\right\}$

$= -2\left(x+\frac{1}{4}-\frac{7}{4}\right)\left(x+\frac{1}{4}+\frac{7}{4}\right)$

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

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

Ex.11 Divide :

(i) $12x^3y^3$ by $3x^2y$ (ii) $-15a^2bc^3$ by $3ab$

Sol. (i) We have,

$\frac{12x^3y^2}{3x^2y} = \frac{12\times x\times x\times x\times y\times y}{3\times x\times x\times y}$

$= 4 \times x \times y = 4xy$

(ii) We have,

$\frac{-15a^2bc^3}{3ab} = \frac{-15\times a\times a\times b\times c\times c\times c}{3\times a\times b} = -5ac^3$

Division of a Polynomial by a Monomial

Step I Obtain the polynomial (dividend) and the monomial (divisor).

Step II Arrange the terms of the dividend in descending order of their degrees. For example, write

$7x^2 + 4x - 3 + 5x^3$ as

$5x^2 + 7x^2 + 4x - 3$.

Step III Divided each term of the plynomial by the given monomial by using the rules of division of a monomial by a monomial.

Ex.12 Divide :

(i) $9m^5 + 12m^4 - 6m^2$ by $3m^2$

(ii) $24x^3y + 20x^2y^2 - 4xy$ by $2xy$

Sol. (i) We have,

$\frac{9m^5+12m^4-6m^2}{3m^2} = \frac{9m^5}{3m^2} + \frac{12m^4}{3m^2} - \frac{6m^2}{3m^2}$

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

(ii) We have,

$\frac{24x^3y+20x^2y^2-4xy}{2xy}$

$= \frac{24x^3y}{2xy} + \frac{20x^2y^2}{2xy} - \frac{4xy}{2xy}$

$= 12x^2 + 10xy - 2$

Division of a Polynomial by a Binomial by using long division

Step I Arrange the terms of the dividend and divisor in descending order of their degrees.

Step II Divide the first term of the dividend by the first term of the divisor to otbain the first term of the quotient.

Step III Multiply the divisor by the first term of the quotient and subtract the result from the dividend to obtain the remainder.

Step IV Consider the remainder (if any) as dividend and repeat step II to obtain the second term of the quotient.

Step V Repeat the above process till we obtain a remainder which is either zero or a polynomial of degree less than that of the divisor.

Ex.13 Divide $6 + x - 4x^2 + x^3$ by $x - 3$.

Sol. We go through the following steps to perform the division:

Step I We write the terms of the dividend as well as of divisor in descending order of their degress. Thus, we write

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

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

$x - 3$ as $x - 3$

Step II We divide the first term x^3 of the dividend by the first term x of the divisor and obtain $\frac{x^3}{x} = x^2$ as the first term of the quotient.

Step III We multiply the divisor $x - 3$ by the first term x of the quotient and subtract the result from the dividend $x^3 - 4x^2 + x + 6$. We obtain $-x^2 + x + 6$ as the remainder.

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

Step IV We take $-x^2 + x + 6$ as the new dividend and repeat step II to obtain the second term $\left(\frac{x^2}{x}=\right) - x$ of the quotient.

Step V We multiply the divisor $x - 3$ by the second term $-x$ of the quotient and

On dividing, we get

$$
\begin{array}{r|l}
 & x^2 + x + 7 \\
\hline
x^2 + 1 & x^4 + x^3 + 8x^2 + ax + b \\
 & x^4 \quad + x^2 \\
 & - \quad - \\
\hline
 & x^3 + 7x^2 + ax + b \\
 & x^3 \quad + x \\
 & - \quad - \\
\hline
 & 7x^2 + x(a-1) + b \\
 & 7x^2 \quad + 7 \\
 & - \quad - \\
\hline
 & x(a-1) + b - 7
\end{array}
$$

$\therefore$ Quotient = $x^2 + x + 7$ and,
Remainder = $x(a - 1) + b - 7$
Now, Remainder = 0
$\Rightarrow$ $x(a - 1) + (b - 7) = 0$
$\Rightarrow$ $x(a - 1) + (b - 7) = 0x + 0$
$\Rightarrow$ $a - 1 = 0$ and $b - 7 = 0$
[Comparing coefficients of x and constant terms] $\Rightarrow$ $a = 1$ and $b = 7$

Ex.18 Divide $x^4 - x^3 + x^2 + 5$ by $(x + 1)$ and write the quotient and remainder.
Sol. We have,
$x^4 - x^3 + x^2 + 5$
$= x^3(x + 1) - 2x^2(x + 1) + 3x(x + 1) - 3(x + 1) + 8$
$= (x + 1)(x^3 - 2x^3 + 3x - 3) + 8$
Hence, Quotient = $x^3 - 2x^2 + 3x - 3$ and, Remainder = 8.

Ex.19 Divide $12x^3 - 8x^2 - 6x + 10$ by $(3x - 2)$. Also, write the quotient and the remainder.
Sol. We have,
$12x^3 - 8x^2 - 6x + 10$
$= 4x^2(3x - 2) - 2(3x - 2) + 6$
$= \{4x^2(3x - 2) - 2(3x - 2)\} + 6$
$= (3x - 2)(4x^2 - 2) + 6$
Hence, Quotient = $4x^2 - 2$ and, Remainder = 6.

Ex.20 Divide $6x^3 - x^2 - 10x - 3$ by $(2x - 3)$.
Sol. We have,
$6x^3 - x^2 - 10x - 3$
$= 3x^2(2x - 3) + 4x(2x - 3) - 1(2x - 3) - 6$
$= \{3x^2(2x - 3) + 4x(2x - 3) - 1(2x - 3)\} - 6$
$= (2x - 3)(3x^2 + 4x - 1) - 6$
Hence, Quotient = $3x^2 + 4x - 1$ and, Remainder = -6.

Ex.21 Divide :
(i) $35a^2 + 32a - 99$ by $7a - 9$
(ii) $ax^2 + (b + ac)x + bc$ by $x + c$
Sol. (i) We have,
$35a^2 + 32a - 99$
$= 35a^2 + 77a - 45a - 99$
$= 7a(5a + 11) - 9(5a + 11)$
$= (5a + 11)(7a - 9)$ ...(i)
$\therefore$ $(35a^2 + 32a - 99) \div (7a - 9)$

$$= \frac{35a^2 + 32a - 99}{7a - 9}$$

$$= \frac{(5a + 11)(7a - 9)}{(7a - 9)} = 5a + 11$$

[Using (i)]

[Just as numbers, we cancel common factor $(7a - 9)$ in numerator and denominator]

(ii) We have, $ax^2 + (b + ac)x + bc$
$= (ax^2 + bx) + (acx + bc)$
$= x(ax + b) + c(ax + b)$
$= (ax + b)(x + c)$ ...(i)
$\therefore$ $\left(ax^2 + (b + ac)x + bc\right) \div (x + c)$

$$= \frac{ax^2 + (b + ac)x + bc}{(x + c)}$$

$$= \frac{(ax + b)(x + c)}{(x + c)}$$ [Using (i)]

$= ax + b$

[Cancelling common factor $(x + c)$ in numerator and denominator]

Ex.22 Divide:
$a^{12} + a^6b^6 + b^{12}$ by $a^6 - a^3b^3 + b^6$
Sol. We have,
$a^{12} + a^6b^6 + b^{12}$
$= a^{12} + 2a^6b^6 + b^{12} - a^6b^6$
[Adding and subtracting a^6b^6]
$= (a^6 + b^6)^2 - (a^3b^3)^2$
$= (a^6 + b^6 - a^3b^3)(a^6 + b^6 + a^3b^3)$
$= (a^6 - a^3b^3 + b^6)(a^6 - a^3b^3 + b^6)$ ...(i)

$\therefore$ $\dfrac{a^{12} + a^6b^6 + b^{12}}{a^6 - a^3b^3 + b^6}$

$$= \frac{(a^6 - a^3b^3 + b^6)(a^6 + a^3b^3 + b^6)}{(a^6 - a^3b^3 + b^6)}$$

$= a^6 + a^3b^3 + b^6$
[Cancelling $a^6 - a^3b^3 + b^6$ from N^r and D^r]

Q.22 Simplify the following products:
(i) $(x^2 + x + 1)(x^2 - x + 1)$
(ii) $(x^2 + 2x + 2)(x^2 - 2x + 2)$

Q.23 Simplify the following by using: $(a + b)(a - b) = a^2 - b^2$.
(i) 68×72 (ii) 101×99
(iii) 67×73 (iv) $128^2 - 77^2$

Q.24 Find the greatest common factor of the monomials $6x^3a^2b^2c$, $8x^2ab^3c^3$ and $12a^3b^2c^2$.

Q.25 Factorize:
(i) $12x^3y^4 + 16x^2y^5 - 4x^5y^2$
(ii) $18a^3b^2 + 36ab^4 - 24a^2b^3$

Q.26 Factorize:
(i) $(x + y)(2x + 3y) - (2x + 3y) - (x + y)(x + 1)$
(ii) $(x + y)(2a + b) - (3x - 2y)(2a + b)$

Q.27 Factorize :
(i) $x^2 + xy + 8x + 8y$
(ii) $15xy - 6x + 10y - 4$
(iii) $n - 7 + 7lm - lmn$

Q.28 Factorize:
(i) $a^2 + 2a + ab + 2b$
(ii) $x^2 - xz + xy - xz$

Q.29 Factorize each of the following expressions:
(i) $a^2 - b + ab - a$
(ii) $xy - ab + bx - ay$
(iii) $6ab - b^2 + 12ac - 2bc$
(iv) $a(a + b - c) - bc$
(v) $a^2x^2 + (ax^2 + 1)x + a$
(vi) $3ax - 6ay - 8by + 4bx$

Q.30 Factorize:
(i) $x^3 - 2x^2y + 3xy^2 - 6y^3$
(ii) $6ab - b^2 + 12ac - 2bc$

Q.31 Factorize :
(i) $x^4 - y^4$ (ii) $16x^4 - 81$
(iii) $x^4 - (y + z)^4$ (iv) $2x - 32x^5$
(v) $3a^4 - 48b^4$ (vi) $81x^4 - 121x^2$

Q.32 Factorize each of the following algebraic expressions:
(i) $16(2x - 1)^2 - 25z^2$
(ii) $4a^2 - 9b^2 - 2b - 3b$
(iii) $x^2 - 4x + 4y - y^2$
(iv) $3 - 12(a - b)^2$
(v) $x(x + z) - y(y + z)$
(vi) $a^2 - b^2 - a - b$

Q.33 Factorize :
(i) $4x^2 - 4xy + y^2 - 9z^2$
(ii) $16 - x^2 - 2xy - y^2$
(iii) $x^4 - (x - z)^4$

Q.34 Factorize :
(i) $4(x + y)^2 - 28y(x + y) + 49y^2$
(ii) $(2a + 3b)^2 + 2(2a + 3b)(2a - 3b) + (2a - 3b)^2$

Q.35 Factorize each of the following expressions:
(i) $9x^2 - 4y^2$
(ii) $36x^2 - 12x + 1 - 25y^2$
(iii) $a^2 - 1 + 2x - x^2$

Q.36 Factorize:
(i) $9 - a^6 + 2a^3b^3 - b^6$
(ii) $x^{16} - y^{16} + x^8 + y^8$

Q.37 Factorzie: $(2x + 3y)^2 - 5(2x + 3y) - 14$

Q.38 Factorize: $3m^2 + 24m + 36$

Q.39 Divide:
(i) $6x^4yz - 3xy^3z + 8x^2yz^4$ by $2xyz$
(ii) $\frac{2}{3}a^2b^2c^2 + \frac{4}{3}ab^2c^3 - \frac{1}{5}ab^3c^2$ by $\frac{1}{2}abc$

Q.40 Divide the polynomial $2x^4 + 8x^3 + 7x^2 + 4x + 3$ by $x + 3$.

Q.41 Divide $10x^4 + 17x^3 - 62x^2 + 30x - 3$ by $2x^2 + 7x - 1$

Q.42 Divide $3y^5 + 6y^4 + 6y^3 + 7y^2 + 8y + 9$ by $3y^3 + 1$ and verify that Dividend = Divisor × Quotient + Remainder

Q.43 Divide $16x^4 + 12x^3 - 10x^2 + 8x + 20$ by $4x - 3$. Also, write the quotient and remainder.

Q.44 Divide $8y^3 - 6y^2 + 4y - 1$ by $4y + 2$. Also, write the quotient and the remainder.

Q.45 Divide: $a^4 - b^4$ by $a - b$

Q.46 Divide:
$x^{4a} + x^{2a}y^{2b} + 4y^{4b}$ by $x^{2a} + x^ay^b + y^{2b}$

ANSWER KEY

1. $\frac{28}{15} + \frac{19}{6}y + 2y^2 + \frac{25}{6}y^3$ 2. $9y^2 - \frac{5}{2}y + 13$ 3. $\frac{41}{15}x^2yz - \frac{5}{6}x^2y - \frac{3}{5}xyz - \frac{4}{5}y$

4. (i) 30 abcxyz (ii) $m^3n^3p^3$ (iii) $64q^6$ 5. (i) $-84x^{14}a^7$ (ii) $-48s^6t^8$ (iii) $1000x^{14}y^{11}$

6. $-\frac{8}{7}x^3y^4$ 7. $-\frac{4}{9}x^4y^4z^4$ 8. $\frac{7}{2}s^3t + \frac{7}{2}s^2t^2$ 9.(i) $x^5 - x^3$ (ii) $121.5a^2bc + 12.15ab^2$

(iii) $0.001a^2 + 0.0001ab$ 10.(i) $2m + m^2$ 11. (i) $25ln + 5l^2$ (ii) $-7ac + 6bc + 4c^2 - 3a^2 - ab - 2b^2$

12. $x^3 - \frac{4}{5}xy^2 - \frac{5}{4}x^2y + y^3$ 13. $3x^4 + 7x^2y^2 + 2y^4$ 14. $7y^2 + y^3 - \frac{2}{7}y^4$ 16. (i) $12x^4 - 75y^4$
(ii) $-225x^{18} + 90x^{17} + 675x^{16} - 270x^{15}$ 17. $2x^4 + 2x^3 - 21x^2 + 43x - 35$

18. (i) $36x^4 - 84^2y^2 + 49y^4$ (ii) $\frac{1}{4}x^4 - \frac{xy}{5} + \frac{1}{25}y^2$ 19. (i) $\frac{9}{16}x^2 - \frac{25}{36}y^2$ (ii) $4a^2 - \frac{9}{b^2}$

(iii) $b^4 - a^4$ (iv) $a^2 - c^2$ 20. ± 5 21. 116 22. (i) $x^4 + x^2 + 1$, (ii) $x^4 - 2x^2 + 4$
23. (i) 4896 (ii) 9999 (iii) 4891 (iv) 10455 24. (i)(x + y) (x + 3y–1) (ii) (–2x + 3y) (2a + b)
28. (i) (a + 2) (a + b) (ii) (x + y) (x – z) 29. (i) (a + b) (a – 1) (ii) (y + b) (x – a)
(iii) (b + 2c) (6a – b) (iv) (a + b) (a – c) (v) (x + a) $(ax^2 + 1)$ (vi) (3a + 4b) (x – 2y)
30. (i) (x – 2y) $(x^2 + 3y^2)$ (ii) (6a – b)(b + 2c) 31. (i) (x – y)(x + y) $(x^2 + y^2)$
(ii) (2x – 3) (2x + 3) $(4x^2 + 9)$ (iii) (x – y – z) (x + y + z) $\{x^2 + (y + z)^2\}$
(iv) 2x $(1 + 4x^2)$ (1 – 2x) (1 + 2x) (v) 3(a – 2b) (a + 2b) $(a^2 + 4b^2)$
(vi) x^2 (9x – 11) (9x + 11) 32. (i) (8x – 5z – 4) (8x + 5z – 4)
(ii) (2a + 3b) (2a – 3b – 1) (iii) (x – y) (x + y – 4) (iv) 3(1 + 2a – 2b) (1 – 2a + 2b)
(v) (x – y) (x + y + z) (vi) (a + b) {(a – b) – 1}33. (i) (2x – y + 3z) (2x – y – 3z
(ii) (4 + x + y) (4 – x – y) (iii) $(2x^2 - 2xz + z^2)$ (2x – z)z 34. (i) $(2x - 5y)^2$ (ii) $16a^2$
35. (i) (3x + 2y) (3x – 2y) (ii) (6x – 5y – 1) (6x + 5y – 1) (iii) (a – 1 + x) (a + 1 – x)
36. (i) $(a^3 - b^3 + 3)$ $(-a^3 + b^3 + 3)$ (ii) $(x^8 + y^8)$ $(x^8 - y^8 + 1)$
(iii) (p + q – a + b) (p + q + a – b + 1)37. (2x + 3y – 7) (2x + 3y + 2)

38.3(m + 2) (m + 6)39. (i) $3x^3 - \frac{3}{2}y^2 + 4xz^3$ (ii) $\frac{4}{3}abc + \frac{8}{3}bc^2 - \frac{2}{5}b^2c$

40. (x + 3) $(2x^3 + 2x^2 + x + 1)$41.$(2x^2 + 7x - 1)(5x^2 - 9x + 3)$ 44.$(4y + 2)\left(2y^2 - \frac{5}{2}y + \frac{9}{4}\right) - \frac{11}{2}$

45. (a+b)$(a^2 + b^2)$ 46.$x^{2a} - x^ay^b + y^{2b}$ 47.$9x^2 - 3x + 13$ 48. $\frac{5}{2}x^2 + \frac{11}{30}x + 2$ 49. (i) 28x
(ii) $-28a^2$ (iii)$-28x^2y$ (iv) $-12x^4y$ (v) = 0 50. (i) = xy (ii)= 50xy (iii) $=10x^2y^2$ (iv) = 12 a^3
(v) = 12 mn^2p 51.(i)= $15a^4b^4c^4$ (ii) $-6x^{2+2}y^{1+1}z^{1+2} = -6x^4y^2z^3$ (iii) $= \frac{6}{5}x^3y^3z^4$ (iv)= $\frac{3}{4}x^6y^2$

(v) = $8.4a^3b^3c$ 52.$6x^2 + 10xy$ 53. $21x^2y^2 + 15xy^2$ 54.$-\frac{2}{5}a^2b^2 + \frac{3}{5}ab^3$ 55. $\frac{3}{2}x^2y - \frac{2}{5}x^2y^3$

56.(i) = – 540 (ii)= 0.106450 (iii)= 0.000085 (vi)= 27.508 57. (i) = 0 (ii) = 21

58. (i) = $3a^4b^2c$ (ii)= $\frac{80}{3}a^8b^3$ (iii) = $-1035x^3y$. (iv)= $\frac{3}{7}x^4y^2z^3$ 59.(i) = 0 (ii) $\frac{4}{3}a^2b^3c^2$

(iii) $\frac{87}{100}x^6y^5z^8$ (iv)$2000x^{12}y^{22}z^{32}$(v) $\frac{48}{5}x^4y^5z^4$60.$-\frac{42}{5} \times (1)^{14} = -\frac{42}{5}$ 61. $\frac{105}{32}$ 62. $-p^2q + 5pq^2$

63.(i) = $p^2 + q^2 + r^2 - pq - qr - rp$ (ii)= $2xz - 2x^2 - 4xy + 2yz - 2y^2$64.(i)$16a^2 + 15a$
(ii) = $-x^2 + 10x^2y^2 - 3y^2$(iii)– $3st^2$65.$15x^2 + 19xy + 6y^2$66.$8x^2 + 2xy - 15y^2$
67.(i) 1(ii) 25 (iii) 100

(A) 0 (B) abc
(C) 3abc (D) (ab + bc + ca)

Q.20 If a + b + c = 0, then the value of $\left(\frac{a^2}{bc}+\frac{b^2}{ca}+\frac{c^2}{ab}\right)$ is -
(A) 1 (B) 0
(C) –1 (D) 3

Q.21 If x + y + z = 9 & xy + yz + zx = 23, then the value of $(x^3 + y^3 + z^3 – 3xyz)$ is -
(A) 108 (B) 207
(C) 669 (D) 729

Q.22 If $\frac{5^x}{125}$ = 1, then x is equal to -
(A) 5 (B) 2
(C) 0 (D) 3

Q.23 If $3^x – 3^{x–1} = 18$, then the value of x^x is -
(A) 3 (B) 8
(C) 27 (D) 216

Q.24 If $2^x – 2^{x–1} = 16$, then the value of x^2 is -
(A) 4 (B) 9
(C) 16 (D) 25

Q.25 If x and y are non-zero rational unequal numbers, then $\frac{(x+y)^2-(x-y)^2}{x^2y-xy^2}$ is equal to -
(A) $\frac{1}{xy}$ (B) $\frac{1}{x-y}$
(C) $\frac{4}{x-y}$ (D) $\frac{2}{x-y}$

Q.26 If $\frac{x}{(b-c)(b+c-2a)} = \frac{y}{(c-a)(c+a-2b)} = \frac{z}{(a-b)(a+b-2c)}$, the value of (x + y + z) is -
(A) a + b + c (B) $a^2 + b^2 + c^2$
(C) 0 (D) indeterminate

Q.27 Let $\frac{a}{b} – \frac{b}{a}$ = x : y. If $(x – y) = \left(\frac{a}{b}+\frac{b}{a}\right)$, then x is equal to -
(A) $\frac{a+b}{a}$ (B) $\frac{a+b}{b}$
(C) $\frac{a-b}{a}$ (D) None of these

Q.28 If (x – 2) is a factor of $(x^2 + 3qx – 2q)$, then the value of q is -
(A) 2 (B) –2
(C) 1 (D) –1

Q.29 If $x^3 + 6x^2 + 4x + k$ is exactly divisible by (x + 2), then the value of k is -
(A) –6 (B) –7
(C) –8 (D) –10

Q.30 Let $f(x) = x^3 – 6x^2 + 11x – 6$. Then, which one of the following is not factor of f(x) ?
(A) x – 1 (B) x – 2
(C) x + 3 (D) x – 3

Q.31 The polynomial $(x^4 – 5x^3 + 5x^2 – 10x + 24)$ has a factor as -
(A) x + 4 (B) x – 2
(C) x + 2 (D) None of these

Q.32 Which of the following statements are correct ?
1. x + 3 is a factor of $x^3 + 2x^2 + 3x + 18$
2. x + 2 is a factor of $x^3 + 2x^2 – x – 2$
3. x + 1 is a factor of $x^3 + x^2 – 4x – 4$
4. x – 2 is a factor of $2x^3 – 3x + 4$
(A) 2, 3, 4 (B) 1, 3, 4
(C) 1, 2, 4 (D) 1, 2, 3

Q.33 $(x^{29} – x^{25} + x^{13} – 1)$ is divisible by -
(A) both (x – 1) & (x + 1)
(B) (x – 1) but not by (x + 1)
(C) (x + 1) but not by (x – 1)
(D) neither (x – 1) nor (x + 1)

Q.34 Value of k for which (x – 1) is a factor of $(x^3 – k)$ is -
(A) –1 (B) 1
(C) 8 (D) –8

Q.35 The factors of $(8x^3 – 27y^3)$ are -
(A) $(2x – 3y) (4x^2 + 9y^2 – 6xy)$
(B) $(2x – 3y) (4x^2 + 9y^2 + 6xy)$
(C) $(2x – 3y) (4x^2 – 9y^2 – 6xy)$
(D) $(2x – 3y) (4x^2 – 9y^2 + 6xy)$

Q.36 The factors of $(x^3 + y^3 + 2x^2 – 2y^2)$ are -
(A) $(x + y) (x^2 + y^2 + xy + 2x – 2y)$
(B) $(x + y) (x^2 + y^2 – xy + 2x –2y)$
(C) $(x + y) (x^2 + y^2 + 2x – 2y)$
(D) None of these

Q.37 The factors of $(x^3 – 5x^2 + 8x – 4)$ are
(A) (x + 2) (x – 2) (x – 1)
(B) (x + 1) (x + 2) (x – 2)
(C) $(x – 2)^2 (x – 1)$
(D) $(x – 2)^2 (x + 1)$

Q.57 The factors of $(x^2 - 1 - 2a - a^2)$ are

(A) $(x - a + 1)(x - a - 1)$

(B) $(x + a - 1)(x - a + 1)$

(C) $(x + a + 1)(x - a - 1)$

(D) None of these

Q.58 The factors of $(x^2 - 8x - 20)$ are -

(A) $(x + 10)(x - 2)$

(B) $(x - 10)(x + 2)$

(C) $(x - 5)(x + 4)$

(D) $(x + 5)(x - 4)$

Q.59 The factors of $(x^2 - xy - 72y^2)$ are -

(A) $(x - 8y)(x + 9y)$

(B) $(x - 9y)(x + 8y)$

(C) $(x - y)(x + 72y)$

(D) $(x - 6y)(x + 12y)$

Q.60 The factors of $(x^2 - 11xy - 60y^2)$ are

(A) $(x + 15y)(x - 4y)$

(B) $(x - 15y)(x + 4y)$

(C) $(15x + y)(4x - y)$

(D) None of these

Q.61 The factors of $(x^4 + x^2 + 25)$ are -

(A) $(x^2 + 5 + 3x)(x^2 + 5 - 3x)$

(B) $(x^2 + 3x + 5)(x^2 + 3x - 5)$

(C) $(x^2 + x + 5)(x^2 - x + 5)$

(D) None of these

Q.62 The factors of $(x^4 - 7x^2y^2 + y^4)$ are -

(A) $(x^2 + y^2 - 3xy)(x^2 + y^2 + 3xy)$

(B) $(x^2 - y^2 - 3xy)(x^2 - y^2 + 3xy)$

(C) $(x^2 - 3xy + y^2)(x^2 - 3xy - y^2)$

(D) None of these

Q.63 The factors of $(x^2 + 4y^2 + 4y - 4xy - 2x - 8)$ are-

(A) $(x - 2y - 4)(x - 2y + 2)$

(B) $(x - y + 2)(x - 4y - 4)$

(C) $(x + 2y - 4)(x + 2y + 2)$

(D) None of these

Q.64 The factors of $(x^2 + xy - 2y^2)$ are -

(A) $(x - 2y)(x + y)$

(B) $(x + 2y)(x - y)$

(C) $(x - 2y)(x - y)$

(D) $(x + 2y)(x + y)$

Q.65 The factors of $(x^3 - x^2y - xy^2 + y^3)$ are

(A) $(x + y)(x^2 + y^2 - xy)$

(B) $(x + y)(x^2 + y^2 + xy)$

(C) $(x + y)^2 (x - y)$

(D) $(x - y)^2 . (x + y)$

Q.66 The factors of $(216x^3 - 64y^3)$ are -

(A) $8(3x - 2y)(9x^2 + 4y^2 - 6xy)$

(B) $8(3x - 2y)(9x^2 - 4y^2 - 6xy)$

(C) $8(3x - 2y)(9x^2 + 4y^2)$

(D) $8(3x - 2y)(9x^2 + 4y^2 + 6xy)$

ANSWER KEY

1	C	2	C	3	B	4	A
5	D	6	B	7	A	8	A
9	D	10	C	11	B	12	C
13	D	14	C	15	A	16	C
17	B	18	B	19	C	20	D
21	A	22	D	23	C	24	D
25	C	26	C	27	D	28	D
29	C	30	C	31	B	32	D
33	B	34	B	35	B	36	B
37	C	38	C	39	A	40	A
41	C	42	B	43	A	44	B
45	D	46	A	47	C	48	C
49	C	50	C	51	B	52	B
53	B	54	A	55	D	56	D
57	C	58	B	59	B	60	B
61	A	62	A	63	A	64	B
65	D	66	D				