

Mathematics

(Chapter – 12) (Algebraic Expressions) (Class – VII)

Exercise 12.1

Question 1:

Get the algebraic expressions in the following cases using variables, constants and arithmetic operations:

- (i) Subtraction of z from y .
- (ii) One-half of the sum of numbers x and y .
- (iii) The number z multiplied by itself.
- (iv) One-fourth of the product of numbers p and q .
- (v) Numbers x and y both squared and added.
- (vi) Number 5 added to three times the product of m and n .
- (vii) Product of numbers y and z subtracted from 10.
- (viii) Sum of numbers a and b subtracted from their product.



Answer 1:

- | | |
|-----------------|------------------------|
| (i) $y - z$ | (ii) $\frac{x + y}{2}$ |
| (iii) z^2 | (iv) $\frac{pq}{4}$ |
| (v) $x^2 + y^2$ | (vi) $3mn + 5$ |
| (vii) $10 - yz$ | (viii) $ab - (a + b)$ |

Question 2:

(i) Identify the terms and their factors in the following expressions, show the terms and factors by tree diagram:

- | | | |
|---------------------|-------------------------|---------------|
| (a) $x - 3$ | (b) $1 + x + x^2$ | (c) $y - y^3$ |
| (d) $5xy^2 + 7x^2y$ | (e) $-ab + 2b^2 - 3a^2$ | |

(ii) Identify the terms and factors in the expressions given below:

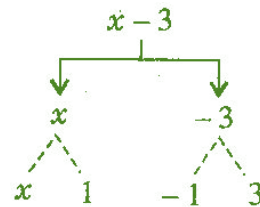
- | | | |
|----------------------------------|-----------------------|---------------------------|
| (a) $-4x + 5$ | (b) $-4x + 5y$ | (c) $5y + 3y^2$ |
| (d) $xy + 2x^2y^2$ | (e) $pq + q$ | (f) $1.2ab - 2.4b + 3.6a$ |
| (g) $\frac{3}{4}x + \frac{1}{4}$ | (h) $0.1p^2 + 0.2q^2$ | |

 Answer 2:

- (i) (a) $x - 3$
Expression

Terms

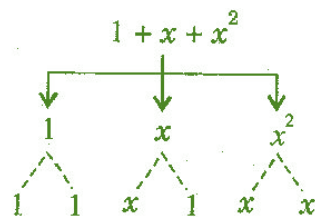
Factors



- (b) $1 + x + x^2$
Expression

Terms

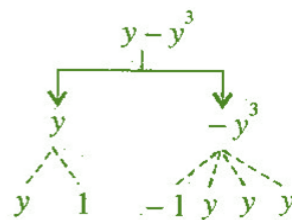
Factors



- (c) $y - y^3$
Expression

Terms

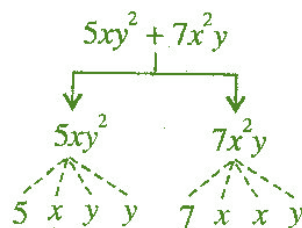
Factors



- (d) $5xy^2 + 7x^2y$
Expression

Terms

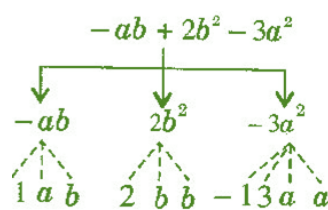
Factors



- (e) $-ab + 2b^2 - 3a^2$
Expression

Terms

Factors



(ii) (a) $-4x+5$

Terms: $-4x, 5$

Factors: $-4, x ; 5$

(b) $-4x+5y$

Terms: $-4x, 5y$

Factors: $-4, x ; 5, y$

(c) $5y+3y^2$

Terms: $5y, 3y^2$

Factors: $5, y ; 3, y, y$

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

Terms: $xy, 2x^2y^2$

Factors: $x, y ; 2x, x, y, y$

(e) $pq+q$

Terms: pq, q

Factors: $p, q ; q$

(f) $1.2ab-2.4b+3.6a$

Terms: $1.2ab, -2.4b, 3.6a$

Factors: $1.2, a, b ; -2.4, b ; 3.6, a$

(g) $\frac{3}{4}x+\frac{1}{4}$

Terms: $\frac{3}{4}x, \frac{1}{4}$

Factors: $\frac{3}{4}, x ; \frac{1}{4}$

(h) $0.1p^2+0.2q^2$

Terms: $0.1p^2, 0.2q^2$

Factors: $0.1, p, p ; 0.2, q, q$

Question 3:

Identify the numerical coefficients of terms (other than constants) in the following expressions:

(i) $5-3t^2$

(ii) $1+t+t^2+t^3$

(iii) $x+2xy+3y$

(iv) $100m+1000n$

(v) $-p^2q^2+7pq$

(vi) $1.2a+0.8b$

(vii) $3.14r^2$

(viii) $2(l+b)$

(ix) $0.1y+0.01y^2$

 Answer 3:

S.No.	Expression	Terms	Numerical Coefficient
(i)	$5 - 3t^2$	$-3t^2$	-3
(ii)	$1 + t + t^2 + t^3$	t	1
		t^2	1
		t^3	1
(iii)	$x + 2xy + 3y$	x	1
		$2xy$	2
		$3y$	3
(iv)	$100m + 1000n$	$100m$	100
		$1000n$	1000
(v)	$-p^2q^2 + 7pq$	$-p^2q^2$	-1
		$7pq$	7
(vi)	$1.2a + 0.8b$	$1.2a$	1.2
		$0.8b$	0.8
(vii)	$3.14r^2$	$3.14r^2$	3.14
(viii)	$2(l + b) = 2l + 2b$	$2l$	2
		$2b$	2
(ix)	$0.1y + 0.01y^2$	$0.1y$	0.1
		$0.01y^2$	0.01

Question 4:

(a) Identify terms which contain x and give the coefficient of x .

- (i) $y^2x + y$ (ii) $13y^2 - 8yx$ (iii) $x + y + 2$
 (iv) $5 + z + zx$ (v) $1 + x + xy$ (vi) $12xy^2 + 25$
 (vii) $7x + xy^2$

(b) Identify terms which contain y^2 and give the coefficient of y^2 .

- (i) $8 - xy^2$ (ii) $5y^2 + 7x$ (iii) $2x^2y - 15xy^2 + 7y^2$

Answer 4:

(a)

S.No.	Expression	Term with factor x	Coefficient of x
(i)	$y^2x + y$	y^2x	y^2
(ii)	$13y^2 - 8yx$	$-8yx$	$-8y$
(iii)	$x + y + 2$	x	1
(iv)	$5 + z + zx$	zx	z
(v)	$1 + x + xy$	x	1
		xy	y
(vi)	$12xy^2 + 25$	$12xy^2$	$12y^2$
(vii)	$7x + xy^2$	xy^2	y^2
		$7x$	7

(b)

S.No.	Expression	Term contains y^2	Coefficient of y^2
(i)	$8 - xy^2$	$-xy^2$	$-x$
(ii)	$5y^2 + 7x$	$5y^2$	5
(iii)	$2x^2y - 15xy^2 + 7y^2$	$-15xy^2$	$-15x$
		$7y^2$	7

Question 5:

Classify into monomials, binomials and trinomials:

- | | | |
|-----------------------|------------------|---------------------|
| (i) $4y - 7x$ | (ii) y^2 | (iii) $x + y - xy$ |
| (iv) 100 | (v) $ab - a - b$ | (vi) $5 - 3t$ |
| (vii) $4p^2q - 4pq^2$ | (viii) $7mn$ | (ix) $z^2 - 3z + 8$ |
| (x) $a^2 + b^2$ | (xi) $z^2 + z$ | (xii) $1 + x + x^2$ |

Answer 5:

S.No.	Expression	Type of Polynomial
(i)	$4y - 7z$	Binomial
(ii)	y^2	Monomial
(iii)	$x + y - xy$	Trinomial
(iv)	100	Monomial
(v)	$ab - a - b$	Trinomial
(vi)	$5 - 3t$	Binomial
(vii)	$4p^2q - 4pq^2$	Binomial
(viii)	$7mn$	Monomial
(ix)	$z^2 - 3z + 8$	Trinomial
(x)	$a^2 + b^2$	Binomial
(xi)	$z^2 + z$	Binomial
(xii)	$1 + x + x^2$	Trinomial

Question 6:

State whether a given pair of terms is of like or unlike terms:

- | | | |
|-------------------|--------------------------|-----------------------|
| (i) $1, 100$ | (ii) $-7x, \frac{5}{2}x$ | (iii) $-29x, -29y$ |
| (iv) $14xy, 42yx$ | (v) $4m^2p, 4mp^2$ | (vi) $12xz, 12x^2z^2$ |

 Answer 6:

S.No.	Pair of terms	Like / Unlike terms
(i)	1, 100	Like terms
(ii)	$-7x, \frac{5}{2}x$	Like terms
(iii)	$-29x, -29y$	Unlike terms
(iv)	$14xy, 42yx$	Like terms
(v)	$4m^2p, 4mp^2$	Unlike terms
(vi)	$12xz, 12x^2z^2$	Unlike terms

Question 7:

Identify like terms in the following:

(a) $-xy^2, -4yx^2, 8x^2, 2xy^2, 7y, -11x^2 - 100x, -11yx, 20x^2y, -6x^2, y, 2xy, 3x$

(b) $10pq, 7p, 8q, -p^2q^2, -7qp, -100q, -23, 12q^2p^2, -5p^2, 41, 2405p, 78qp, 13p^2q, qp^2, 701p^2$

 Answer 7:

(a) Like terms are:

(i) $-xy^2, 2xy^2$

(ii) $-4yx^2, 20x^2y$

(iii) $8x^2, -11x^2, -6x^2$

(iv) $7y, y$

(v) $-100x, 3x$

(vi) $-11yx, 2xy$

(b) Like terms are:

(i) $10pq, -7pq, 78pq$

(ii) $7p, 2405p$

(iii) $8q, -100q$

(iv) $-p^2q^2, 12p^2q^2$

(v) $-12, 41$

(vi) $-5p^2, 701p^2$

(vii) $13p^2q, qp^2$

Exercise 12.2

Question 1:

Simplify combining like terms:

- (i) $21b - 32 + 7b - 20b$
- (ii) $-z^2 + 13z^2 - 5x + 7z^3 - 15z$
- (iii) $p - (p - q) - q - (q - p)$
- (iv) $3a - 2b - ab - (a - b + ab) + 3ab + b - a$
- (v) $5x^2y - 5x^2 + 3yx^2 - 3y^2 + x^2 - y^2 + 8xy^2 - 3y^2$
- (vi) $(3y^2 + 5y - 4) - (8y - y^2 - 4)$



Answer 1:

- (i) $21b - 32 + 7b - 20b = 21b + 7b - 20b - 32$
 $= 28b - 20b - 32 = 8b - 32$
- (ii) $-z^2 + 13z^2 - 5x + 7z^3 - 15z = 7z^3 + (-z^2 + 13z^2) - (5x + 15z)$
 $= 7z^3 + 12z^2 - 20z$
- (iii) $p - (p - q) - q - (q - p) = p - p + q - q - q + p$
 $= p - p + p + q - q - q = p - q$
- (iv) $3a - 2b - ab - (a - b + ab) + 3ab + b - a = 3a - 2b - ab - a + b - ab + 3ab + b - a$
 $= 3a - a - a - 2b + b + b - ab - ab + 3ab$
 $= (3a - a - a) - (2b - b - b) - (ab + ab - 3ab)$
 $= a - 0 - (-ab)$
 $= a + ab$
- (v) $5x^2y - 5x^2 + 3yx^2 - 3y^2 + x^2 - y^2 + 8xy^2 - 3y^2 = 5x^2y + 3yx^2 + 8xy^2 - 5x^2 + x^2 - 3y^2 - y^2 - 3y^2$
 $= (5x^2y + 3x^2y) + 8xy^2 - (5x^2 - x^2) - (3y^2 + y^2 + 3y^2)$
 $= 8x^2y + 8xy^2 - 4x^2 - 7y^2$
- (vi) $(3y^2 + 5y - 4) - (8y - y^2 - 4) = 3y^2 + 5y - 4 - 8y + y^2 + 4$
 $= (3y^2 + y^2) + (5y - 8y) - (4 - 4)$
 $= 4y^2 - 3y - 0 = 4y^2 - 3y$

Question 2:

Add:

- (i) $3mn, -5mn, 8mn - 4mn$
- (ii) $t - 8tz, 3tz - z, z - t$
- (iii) $-7mn + 5, 12mn + 2, 9mn - 8, -2mn - 3$
- (iv) $a + b - 3, b - a + 3, a - b + 3$
- (v) $14x + 10y - 12xy - 13, 18 - 7x - 10y + 8xy, 4xy$
- (vi) $5m - 7n, 3n - 4m + 2, 2m - 3mn - 5$
- (vii) $4x^2y, -3xy^2, -5xy^2, 5x^2y$
- (viii) $3p^2q^2 - 4pq + 5, -10p^2q^2, 15 + 9pq + 7p^2q^2$
- (ix) $ab - 4a, 4b - ab, 4a - 4b$
- (x) $x^2 - y^2 - 1, y^2 - 1 - x^2, 1 - x^2 - y^2$

Answer 2:

$$\begin{aligned} \text{(i)} \quad 3mn, -5mn, 8mn, -4mn &= 3mn + (-5mn) + 8mn + (-4mn) \\ &= (3 - 5 + 8 - 4)mn = 2mn \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad t - 8tz, 3tz - z, z - t &= t - 8tz + 3tz - z + z - t \\ &= t - t - 8tz + 3tz - z + z \\ &= (1 - 1)t + (-8 + 3)tz + (-1 + 1)z \\ &= 0 - 5tz + 0 = -5tz \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad -7mn + 5, 12mn + 2, 9mn - 8, -2mn - 3 &= -7mn + 5 + 12mn + 2 + 9mn - 8 + (-2mn) - 3 \\ &= -7mn + 12mn + 9mn - 2mn + 5 + 2 - 8 - 3 \\ &= (-7 + 12 + 9 - 2)mn + 7 - 11 \\ &= 12mn - 4 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad a + b - 3, b - a + 3, a - b + 3 &= a + b - 3 + b - a + 3 + a - b + 3 \\ &= (a - a + a) + (b + b - b) - 3 + 3 + 3 \\ &= a + b + 3 \end{aligned}$$

(v)

$$\begin{aligned} 14x + 10y - 12xy - 13, 18 - 7x - 10y + 8xy, 4xy &= 14x + 10y - 12xy - 13 + 18 - 7x - 10y + 8xy + 4xy \\ &= 14x - 7x + 10y - 10y - 12xy + 8xy + 4xy - 13 + 18 \\ &= 7x + 0y + 0xy + 5 = 7x + 5 \end{aligned}$$

$$\begin{aligned}
\text{(vi)} \quad & 5m - 7n, 3n - 4m + 2, 2m - 3mn - 5 = 5m - 7n + 3n - 4m + 2 + 2m - 3mn - 5 \\
& = 5m - 4m + 2m - 7n + 3n - 3mn + 2 - 5 \\
& = (5 - 4 + 2)m + (-7 + 3)n - 3mn - 3 \\
& = 3m - 4n + 3mn - 3 \\
\text{(vii)} \quad & 4x^2y, -3xy^2, -5xy^2, 5x^2y = 4x^2y + (-3xy^2) + (-5xy^2) + 5x^2y \\
& = 4x^2y + 5x^2y - 3xy^2 - 5xy^2 \\
& = 9x^2y - 8xy^2 \\
\text{(viii)} \quad & 3p^2q^2 - 4pq + 5, -10p^2q^2, 15 + 9pq + 7p^2q^2 \\
& = 3p^2q^2 - 4pq + 5 + (-10p^2q^2) + 15 + 9pq + 7p^2q^2 \\
& = 3p^2q^2 - 10p^2q^2 + 7p^2q^2 + 4pq + 9pq + 5 + 15 \\
& = (3 - 10 + 7)p^2q^2 + (-4 + 9)pq + 20 \\
& = 0p^2q^2 + 5pq + 20 = 5pq + 20 \\
\text{(ix)} \quad & ab - 4a, 4b - ab, 4a - ab = ab - 4a + 4b - ab + 4a - ab \\
& = -4a + 4a + 4b - 4b + ab - ab \\
& = 0 + 0 + 0 = 0 \\
\text{(x)} \quad & x^2 - y^2 - 1, y^2 - 1 - x^2, 1 - x^2 - y^2 \\
& = x^2 - y^2 - 1 + y^2 - 1 - x^2 + 1 - x^2 - y^2 \\
& = x^2 - x^2 - x^2 - y^2 + y^2 - y^2 - 1 - 1 + 1 \\
& = (1 - 1 - 1)x^2 + (-1 + 1 - 1)y^2 - 1 - 1 + 1 \\
& = -x^2 - y^2 - 1
\end{aligned}$$

Question 3:

Subtract:

- (i) $-5y^2$ from y^2
- (ii) $6xy$ from $-12xy$
- (iii) $(a - b)$ from $(a + b)$
- (iv) $a(b - 5)$ from $b(5 - a)$
- (v) $-m^2 + 5mn$ from $4m^2 - 3mn + 8$
- (vi) $-x^2 + 10x - 5$ from $5x - 10$
- (vii) $5a^2 - 7ab + 5b^2$ from $3ab - 2a^2 - 2b^2$
- (viii) $4pq - 5q^2 - 3p^2$ from $5p^2 + 3q^2 - pq$

 Answer 3:

$$\begin{aligned} \text{(i)} \quad y^2 - (-5y^2) &= y^2 + 5y^2 \\ &= 6y^2 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad -12xy - (6xy) &= -12xy - 6xy \\ &= -18xy \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad (a+b) - (a-b) &= a+b-a+b \\ &= a-a+b+b \\ &= 2b \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad b(5-a) - a(b-5) &= 5b-ab-ab+5a \\ &= 5b-2ab+5a \\ &= 5a+5b-2ab \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad 4m^2 - 3mn + 8 - (-m^2 + 5mn) &= 4m^2 - 3mn + 8 + m^2 - 5mn \\ &= 4m^2 + m^2 - 3mn - 5mn + 8 \\ &= 5m^2 - 8mn + 8 \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad 5x - 10 - (-x^2 + 10x - 5) &= 5x - 10 + x^2 - 10x + 5 \\ &= x^2 + 5x - 10x - 10 + 5 \\ &= x^2 - 5x - 5 \end{aligned}$$

$$\begin{aligned} \text{(vii)} \quad 3ab - 2a^2 - 2b^2 - (5a^2 - 7ab + 5b^2) &= 3ab - 2a^2 - 2b^2 - 5a^2 + 7ab - 5b^2 \\ &= 3ab + 7ab - 2a^2 - 5a^2 - 2b^2 - 5b^2 \\ &= 10ab - 7a^2 - 7b^2 \\ &= -7a^2 - 7b^2 + 10ab \end{aligned}$$

$$\begin{aligned} \text{(viii)} \quad 5p^2 + 3q^2 - pq - (4pq - 5q^2 - 3p^2) &= 5p^2 + 3q^2 - pq - 4pq + 5q^2 + 3p^2 \\ &= 5p^2 + 3p^2 + 3q^2 + 5q^2 - pq - 4pq \\ &= 8p^2 + 8q^2 - 5pq \end{aligned}$$

Question 4:

- (a) What should be added to $x^2 + xy + y^2$ to obtain $2x^2 + 3xy$?
- (b) What should be subtracted from $2a + 8b + 10$ to get $-3a + 7b + 16$?

Answer 4:

- (a) Let p should be added.

Then according to question,

$$x^2 + xy + y^2 + p = 2x^2 + 3xy$$

$$\Rightarrow p = 2x^2 + 3xy - (x^2 + xy + y^2)$$

$$\Rightarrow p = 2x^2 + 3xy - x^2 - xy - y^2$$

$$\Rightarrow p = 2x^2 - x^2 - y^2 + 3xy - xy$$

$$\Rightarrow p = x^2 - y^2 + 2xy$$

Hence, $x^2 - y^2 + 2xy$ should be added.

- (b) Let q should be subtracted.

Then according to question,

$$2a + 8b + 10 - q = -3a + 7b + 16$$

$$\Rightarrow -q = -3a + 7b + 16 - (2a + 8b + 10)$$

$$\Rightarrow -q = -3a + 7b + 16 - 2a - 8b - 10$$

$$\Rightarrow -q = -3a - 2a + 7b - 8b + 16 - 10$$

$$\Rightarrow -q = -5a - b + 6$$

$$\Rightarrow q = -(-5a - b + 6)$$

$$\Rightarrow q = 5a + b - 6$$

Question 5:

What should be taken away from $3x^2 - 4y^2 + 5xy + 20$ to obtain $-x^2 - y^2 + 6xy + 20$?

Answer 5:

Let q should be subtracted.

Then according to question,

$$3x^2 - 4y^2 + 5xy + 20 - q = -x^2 - y^2 + 6xy + 20$$

$$\Rightarrow q = 3x^2 - 4y^2 + 5xy + 20 - (-x^2 - y^2 + 6xy + 20)$$

$$\Rightarrow q = 3x^2 - 4y^2 + 5xy + 20 + x^2 + y^2 - 6xy - 20$$

$$\Rightarrow q = 3x^2 + x^2 - 4y^2 + y^2 + 5xy - 6xy + 20 - 20$$

$$\Rightarrow q = 4x^2 - 3y^2 - xy + 0$$

Hence, $4x^2 - 3y^2 - xy$ should be subtracted.

Question 6:

- (a) From the sum of $3x - y + 11$ and $-y - 11$, subtract $3x - y - 11$.
(b) From the sum of $4 + 3x$ and $5 - 4x + 2x^2$, subtract the sum of $3x^2 - 5x$ and $-x^2 + 2x + 5$.

Answer 6:

- (a) According to question,

$$\begin{aligned} & (3x - y + 11) + (-y - 11) - (3x - y - 11) = 3x - y + 11 - y - 11 - 3x + y + 11 \\ & = 3x - 3x - y - y + y + 11 - 11 + 11 \\ & = (3 - 3)x - (1 + 1 - 1)y + 11 + 11 - 11 \\ & = 0x - y + 11 = -y + 11 \end{aligned}$$

- (b) According to question,

$$\begin{aligned} & [(4 + 3x) + (5 - 4x + 2x^2)] - [(3x^2 - 5x) + (-x^2 + 2x + 5)] \\ & = [4 + 3x + 5 - 4x + 2x^2] - [3x^2 - 5x - x^2 + 2x + 5] \\ & = [2x^2 + 3x - 4x + 5 + 4] - [3x^2 - x^2 + 2x - 5x + 5] \\ & = [2x^2 - x + 9] - [2x^2 - 3x + 5] \\ & = 2x^2 - x + 9 - 2x^2 + 3x - 5 \\ & = 2x^2 - 2x^2 - x + 3x + 9 - 5 \\ & = 2x + 4 \end{aligned}$$

Exercise 12.3

Question 1:

If $m = 2$, find the value of:

$$\begin{array}{llll} \text{(i)} & m-2 & \text{(ii)} & 3m-5 \quad \text{(iii)} \quad 9-5m \\ \text{(iv)} & 3m^2-2m-7 & \text{(v)} & \frac{5m}{2}-4 \end{array}$$

Answer 1:

$$\begin{array}{ll} \text{(i)} & m-2 = 2-2 \quad \text{[Putting } m=2 \text{]} \\ & = 0 \end{array}$$

$$\begin{array}{ll} \text{(ii)} & 3m-5 = 3 \times 2-5 \quad \text{[Putting } m=2 \text{]} \\ & = 6-5 = 1 \end{array}$$

$$\begin{array}{ll} \text{(iii)} & 9-5m = 9-5 \times 2 \quad \text{[Putting } m=2 \text{]} \\ & = 9-10 = -1 \end{array}$$

$$\begin{array}{ll} \text{(iv)} & 3m^2-2m-7 \\ & = 3(2)^2-2(2)-7 \quad \text{[Putting } m=2 \text{]} \\ & = 3 \times 4-2 \times 2-7 \\ & = 12-4-7 \\ & = 12-11 = 1 \end{array}$$

$$\begin{array}{ll} \text{(v)} & \frac{5m}{2}-4 = \frac{5 \times 2}{2}-4 \quad \text{[Putting } m=2 \text{]} \\ & = 5-4 = 1 \end{array}$$

Question 2:

If $p = -2$, find the value of:

$$\begin{array}{lll} \text{(i)} & 4p+7 & \text{(ii)} \quad -3p^2+4p+7 \quad \text{(iii)} \quad -2p^3-3p^2+4p+7 \end{array}$$

Answer 2:

$$\begin{array}{ll} \text{(i)} & 4p+7 = 4(-2)+7 \quad \text{[Putting } p=-2 \text{]} \\ & = -8+7 = -1 \end{array}$$

$$\begin{array}{ll} \text{(ii)} & -3p^2+4p+7 \\ & = -3(-2)^2+4(-2)+7 \quad \text{[Putting } p=-2 \text{]} \\ & = -3 \times 4-8+7 \\ & = -12-8+7 \\ & = -20+7 = -13 \end{array}$$

$$\begin{aligned}
 \text{(iii)} \quad & -2p^3 - 3p^2 + 4p + 7 \\
 & = -2(-2)^3 - 3(-2)^2 + 4(-2) + 7 && [\text{Putting } p = -2] \\
 & = -2 \times (-8) - 3 \times 4 - 8 + 7 \\
 & = 16 - 12 - 8 + 7 \\
 & = -20 + 23 = 3
 \end{aligned}$$

Question 3:

Find the value of the following expressions, when $x = -1$:

$$\begin{array}{lll}
 \text{(i)} & 2x - 7 & \text{(ii)} \quad -x + 2 \quad \text{(iii)} \quad x^2 + 2x + 1 \\
 \text{(iv)} & 2x^2 - x - 2 &
 \end{array}$$

Answer 3:

$$\begin{aligned}
 \text{(i)} \quad & 2x - 7 = 2(-1) - 7 && [\text{Putting } x = -1] \\
 & = -2 - 7 = -9 \\
 \text{(ii)} \quad & -x + 2 = -(-1) + 2 && [\text{Putting } x = -1] \\
 & = 1 + 2 = 3 \\
 \text{(iii)} \quad & x^2 + 2x + 1 = (-1)^2 + 2(-1) + 1 && [\text{Putting } x = -1] \\
 & = 1 - 2 + 1 \\
 & = 2 - 2 = 0 \\
 \text{(iv)} \quad & 2x^2 - x - 2 = 2(-1)^2 - (-1) - 2 && [\text{Putting } x = -1] \\
 & = 2 \times 1 + 1 - 2 \\
 & = 2 + 1 - 2 \\
 & = 3 - 2 = 1
 \end{aligned}$$

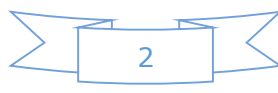
Question 4:

If $a = 2, b = -2$, find the value of:

$$\begin{array}{lll}
 \text{(i)} & a^2 + b^2 & \text{(ii)} \quad a^2 + ab + b^2 \quad \text{(iii)} \quad a^2 - b^2
 \end{array}$$

Answer 4:

$$\begin{aligned}
 \text{(i)} \quad & a^2 + b^2 = (2)^2 + (-2)^2 && [\text{Putting } a = 2, b = -2] \\
 & = 4 + 4 = 8 \\
 \text{(ii)} \quad & a^2 + ab + b^2 && \\
 & = (2)^2 + (2)(-2) + (-2)^2 && [\text{Putting } a = 2, b = -2] \\
 & = 4 - 4 + 4 = 4
 \end{aligned}$$



$$\begin{aligned} \text{(iii)} \quad a^2 - b^2 &= (2)^2 - (-2)^2 & [\text{Putting } a = 2, b = -2] \\ &= 4 - 4 = 0 \end{aligned}$$

Question 5:

When $a = 0, b = -1$, find the value of the given expressions:

$$\begin{array}{ll} \text{(i)} & 2a + 2b & \text{(ii)} & 2a^2 + b^2 + 1 \\ \text{(iii)} & 2a^2b + 2ab^2 + ab & \text{(iv)} & a^2 + ab + 2 \end{array}$$

Answer 5:

$$\begin{aligned} \text{(i)} \quad 2a + 2b &= 2(0) + 2(-1) & [\text{Putting } a = 0, b = -1] \\ &= 0 - 2 = -2 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad 2a^2 + b^2 + 1 &= 2(0)^2 + (-1)^2 + 1 & [\text{Putting } a = 0, b = -1] \\ &= 2 \times 0 + 1 + 1 = 0 + 2 = 2 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad 2a^2b + 2ab^2 + ab &= 2(0)^2(-1) + 2(0)(-1)^2 + (0)(-1) & [\text{Putting } a = 0, b = -1] \\ &= 0 + 0 + 0 = 0 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad a^2 + ab + 2 &= (0)^2 + (0)(-1) + 2 & [\text{Putting } a = 0, b = -1] \\ &= 0 + 0 + 2 = 2 \end{aligned}$$

Question 6:

Simplify the expressions and find the value if x is equal to 2:

$$\begin{array}{ll} \text{(i)} & x + 7 + 4(x - 5) & \text{(ii)} & 3(x + 2) + 5x - 7 \\ \text{(iii)} & 6x + 5(x - 2) & \text{(iv)} & 4(2x - 1) + 3x + 11 \end{array}$$

Answer 6:

$$\begin{aligned} \text{(i)} \quad x + 7 + 4(x - 5) &= x + 7 + 4x - 20 = x + 4x + 7 - 20 \\ &= 5x - 13 = 5 \times 2 - 13 & [\text{Putting } x = 2] \\ &= 10 - 13 = -3 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad 3(x + 2) + 5x - 7 &= 3x + 6 + 5x - 7 = 3x + 5x + 6 - 7 \\ &= 8x - 1 = 8 \times 2 - 1 & [\text{Putting } x = -1] \\ &= 16 - 1 = 15 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad 6x + 5(x - 2) &= 6x + 5x - 10 = 11x - 10 \\ &= 11 \times 2 - 10 & [\text{Putting } x = -1] \\ &= 22 - 10 = 12 \end{aligned}$$

$$\begin{aligned}
 \text{(iv)} \quad & 4(2x-1)+3x+11 = 8x-4+3x+11 = 8x+3x-4+11 \\
 & = 11x+7 = 11 \times 2 + 7 \\
 & = 22 + 7 = 29
 \end{aligned}
 \quad \text{[Putting } x = -1\text{]}$$

Question 7:

Simplify these expressions and find their values if $x = 3, a = -1, b = -2$:

$$\begin{array}{ll}
 \text{(i)} & 3x-5-x+9 \\
 \text{(ii)} & 2-8x+4x+4 \\
 \text{(iii)} & 3a+5-8a+1 \\
 \text{(iv)} & 10-3b-4-5b \\
 \text{(v)} & 2a-2b-4-5+a
 \end{array}$$

Answer 7:

$$\begin{aligned}
 \text{(i)} \quad & 3x-5-x+9 = 3x-x-5+9 = 2x+4 \\
 & = 2 \times 3 + 4 \quad \text{[Putting } x = 3\text{]} \\
 & = 6 + 4 = 10 \\
 \text{(ii)} \quad & 2-8x+4x+4 = -8x+4x+2+4 = -4x+6 \\
 & = -4 \times 3 + 6 \quad \text{[Putting } x = 3\text{]} \\
 & = -12 + 6 = -6 \\
 \text{(iii)} \quad & 3a+5-8a+1 = 3a-8a+5+1 = -5a+6 \\
 & = -5(-1)+6 \quad \text{[Putting } a = -1\text{]} \\
 & = 5 + 6 = 11 \\
 \text{(iv)} \quad & 10-3b-4-5b = -3b-5b+10-4 = -8b+6 \\
 & = -8(-2)+6 \quad \text{[Putting } b = -2\text{]} \\
 & = 16 + 6 = 22 \\
 \text{(v)} \quad & 2a-2b-4-5+a = 2a+a-2b-4-5 \\
 & = 3a-2b-9 = 3(-1)-2(-2)-9 \quad \text{[Putting } a = -1, b = -2\text{]} \\
 & = -3+4-9 = -8
 \end{aligned}$$

Question 8:

$$\begin{array}{ll}
 \text{(i)} & \text{If } z = 10, \text{ find the value of } z^3 - 3(z-10). \\
 \text{(ii)} & \text{If } p = -10, \text{ find the value of } p^2 - 2p - 100.
 \end{array}$$

Answer 8:

$$\begin{aligned}
 \text{(i)} \quad & z^3 - 3(z-10) = (10)^3 - 3(10-10) \quad \text{[Putting } z = 10\text{]} \\
 & = 1000 - 3 \times 0 = 1000 - 0 \\
 & = 1000
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad p^2 - 2p - 100 &= (-10)^2 - 2(-10) - 100 && [\text{Putting } p = -10] \\
 &= 100 + 20 - 100 = 20
 \end{aligned}$$

Question 9:

What should be the value of a if the value of $2x^2 + x - a$ equals to 5, when $x = 0$?

Answer 9:

$$\begin{aligned}
 \text{Given: } 2x^2 + x - a &= 5 \\
 \Rightarrow 2(0)^2 + 0 - a &= 5 && [\text{Putting } x = 0] \\
 \Rightarrow 0 + 0 - a &= 5 \\
 \Rightarrow a &= -5
 \end{aligned}$$

Hence, the value of a is -5 .

Question 10:

Simplify the expression and find its value when $a = 5$ and $b = -3$: $2(a^2 + ab) + 3 - ab$

Answer 10:

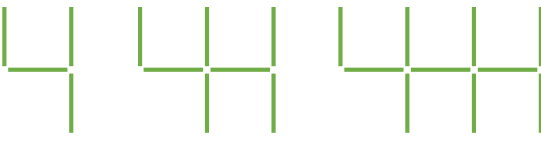
$$\begin{aligned}
 \text{Given: } 2(a^2 + ab) + 3 - ab \\
 \Rightarrow 2a^2 + 2ab + 3 - ab \\
 \Rightarrow 2a^2 + 2ab - ab + 3 \\
 \Rightarrow 2a^2 + ab + 3 \\
 \Rightarrow 2(5)^2 + (5)(-3) + 3 &&& [\text{Putting } a = 5, b = -3] \\
 \Rightarrow 2 \times 25 - 15 + 3 \\
 \Rightarrow 50 - 15 + 3 \\
 \Rightarrow 38
 \end{aligned}$$

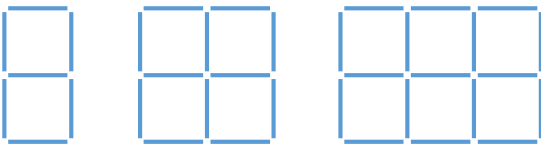
Exercise 12.4

Question 1:

Observe the patterns of digits made from line segments of equal length. You will find such segmented digits on the display of electronic watches or calculators.

(a)  ...
 6 11 16 21... $(5n+1)...$

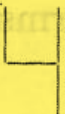
(b)  ...
 4 7 10 13... $(3n+1)...$

(c)  ...
 7 12 17 22... $(5n+2)...$

If the number of digits formed is taken to be n , the number of segments required to form n digits is given by the algebraic expression appearing on the right of each pattern.

How many segments are required to form 5, 10, 100 digits of the kind   

Answer 1:

S. No.	Symbol	Digit's number	Pattern's Formulae	No. of Segments
(i)		5	$5n+1$	26
		10		51
		100		501
(ii)		5	$3n+1$	16
		10		31
		100		301

(iii)		5	$5n + 2$	27
		10		52
		100		502

- (i) $5n + 1$
 Putting $n = 5$, $5 \times 5 + 1 = 25 + 1 = 26$
 Putting $n = 10$, $5 \times 10 + 1 = 50 + 1 = 51$
 Putting $n = 100$, $5 \times 100 + 1 = 500 + 1 = 501$
- (ii) $3n + 1$
 Putting $n = 5$, $3 \times 5 + 1 = 15 + 1 = 16$
 Putting $n = 10$, $3 \times 10 + 1 = 30 + 1 = 31$
 Putting $n = 100$, $3 \times 100 + 1 = 300 + 1 = 301$
- (iii) $5n + 2$
 Putting $n = 5$, $5 \times 5 + 2 = 25 + 2 = 27$
 Putting $n = 10$, $5 \times 10 + 2 = 50 + 2 = 52$
 Putting $n = 100$, $5 \times 100 + 2 = 500 + 2 = 502$

Question 2:

Use the given algebraic expression to complete the table of number patterns:

S.No.	Expression	Terms									
		1 st	2 nd	3 rd	4 th	5 th	...	10 th	...	100 th	...
(i)	$2n - 1$	1	3	5	7	9	---	19	---	---	---
(ii)	$3n + 2$	2	5	8	11	---	---	---	---	---	---
(iii)	$4n + 1$	5	9	13	17	---	---	---	---	---	---
(iv)	$7n + 20$	27	34	41	48	---	---	---	---	---	---
(v)	$n^2 + 1$	2	5	10	17	---	---	---	---	10001	---

Answer 2:

- (i) $2n - 1$
 Putting $n = 100$, $2 \times 100 - 1 = 200 - 1 = 199$
- (ii) $3n + 2$
 Putting $n = 5$, $3 \times 5 + 2 = 15 + 2 = 17$

	Putting	$n = 10,$	$3 \times 10 + 2 = 30 + 2 = 32$
	Putting	$n = 100,$	$3 \times 100 + 2 = 300 + 2 = 302$
(iii)	$4n + 1$		
	Putting	$n = 5,$	$4 \times 5 + 1 = 20 + 1 = 21$
	Putting	$n = 10,$	$4 \times 10 + 1 = 40 + 1 = 41$
	Putting	$n = 100,$	$4 \times 100 + 1 = 400 + 1 = 401$
(iv)	$7n + 20$		
	Putting	$n = 5,$	$7 \times 5 + 20 = 25 + 20 = 55$
	Putting	$n = 10,$	$7 \times 10 + 20 = 70 + 20 = 90$
	Putting	$n = 100,$	$7 \times 100 + 20 = 700 + 20 = 720$
(v)	$n^2 + 1$		
	Putting	$n = 5,$	$5 \times 5 + 1 = 25 + 1 = 26$
	Putting	$n = 10,$	$10 \times 10 + 1 = 100 + 1 = 101$
	Putting	$n = 100,$	$100 \times 100 + 1 = 10000 + 1 = 10001$

Now complete table is,

S.No.	Expression	Terms									
		1 st	2 nd	3 rd	4 th	5 th	...	10 th	...	100 th	...
(i)	$2n - 1$	1	3	5	7	9	---	19	---	199	---
(ii)	$3n + 2$	2	5	8	11	17	---	32	---	302	---
(iii)	$4n + 1$	5	9	13	17	21	---	41	---	401	---
(iv)	$7n + 20$	27	34	41	48	55	---	90	---	720	---
(v)	$n^2 + 1$	2	5	10	17	26	---	101	---	10001	---