

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:

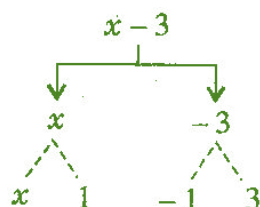
- | | | |
|----------------------------------|-----------------------|---------------------------|
| (a) $-4x + 5$ | (b) $-4x + 5y$ | (c) $5y + 3y^2$ |
| (d) $xy + 2x^2y^2$ | (e) $pq + q$ | (f) $1.2ab - 2.4b + 3.6a$ |
| (g) $\frac{3}{4}x + \frac{1}{4}$ | (h) $0.1p^2 + 0.2q^2$ | |

Answer 2:

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

Terms

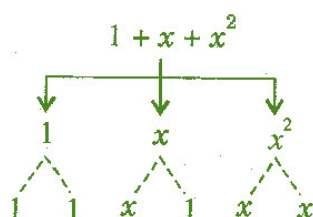
Factors



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

Terms

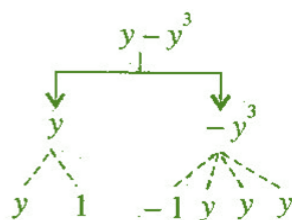
Factors



(c) $y-y^3$
Expression

Terms

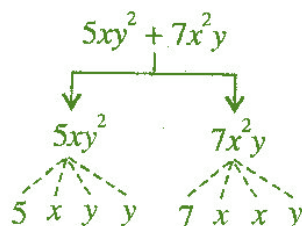
Factors



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

Terms

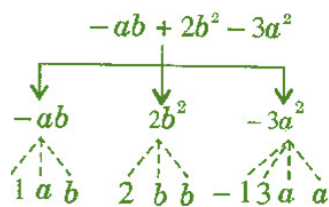
Factors



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

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:

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

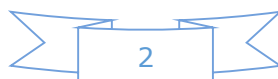
$$\begin{aligned} \text{(ii)} \quad t - 8tz, 3tz - z, z - t &= t - 8tz + 3tz - z + z - t \\ &= t - t - 8tz + 3tz - z + z \\ &= (1 - 1)t + (-8 + 3)tz + (-1 + 1)z \\ &= 0 - 5tz + 0 = -5tz \end{aligned}$$

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

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

(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,

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

Exercise 12.3

Question 1:

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

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

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:

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

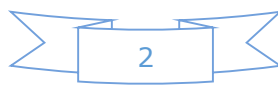
Question 4:

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:

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

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

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

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

[Putting $x = -1$]

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:

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

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:

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

[Putting $z = 10$]



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

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 $b = -3$: $2(a^2 + ab) + 3 - ab$

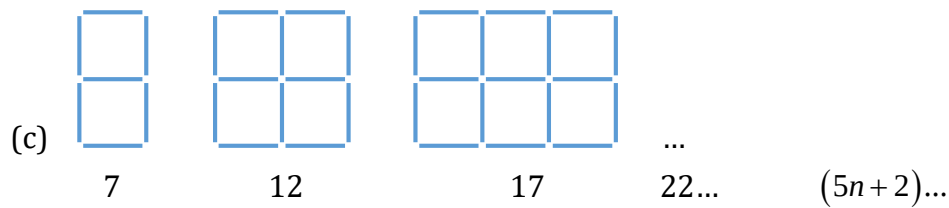
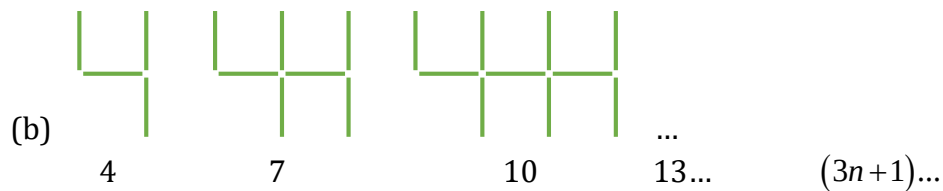
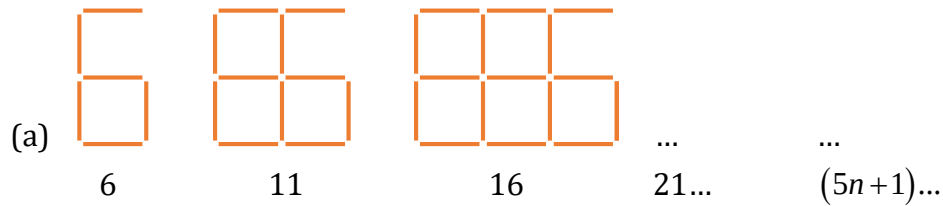
Answer 10:

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

Exercise 12.4

Question 1:

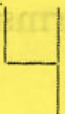
Observe the patterns of digits made from line segments of equal length. You will find such segmented digits on the display of electronic watches or calculators.



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	---