

Mathematics

Algebraic Expressions



NCERT

Exercises (Questions-Solutions)

Exercise 12.1

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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 numbers m and n .
 - (vii) Product of numbers y and z subtracted from 10.
 - (viii) Sum of numbers a and b subtracted from their product.

Sol.

(i) $y - z$	(ii) $\frac{1}{2}(x + y)$
(iii) z^2	(iv) $\frac{1}{4}pq$
(v) $x^2 + y^2$	(vi) $3mn + 5$
(vii) $10 - yz$	(viii) $ab - (a + b)$

2. (i) Identify the terms and their factors in the following expressions. Show the terms and factors by tree diagrams:

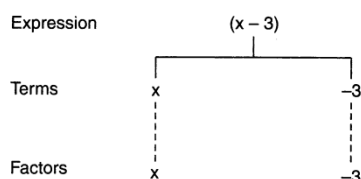
(a) $x - 3$	(b) $1 + x + x^2$	(c) $y - y^3$	(d) $5xy^2 + 7x^2y$
(e) $-ab + 2b^2 - 3a^2$			

- (ii) Identify 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) $0.1p^2 + 0.2q^2$

Sol. (i) (a) $x - 3$

Tree Diagram

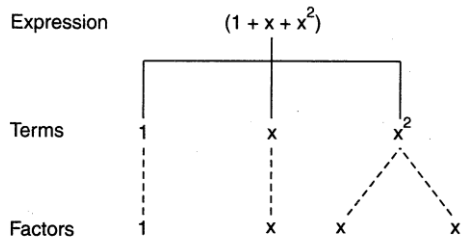


Terms: $x; -3$

Factor: $x; -3$

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

Tree Diagram

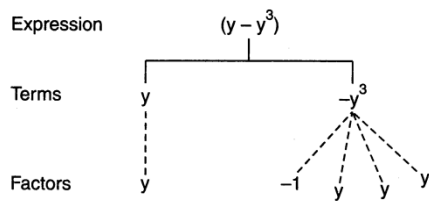


Terms: $1; x; x^2$

Factors: $1; x; x, x$

(c) $y - y^3$

Tree Diagram

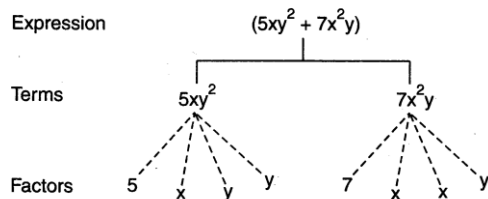


Terms: $y; -y^3$

Factors: $y; -1, y, y, y$

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

Tree Diagram

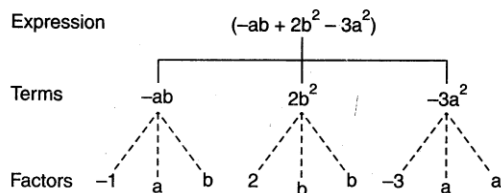


Terms: $5xy^2; 7x^2y$

Factors: $5, x, y, y; 7, x, x, y$

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

Tree Diagram



Terms: $-ab; 2b^2; -3a^2$

Factor: $-1, a, b; 2, b, b; -3, a, a$

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

Terms: $-4x; 5$

Factors: $-1, 4, x, 5$

(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: $x, y, 2, x, x, y, y$

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

Factor: $0.1p, p, 0.2, q, q$.

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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) $0.1y + 0.01y^2$

Sol. (i) -3

(ii) $1, 1, 1$

(iii) $1, 2, 3$

(iv) $100, 1000$

(v) $-1, 7$

(vi) $1.2, 0.8$

(vii) 3.14

(viii) $2, 2$

$|2(l + b) = 2l + 2b$

(ix) $0.1, 0.01$

4. (a) Identify terms which contain x and give that 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) $2x^2y - 15xy^2 + 7y^2$

Sol.

(i)	$y^2x + y$	Term which contain x	coefficient of x
		y^2x	y^2
(ii)	$13y^2 - 8yx$	Term which contain x	coefficient of x
		$-8yx$	$-8y$
(iii)	$x + y + z$	Term which contain x	coefficient of x
		x	1
(iv)	$5 + z + zx$	Term which contain x	coefficient of x
		zx	z
(v)	$1 + x + xy$	Term which contain x	coefficient of x
		x	1
		xy	y
(vi)	$12xy^2 + 25$	Term which contain x	coefficient of x
		$12xy^2$	$12y^2$
(vii)	$7x + xy^2$	Term which contain x	coefficient of x
		$7x$	7
		xy^2	y^2
(b)	$8x - xy^2$	Term which contains	coefficient of y^2
(i)		y^2	
		$-xy^2$	$-x$
(ii)	$5y^2 + 7x$	Term which contains	coefficient of y^2
		y^2	
		$5y^2$	5
(iii)	$2x^2y - 15xy^2 + 7y^2$	Terms which contains	coefficient of y^2
		y^2	
		$-15xy^2$	$-15x$
		$7y^2$	7

5. Classify into monomials, binomials and trinomials.

- | | | | |
|---------------------|-----------------|-----------------------|---------------------|
| (i) $4y - 7z$ | (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) $1 + x + x^2$ |

- Sol.** (i) $4y - 7z$. This expressions is a binomial because it contains two terms: $4y$ and $-7z$.
- (ii) y^2 . This expression is a monomial because it contains only one term: y^2 .
- (iii) $x + y - xy$. This expression is a trinomial because it contains three terms: x , y and $-xy$.
- (iv) 100. This expression is a monomial because it contains only one term: 100.
- (v) $ab - a - b$. This expression is a trinomial because it contains three terms: ab , $-a$ and $-b$.
- (vi) $5 - 3t$. This expression is a binomial because it contains two terms: 5 and $-3t$.
- (vii) $4p^2q - 4pq^2$. This expression is a binomial because it contains two terms: $4p^2q$ and $-4pq^2$.
- (viii) $7mb$. This expression is a monomial because it contains only one term: $7mn$.
- (ix) $z^2 - 3z + 8$. This expression is a trinomial because it contains three terms: z^2 , $-3z$ and 8.
- (x) $a^2 + b^2$. This expression is a binomial because it contains two terms: a^2 and b^2 .
- (xi) $z^2 + z$. This expression is a binomial because it contains two terms: z^2 and z .

(xii) $1 + x + x^2$. This expression is a trinomial because it contains three terms: 1, x and x^2 .

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) $12xz, 12x^2z^2$

Sol. (i) Yes (ii) Yes (iii) No (iv) Yes
 (v) No (vi) No.

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) $10pq, 7p, 8q, -p^2q^2, -7qp, -100q, -23, 12q^2p^2, -5p^2, 41, 2405p, 78qp, 13p^2q, qp^2, 701p^2$
Sol. (a) $-xy^2, 2xy^2; -4yx^2, 20x^2y; 8x^2, -11x^2, -6x^2; 7y, y; -100x, 3x; -11yx, 2xy$
 (b) $10pq, -7qp, 78qp; 7p, 2405p; 8q, -100q; -23, 41; 12q^2p^2, -p^2q^2; -5p^2, 701p^2; 13p^2q, qp^2$

Exercise 12.2

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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) $(3y^2 + 5y - 4) - (8y - y^2 - 4)$

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

$$= 3y^2 + y^2 + 5y - 8y - 4 + 4$$

$$= 4y^2 - 3y.$$

|rearranging terms

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) $x^2 - y^2 - 1, y^2 - 1 - x^2, 1 - x^2 - y^2$

Sol. (i) $\text{Sum} = 3mn + (-5mn) + 8mn + (-4mn)$

$$= 3mn - 5mn + 8mn - 4mn$$

$$= 3mn + 8mn - 5mn - 4mn$$

|rearranging terms

$$= 11mn - 9mn = 2mn$$

(ii) $\text{Sum} = t - 8tz + 3tz - z + z - t$

$$= t - t - 8tz + 3tz - z + z$$

|rearranging terms

$$= 0 - 5tz - 0 = -5tz.$$

(iii) $\text{Sum} = -7mn + 5 + 12mn + 2 + 9mn + (-8) + (-2mn - 3)$

$$= -7mn + 5 + 12mn + 2 + 9mn - 8 - 2mn - 3$$

$$= -7mn + 12mn + 9mn - 2mn + 5 + 2 - 8 - 3$$

|rearranging terms

$$= 12mn + 9mn - 7mn - 2mn + 5 + 2 - 8 - 3$$

|rearranging terms

$$= 21mn - 9mn + 7 - 11$$

$$= 12mn - 4.$$

(iv) $\text{Sum} = a + b - 3 + b - a + 3 + a - b + 3$

$$= a - a + a + b + b - b - 3 + 3 + 3$$

|rearranging terms

$$= a + a - a + b + b - b + 3 + 3 - 3$$

|rearranging terms

$$= a + b + 3.$$

(v) $\text{Sum} = 14x + 10y - 12xy - 13 + 18 - 7x - 10y + 8xy + 4xy$

$$= 8xy + 4xy - 12xy + 14x - 7x + 10y - 10y + 18 - 13$$

|rearranging terms

$$= 7x + 5.$$

(vi) $\text{Sum} = 5m - 7n + 3n - 4m + 2 + 2m - 3mn - 5$

$$= 5m + 2m - 4m + 3n - 7n + 2 - 5 - 3mn$$

|rearranging terms

$$= 3m - 4n - 3 - 3mn.$$

(vii) $\text{sum} = 4x^2y + (-3xy^2) + (-5xy^2) + 5x^2y$

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

|rearranging terms

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

|rearranging terms

$$= 9x^2y - 8xy^2$$

$$\begin{aligned}
\text{(viii) Sum} &= 3p^2q^2 - 4pq + 5 + (-10p^2q^2) + (15 + 9pq + 7p^2q^2) \\
&= 3p^2q^2 - 4pq + 5 - 10p^2q^2 + 15 + 9pq + 7p^2q^2 \\
&= 3p^2q^2 + 7p^2q^2 - 10p^2q^2 + 9pq - 4pq + 5 + 15 && \text{rearranging terms} \\
&= 5pq + 20. \\
\text{(ix) Sum} &= ab - 4a + 4b - ab + 4a - 4b \\
&= ab - ab + 4a - 4a + 4b - 4b && \text{rearranging terms} \\
&= 0. \\
\text{(x) Sum} &= x^2 - y^2 - 1 + y^2 - 1 - x^2 + 1 - x^2 - y^2 \\
&= x^2 - x^2 - x^2 + y^2 - y^2 - y^2 + 1 - 1 - 1 \\
&= x^2 + y^2 + 1. && \text{rearranging terms}
\end{aligned}$$

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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 $5p^2 + 3q^2 - pq$

Sol. (i) $-5y^2$ from y^2

$$y^2 - (-5y^2) = y^2 + 5y^2 = 6y^2.$$

(ii) $6xy$ from $-12xy$

$$-12xy - 6xy = -18xy$$

(iii) $(a-b)$ from $(a+b)$

$$(a+b) - (a-b) = a+b-a+b$$

$$= a - a + b + b$$

|rearranging terms

$$= 2b$$

(iv) $a(b-5)$ from $b(5-a)$

$$b(5-a) - a(b-5) = 5b - ab - ab + 5a$$

$$= 5a + 5b - ab - ab$$

|rearranging terms

$$= 5a + 5b - 2ab$$

(v) $-m^2 + 5mn$ from $4m^2 - 3mn + 8$

$$4m^2 - 3mn + 8 - (-m^2 + 5mn)$$

$$= 4m^2 - 3mn + 8 + m^2 - 5mn$$

$$= 4m^2 + m^2 - 3mn - 5mn + 8$$

|rearranging terms

$$= 5m^2 - 8mn + 8$$

(vi) $-x^2 + 10x - 5$ from $5x - 10$

$$5x - 10 - (-x^2 + 10x - 5)$$

$$= 5x - 10 + x^2 - 10x + 5$$

$$= x^2 + 5x - 10x - 10 + 5$$

|rearranging terms

$$= x^2 - 5x - 5$$

(vii) $5a^2 - 7ab + 5b^2$ from $3ab - 2a^2 - 2b^2$

$$\begin{aligned}
& 3ab - 2a^2 - 2b^2 - (5a^2 - 7ab + 5b^2) \\
&= 3ab - 2a^2 - 2b^2 - 5a^2 + 7ab - 5b^2 \\
&= -2a^2 - 5a^2 - 2b^2 - 5b^2 + 3ab + 7ab & | \text{rearranging terms} \\
&= -7a^2 - 7b^2 + 10ab.
\end{aligned}$$

(viii) $4pq - 5q^2 - 3p^2$ from $5p^2 + 3q^2 - pq$

$$\begin{aligned}
& 5p^2 + 3q^2 - pq - (4pq - 5q^2 - 3p^2) \\
&= 5p^2 + 3q^2 - pq - 4pq + 5q^2 + 3p^2 \\
&= 5p^2 + 3p^2 + 3q^2 + 5q^2 - pq - 4pq & | \text{rearranging terms} \\
&= 8p^2 + 8q^2 - 5pq.
\end{aligned}$$

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 $-3a + 7b + 16$?

Sol. (a) Required expression
 $= 2x^2 + 3xy - (x^2 + xy + y^2)$

$$\begin{aligned}
&= 2x^2 + 3xy - x^2 - xy - y^2 \\
&= 2x^2 - x^2 + 3xy - xy - y^2 & | \text{rearranging terms} \\
&= x^2 + 2xy - y^2.
\end{aligned}$$

$$\begin{aligned}
& \text{(b) Required expression} \\
&= (2a + 8b + 10) - (-3a + 7b + 16) \\
&= 2a + 8b + 10 + 3a - 7b - 16 \\
&= 2a + 3a + 8b - 7b + 10 - 16 & | \text{rearranging terms} \\
&= 5a + b - 6
\end{aligned}$$

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

Sol. Required expression

$$\begin{aligned}
&= (3x^2 - 4y^2 + 5xy + 20) - (-x^2 - y^2 + 6xy + 20) \\
&= 3x^2 - 4y^2 + 5xy + 20 + x^2 + y^2 - 6xy - 20 \\
&= 3x^2 + x^2 + y^2 - 4y^2 + 5xy - 6xy + 20 - 20 & | \text{rearranging terms} \\
&= 4x^2 - 3y^2 - xy.
\end{aligned}$$

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 $-x^2 + 2x + 5$.

Sol. (a) Resulting expression

$$\begin{aligned}
&= \{(3x - y + 11) + (-y - 11)\} - (3x - y - 11) \\
&= 3x - y + 11 - y - 11 - 3x + y + 11 \\
&= 3x - 3x + y - y - y + 11 + 11 - 11 & | \text{rearranging terms} \\
&= -y + 11.
\end{aligned}$$

(b) Resulting expression

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

$$= 2x + 4.$$

Exercise 12.3

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

(i) $m - 2$

(ii) $3m - 5$

(iii) $9 - 5m$

(iv) $3m^2 - 2m - 7$

(v) $\frac{5m}{2} - 4$

Sol. (i) $m - 2 = 2 - 2 = 0.$

(ii) $3m - 5 = 3 \times 2 - 5 = 6 - 5 = 1.$

(iii) $9 - 5m = 9 - 5 \times 2 = 9 - 10 = -1$

(iv) $3m^2 - 2m - 7 = 3(2)^2 - 2(2) - 7$
 $= 12 - 4 - 7 = 1$

(v) $\frac{5m}{2} - 4 = \frac{5 \times 2}{2} - 4 = 5 - 4 = 1.$

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

(i) $4p + 7$

(ii) $-3p^2 + 4p + 7$

(iii) $-2p^3 - 3p^2 + 4p + 7$

Sol. (i) $4p + 7 = 4(-2) + 7 = -8 + 7 = -1.$

(ii) $-3p^2 + 4p + 7 = -3(-2)^2 + 4(-2) + 7$
 $= -12 - 8 + 7 = -20 + 7$
 $= -13.$

(iii) $-2p^3 - 3p^2 + 4p + 7 = -2(-2)^3 - 3(-2)^2 + 4(-2) + 7$
 $= -2(-8) - 3(4) - 8 + 7$
 $= 16 - 12 - 8 + 7$
 $= 16 + 7 - 12 - 8$
 $= 23 - 20 = 3.$

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

(i) $2x - 7$

(ii) $-x + 2$

(iii) $x^2 + 2x + 1$

(iv) $2x^2 - x - 2$

Sol. (i) $2x - 7 = 2(-1) - 7 = -2 - 7 = -9.$

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

(iii) $x^2 + 2x + 1 = (-1)^2 + 2(-1) + 1 = 1 - 2 + 1$
 $= 1 + 1 - 2 = 2 - 2 = 0.$

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

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

(i) $a^2 + b^2$

(ii) $a^2 + ab + b^2$

(iii) $a^2 - b^2.$

Sol. (i) $a^2 + b^2 = (2)^2 + (-2)^2 = 4 + 4 = 8$

(ii) $a^2 + ab + b^2 = (2)^2 + (2)(-2) + (-2)^2$
 $= 4 - 4 + 4 = 4 + 4 - 4$

$$= 8 - 4 = 4.$$

$$(iii) a^2 - b^2 = (2)^2 - (-2)^2 = 4 - 4 = 0.$$

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

$$(i) 2a + 2b \quad (ii) 2a^2 + b^2 + 1 \quad (iii) 2a^2b + 2ab^2 + ab \quad (iv) a^2 + ab + 2$$

Sol. (i) $2a + 2b = 2(0) + 2(-1) = 0 - 2 = -2.$

$$(ii) 2a^2 + b^2 + 1 = 2(0)^2 + (-1)^2 + 1 \\ = 0 + 1 + 1 = 2.$$

$$(iii) 2a^2b + 2ab^2 + ab = 2(0)^2(-1) + 2(0)(-1)^2 + (0)(-1) \\ = 0 + 2 + 0 = 2.$$

$$(iv) a^2 + ab + 2 = (0)^2 + (0)(-1) + 2 \\ = 0 + 0 + 2 = 2.$$

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

$$(i) x + 7 + 4(x - 5) \quad (ii) 3(x + 2) + 5x - 7 \quad (iii) 6x + 5(x - 2) \quad (iv) 4(2x - 1) + 3x + 11$$

Sol. (i) $x + 7 + 4(x - 5) = x + 7 + 4x - 20$

$$= x + 4x + 7 - 20 \quad | \text{rearranging terms}$$

$$= 5x - 13 = 5(2) - 13$$

$$= 10 - 13 = -3.$$

$$(ii) 3(x + 2) + 5x - 7 = 3x + 6 + 5x - 7$$

$$= 3x + 5x + 6 - 7 \quad | \text{rearranging terms}$$

$$= 8x - 1 = 8(2) - 1$$

$$= 16 - 1 = 15.$$

$$(iii) 6x + 5(x - 2) = 6x + 5x - 10$$

$$= 11x - 10 = 11(2) - 10$$

$$= 22 - 10 = 12.$$

$$(iv) 4(2x - 1) + 3x + 11 = 8x - 4 + 3x + 11$$

$$= 8x + 3x + 11 - 4 \quad | \text{rearranging terms}$$

$$= 11x + 7 = 11(2) + 7$$

$$= 22 + 7 = 29.$$

7. Simplify these expressions and find their value if $x = 3, a = -1, b = -2$.

$$(i) 3x - 5 - x + 9 \quad (ii) 2 - 8x + 4x + 4 \quad (iii) 3a + 5 - 8a + 1 \quad (iv) 10 - 3b - 4 - 5b$$

$$(v) 2a - 2b - 4 - 5 + a.$$

Sol. (i) $3x - 5 - x + 9 = 3x - x + 9 - 5 \quad | \text{rearranging terms}$

$$= 2x + 4 = 2(3) + 4$$

$$= 6 + 4 = 10$$

$$(ii) 2 - 8x + 4x + 4 = 4x - 8x + 2 + 4 \quad | \text{rearranging terms}$$

$$= -4x + 6 = -4(3) + 6$$

$$= -12 + 6 = -6.$$

$$(iii) 3a + 5 - 8a + 1 = 3a - 8a + 5 + 1 \quad | \text{rearranging terms}$$

$$= -5a + 6 = -5(-1) + 6$$

$$= 5 + 6 = 11.$$

$$(iv) 10 - 3b - 4 - 5b = -3b - 5b + 10 - 4 \quad | \text{rearranging terms}$$

$$= -8b + 6 = -8(-2) + 6$$

$$= 16 + 6 = 22.$$

$$(v) 2a - 2b - 4 - 5 + a = 2a + a - 2b - 4 - 5 \quad | \text{rearranging terms}$$

$$= 3a - 2b - 9$$

$$= 3(-1) - 2(-2) - 9$$

$$= -3 + 4 - 9 = 4 - 3 - 9$$

$$= 4 - 12 = -8$$

8. (a) If $z = 10$, find the value of $z^3 - 3(z - 10)$.

(b) If $p = -10$, find the value of $p^2 - 2p - 100$.

Sol. (a) $z^3 - 3(z - 10) = z^3 - 3z + 10$

$$= (10)^3 - 3(10) + 10$$

$$= 1000 - 30 + 10$$

$$= 1000 + 10 - 30$$

$$= 1010 - 30 = 980$$

(b) $p^2 - 2p - 100 = (-10)^2 - 2(-10) - 100$

$$= 100 + 20 - 100$$

$$= 120 - 100 = 20$$

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

Sol. $2x^2 + x - a = 2(0)^2 + (0) - a \quad | \text{when } x = 0$

$$= -a$$

According to the question,

$$-a = 5$$

$$\Rightarrow a = -5.$$

10. Simplify the expression and find its value when $a = 5$ and $b = -3$

$$2(a^2 + ab) + 3 - ab.$$

Sol. $2(a^2 + ab) + 3 - ab$

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

$$= 2a^2 + 2ab - ab + 3 \quad | \text{rearranging terms}$$

$$= 2a^2 + ab + 3$$

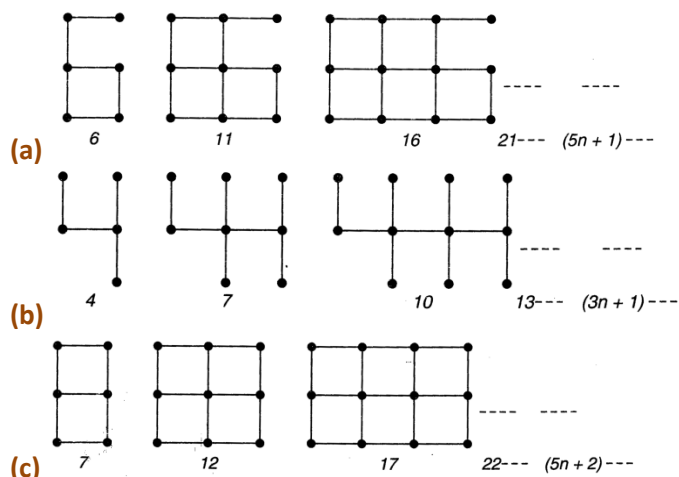
$$= 2(5)^2 + (5)(-3) + 3 = 50 - 15 + 3$$

$$= 50 + 3 - 15 = 53 - 15 = 38$$

Exercise 12.4

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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 digit of the kind , , .

Sol. (a)

Let the number of digits formed be n , Then, the number of segments required to form n digits is given by the algebraic expression $5n+1$.

So,

(i) the number of segments required to form 5 digits of the kind
 $= 5 \times 5 + 1 = 25 + 1 = 26$

(ii) the number of segments required to form 10 digits of this kind
 $= 5 \times 10 + 1 = 50 + 1 = 51$

(iii) the number of segment required to form 100 digits of this kind
 $= 5 \times 100 + 1 = 500 + 1 = 501$

(b)

Let the number of digits formed be n . Then, the number of segments required to form n digits is given by the algebraic expression $3n+1$.

So,

(i) the number of segments required to form 5 digits of this kind
 $= 3 \times 5 + 1 = 15 + 1 = 16$

(ii) the number of segments required to form 10 digits of this kind
 $= 3 \times 10 + 1 = 30 + 1 = 31$

(iii) The number of segments required to form 100 digits of this kind
 $= 3 \times 100 + 1 = 300 + 1 = 301$.

(c)

Let the number of digits formed be n . Then, the number of segments required to form n digits is given by the algebraic expression $5n+2$.

So,

(i) the number of segments required to form 5 digits of this kind
 $= 5 \times 5 + 2 = 25 + 2 = 27$

(ii) the number of segments required to form 10 digits of this kind
 $= 5 \times 10 + 2 = 50 + 2 = 52$

(iii) the number of segments required to form 100 digits of this kind
 $= 5 \times 100 + 2 = 500 + 2 = 502$.

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)	$2n - 2$	1	3	5	7	9	—	19	—	—	—
(ii)	$3n + 2$	5	8	11	14	—	—	—	—	—	—
(iii)	$4n + 1$	5	9	13	17	—	—	—	—	—	—
(iv)	$7n + 20$	27	34	41	48	—	—	—	—	—	—
(v)	$n^2 + 1$	2	5	10	17	—	—	—	—	10,001	—

Sol.

S. No.	Expression	Terms									
		1 st	2 nd	3 rd	4 th	5 th	...	10 th	...	100 th	...
1	$2n - 1$	1	3	5	7	9	—	19	—	199	—
2	$3n + 2$	5	8	11	14	17	—	32	—	302	—
3	$4n + 1$	5	9	13	17	21	—	41	—	401	—
4	$7n + 1$	27	34	41	48	55	—	90	—	720	—
5	$n^2 + 1$	2	5	10	17	26	—	101	—	10,001	—