

Algebraic Expressions

Question Paper, Set 02

Time: 1 hour 30 minutes

Maximum marks: 50

Name: _____ Class: _____ Date: _____

1. Answer all 20 questions. The marks for each question are shown in brackets.
2. Show your working for the 2, 3 and 5 mark questions.
3. The key sheet and worked solutions are at the end of this paper.

1. Write in symbolic form: The subtraction of 5 from a . [1 mark]
2. Write the factors of $-15pq^3r$. [1 mark]
3. Simplify: $7m + 6m + 2m$ [1 mark]
4. Simplify: $2m + m - 4m - 3$ [2 marks]
5. Is $3y^2 - \frac{9}{y}$ a polynomial? Give a reason. [1 mark]
6. Find the degree of $-2a^3b^4m^2$. [1 mark]
7. Find the degree of the polynomial $4m^5 + 4mn^2 + 7m^3n^4 - 6m^5n^3$. [2 marks]
8. Find the value of $2x - 7y + 4$ when $x = 2$ and $y = -5$. [2 marks]
9. Add $-5p - 4q + 9t$ and $-9p + \frac{5}{6}q + t$. [3 marks]
10. Add $\frac{3}{2}a^2 + \frac{1}{3}b^2 + \frac{3}{4}ab$ and $-\frac{1}{2}a^2 + \frac{5}{2}ab + b^2$ by the vertical method. [3 marks]
11. Subtract $8p + \frac{5}{6}q$ from $9p + 7q$. [2 marks]
12. If $A = q^2 - q - 9$ and $B = 2q^2 - 2q + 7$, find (i) $2A - 3B$ (ii) $(A + B) - (A - B)$. [5 marks]
13. Subtract $4x^2 + 2y^2 - 2xy + 5$ from $4x^2 - 3y^2 - 1$ by the vertical method. [3 marks]
14. Find $2a^3b \times (-3a^3b^2) \times 6a^3b^2$. [1 mark]
15. Multiply: $3p^2q(7pr - 3p)$ [2 marks]
16. Multiply: $(3y + z)(4y - 3z)$ [3 marks]
17. Simplify: $(3b + c)(2b - 3c - z) + (2b - 3c)(-z)$ [5 marks]
18. Subtract $5mt(2m - 3t)$ from $4mt(2m + 2t)$. [2 marks]
19. Simplify: $3xz(2x - z) - 6xz(x + z) - 2xz(2x + z) + x(2xz - z^2)$ [5 marks]
20. Simplify: $3a + [3b - \{6m + (a - 5m)\}]$ [5 marks]

Key sheet

Q	Answer
1	$a - 5$
2	$-15, p, q, q, q, r$
3	$15m$
4	$-m - 3$
5	No. It is a multinomial but not a polynomial.
6	9
7	8
8	43
9	$-14p - \frac{19}{6}q + 10t$
10	$a^2 + \frac{4}{3}b^2 + \frac{13}{4}ab$
11	$p + \frac{37}{6}q$
12	(i) $-4q^2 + 4q - 39$ (ii) $4q^2 - 4q + 14$
13	$-5y^2 - 6 + 2xy$
14	$-36a^9b^5$
15	$21p^3qr - 9p^3q$
16	$12y^2 - 5yz - 3z^2$
17	$6b^2 - 7bc - 5bz - 3c^2 + 2cz$
18	$-2m^2t + 23mt^2$
19	$-2x^2z - 12xz^2$
20	$2a + 3b - m$

Solutions

1. Write in symbolic form: The subtraction of 5 from a . [1]

Subtracting 5 from a means a take away 5.

Symbolic form: $a - 5$

Ans: $a - 5$

2. Write the factors of $-15pq^3r$. [1]

$$-15pq^3r = -15 \times p \times q \times q \times q \times r$$

Each number and each letter in the product is a factor.

Factors: $-15, p, q, q, q, r$

Ans: $-15, p, q, q, q, r$

3. Simplify: $7m + 6m + 2m$ [1]

$$7m + 6m + 2m$$

$$= (7 + 6 + 2)m$$

$$= 15m$$

Ans: $15m$

4. Simplify: $2m + m - 4m - 3$ [2]

$$2m + m - 4m - 3$$

$$= (2 + 1 - 4)m - 3$$

$$= -m - 3$$

Ans: $-m - 3$

5. Is $3y^2 - \frac{9}{y}$ a polynomial? Give a reason. [1]

$$\frac{9}{y} = 9y^{-1}; \text{ the power } -1 \text{ is not a whole number.}$$

So $\frac{9}{y}$ is a term but not a monomial.

No. It is a multinomial but not a polynomial.

Ans: No. It is a multinomial but not a polynomial.

6. Find the degree of $-2a^3b^4m^2$. [1]

Degree of a monomial = sum of the powers of its variables.

$$3 + 4 + 2 = 9$$

So the degree of $-2a^3b^4m^2$ is 9.

Ans: 9

7. Find the degree of the polynomial $4m^5 + 4mn^2 + 7m^3n^4 - 6m^5n^3$. [2]

Degrees of the terms: $4m^5$: 5, $4mn^2$: 3, $7m^3n^4$: 7, $-6m^5n^3$: 8.

Greatest among $\{5, 3, 7, 8\}$ is 8.

So the degree of the polynomial is 8.

Ans: 8

8. Find the value of $2x - 7y + 4$ when $x = 2$ and $y = -5$. [2]

Put $x = 2$ and $y = -5$:

$$2(2) - 7(-5) + 4$$

$$= 4 + 35 + 4$$

$$= 43$$

Ans: 43

9. Add $-5p - 4q + 9t$ and $-9p + \frac{5}{6}q + t$. [3]

$$-5p - 4q + 9t - 9p + \frac{5}{6}q + t$$

$$= (-5 - 9)p + (-4 + \frac{5}{6})q + (9 + 1)t$$

$$\text{For } q: -4 + \frac{5}{6} = \frac{-24+5}{6} = -\frac{19}{6}$$

$$= -14p - \frac{19}{6}q + 10t$$

$$\text{Ans: } -14p - \frac{19}{6}q + 10t$$

10. Add $\frac{3}{2}a^2 + \frac{1}{3}b^2 + \frac{3}{4}ab$ and $-\frac{1}{2}a^2 + \frac{5}{2}ab + b^2$ by the vertical method. [3]

Write like terms one below the other and add each column.

$$\begin{array}{r} \frac{3}{2}a^2 + \frac{1}{3}b^2 + \frac{3}{4}ab \\ -\frac{1}{2}a^2 + b^2 + \frac{5}{2}ab \\ \hline a^2 + \frac{4}{3}b^2 + \frac{13}{4}ab \end{array}$$

$$\text{For } a^2: \frac{3}{2} - \frac{1}{2} = \frac{3-1}{2} = \frac{2}{2} = 1$$

$$\text{For } b^2: \frac{1}{3} + 1 = \frac{1+3}{3} = \frac{4}{3}$$

$$\text{For } ab: \frac{3}{4} + \frac{5}{2} = \frac{3+10}{4} = \frac{13}{4}$$

$$\text{Sum} = a^2 + \frac{4}{3}b^2 + \frac{13}{4}ab$$

$$\text{Ans: } a^2 + \frac{4}{3}b^2 + \frac{13}{4}ab$$

11. Subtract $8p + \frac{5}{6}q$ from $9p + 7q$. [2]

$$(9p + 7q) - (8p + \frac{5}{6}q)$$

$$= 9p + 7q - 8p - \frac{5}{6}q$$

$$= (9 - 8)p + (7 - \frac{5}{6})q$$

$$\text{For } q: 7 - \frac{5}{6} = \frac{42-5}{6} = \frac{37}{6}$$

$$= p + \frac{37}{6}q$$

$$\text{Ans: } p + \frac{37}{6}q$$

12. If $A = q^2 - q - 9$ and $B = 2q^2 - 2q + 7$, find (i) $2A - 3B$ (ii) $(A + B) - (A - B)$. [5]

$$\begin{aligned} \text{(i)} \quad & 2(q^2 - q - 9) - 3(2q^2 - 2q + 7) \\ &= 2q^2 - 2q - 18 - 6q^2 + 6q - 21 \\ &= (2 - 6)q^2 + (-2 + 6)q + (-18 - 21) \\ &= -4q^2 + 4q - 39 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & A + B = 3q^2 - 3q - 2 \\ & A - B = -q^2 + q - 16 \\ & (A + B) - (A - B) = (3q^2 - 3q - 2) - (-q^2 + q - 16) \\ &= 3q^2 - 3q - 2 + q^2 - q + 16 \\ &= (3 + 1)q^2 + (-3 - 1)q + (-2 + 16) \\ &= 4q^2 - 4q + 14 \end{aligned}$$

Ans: (i) $-4q^2 + 4q - 39$ (ii) $4q^2 - 4q + 14$

13. Subtract $4x^2 + 2y^2 - 2xy + 5$ from $4x^2 - 3y^2 - 1$ by the vertical method. [3]

Write $4x^2 - 3y^2 - 1$ on top and the expression to be subtracted below it, like terms in the same column.

$$\begin{array}{rrrr} 4x^2 & -3y^2 & -1 & \\ 4x^2 & +2y^2 & +5 & -2xy \\ (-) & (-) & (-) & (+) \\ \hline & -5y^2 & -6 & +2xy \end{array}$$

Change the sign of every term in the lower row, then add each column.

The x^2 terms cancel.

$$= -5y^2 - 6 + 2xy$$

Ans: $-5y^2 - 6 + 2xy$

14. Find $2a^3b \times (-3a^3b^2) \times 6a^3b^2$. [1]

$$\begin{aligned} &= (2 \times (-3) \times 6)(a^3 \times a^3 \times a^3)(b \times b^2 \times b^2) \\ &= -36a^9b^5 \end{aligned}$$

Ans: $-36a^9b^5$

15. Multiply: $3p^2q(7pr - 3p)$ [2]

$$\begin{aligned} &= (3p^2q)(7pr) + (3p^2q)(-3p) \\ &= 21p^3qr - 9p^3q \end{aligned}$$

Ans: $21p^3qr - 9p^3q$

16. Multiply: $(3y + z)(4y - 3z)$ [3]

$$\begin{aligned} &= 12y^2 - 9yz + 4yz - 3z^2 \\ &= 12y^2 - 5yz - 3z^2 \end{aligned}$$

Ans: $12y^2 - 5yz - 3z^2$

17. Simplify: $(3b + c)(2b - 3c - z) + (2b - 3c)(-z)$ [5]

$$\begin{aligned}
 &= (6b^2 - 9bc - 3bz + 2bc - 3c^2 - cz) + (-2bz + 3cz) \\
 &= 6b^2 - 9bc - 3bz + 2bc - 3c^2 - cz - 2bz + 3cz \\
 &= 6b^2 + (-9 + 2)bc + (-3 - 2)bz - 3c^2 + (-1 + 3)cz \\
 &= 6b^2 - 7bc - 5bz - 3c^2 + 2cz \\
 \text{Ans: } &6b^2 - 7bc - 5bz - 3c^2 + 2cz
 \end{aligned}$$

18. Subtract $5mt(2m - 3t)$ from $4mt(2m + 2t)$. [2]

$$\begin{aligned}
 &4mt(2m + 2t) - 5mt(2m - 3t) \\
 &= 8m^2t + 8mt^2 - 10m^2t + 15mt^2 \\
 &= (8 - 10)m^2t + (8 + 15)mt^2 \\
 &= -2m^2t + 23mt^2 \\
 \text{Ans: } &-2m^2t + 23mt^2
 \end{aligned}$$

19. Simplify: $3xz(2x - z) - 6xz(x + z) - 2xz(2x + z) + x(2xz - z^2)$ [5]

$$\begin{aligned}
 &= 6x^2z - 3xz^2 - 6x^2z - 6xz^2 - 4x^2z - 2xz^2 + 2x^2z - xz^2 \\
 &= (6 - 6 - 4 + 2)x^2z + (-3 - 6 - 2 - 1)xz^2 \\
 &= -2x^2z - 12xz^2 \\
 \text{Ans: } &-2x^2z - 12xz^2
 \end{aligned}$$

20. Simplify: $3a + [3b - \{6m + (a - 5m)\}]$ [5]

Remove the innermost brackets first.

$$\begin{aligned}
 &= 3a + [3b - \{6m + a - 5m\}] \\
 &= 3a + [3b - \{m + a\}] \\
 &= 3a + [3b - m - a] \\
 &= 3a + 3b - m - a \\
 &= 2a + 3b - m \\
 \text{Ans: } &2a + 3b - m
 \end{aligned}$$
