

Algebraic Expressions

Question Paper, Set 03

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 product of 7 and q . [1 mark]
2. Write the co-efficient of a^2 in $-6a^2b^2m$. [1 mark]
3. From the terms $3a^3c^2$, $-3ac$, $-\frac{7a^3c^2}{6}$, $3a^2c^3$, $-7c^2a^3$, write the like terms. [1 mark]
4. Simplify: $6y - 5z - 4y + 4z + 7y$ [2 marks]
5. Is $8qr^2 + 4q^3$ a monomial, a binomial or a trinomial? [1 mark]
6. Find the degree of $3m^2n$. [1 mark]
7. Find the degree of the polynomial $7q^2 + 5q^3 - 7p^4q^4 + 6p^2q^2$. [2 marks]
8. Find the value of $-3a^2b$ when $a = -2$ and $b = -1$. [2 marks]
9. Add $-\frac{1}{3}y^2 + \frac{1}{3}yz + 4z^2$ and $-\frac{1}{4}y^2 - 2yz - \frac{5}{3}z^2$. [3 marks]
10. Add $9x + 5y$, $9y + 7t$ and $9x + 5t$ by the vertical method. [3 marks]
11. Subtract $3q - 9r$ from $4q + 9r$. [2 marks]
12. If $A = 7a^2 + \frac{5}{2}ac + 2c^2$ and $B = 4a^2 - \frac{1}{6}ac - \frac{1}{4}c^2$, find (i) $2A - 3B$ (ii) $4B - A$. [5 marks]
13. Subtract $4x^3 - 6y^3 + xy + 5$ from $4x^3 - 5y^3 + 7$ by the vertical method. [3 marks]
14. Find $7a^2b^2 \times (-5a^2bc)$. [1 mark]
15. Multiply: $6a^2b(-6ac + 3c)$ [2 marks]
16. Multiply: $(3x - 1)(2x + 8)$ [3 marks]
17. Simplify: $(a - 1)(a^2 + a + 2) - a(a + 2)$ [5 marks]
18. Subtract $7pq(p - 2q)$ from $5pq(2p + 2q)$. [2 marks]
19. Simplify: $ab(2a + b) - 5b(2a^2 - ab) + 3a^2(2b - b^2) + 5a(ab - b^2)$ [5 marks]
20. Simplify: $4a - [b + \{c - (6b + 3a)\}]$ [5 marks]

Key sheet

Q	Answer
1	$7q$
2	$-6b^2m$
3	$3a^3c^2, -\frac{7a^3c^2}{6}, -7c^2a^3$
4	$9y - z$
5	Binomial
6	3
7	8
8	12
9	$-\frac{7}{12}y^2 - \frac{5}{3}yz + \frac{7}{3}z^2$
10	$18x + 14y + 12t$
11	$q + 18r$
12	(i) $2a^2 + \frac{11}{2}ac + \frac{19}{4}c^2$ (ii) $9a^2 - \frac{19}{6}ac - 3c^2$
13	$y^3 + 2 - xy$
14	$-35a^4b^3c$
15	$-36a^3bc + 18a^2bc$
16	$6x^2 + 22x - 8$
17	$a^3 - a^2 - a - 2$
18	$3p^2q + 24pq^2$
19	$3a^2b + ab^2 - 3a^2b^2$
20	$7a + 5b - c$

Solutions

1. Write in symbolic form: The product of 7 and q . [1]

Product means multiply: $7 \times q = 7q$.

Symbolic form: $7q$

Ans: $7q$

2. Write the co-efficient of a^2 in $-6a^2b^2m$. [1]

$$-6a^2b^2m = (-6b^2m) \times a^2$$

The co-efficient of a^2 is the product of the other factors, $-6b^2m$.

Ans: $-6b^2m$

3. From the terms $3a^3c^2$, $-3ac$, $-\frac{7a^3c^2}{6}$, $3a^2c^3$, $-7c^2a^3$, write the like terms. [1]

Like terms have the same literal factors.

$3a^3c^2$, $-\frac{7a^3c^2}{6}$, $-7c^2a^3$ all have the literal factors a^3c^2 (note $c^2a^3 = a^3c^2$).

$-3ac$ and $3a^2c^3$ have different literal factors, so they are unlike.

Like terms: $3a^3c^2$, $-\frac{7a^3c^2}{6}$, $-7c^2a^3$

Ans: $3a^3c^2$, $-\frac{7a^3c^2}{6}$, $-7c^2a^3$

4. Simplify: $6y - 5z - 4y + 4z + 7y$ [2]

$$6y - 5z - 4y + 4z + 7y$$

$$= (6 - 4 + 7)y + (-5 + 4)z$$

$$= 9y - z$$

Ans: $9y - z$

5. Is $8qr^2 + 4q^3$ a monomial, a binomial or a trinomial? [1]

The terms are $8qr^2$, $4q^3$; each is a monomial (whole number powers).

Two monomials, so it is a binomial.

Ans: Binomial

6. Find the degree of $3m^2n$. [1]

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

$$2 + 1 = 3$$

So the degree of $3m^2n$ is 3.

Ans: 3

7. Find the degree of the polynomial $7q^2 + 5q^3 - 7p^4q^4 + 6p^2q^2$. [2]

Degrees of the terms: $7q^2$: 2, $5q^3$: 3, $-7p^4q^4$: 8, $6p^2q^2$: 4.

Greatest among $\{2, 3, 8, 4\}$ is 8.

So the degree of the polynomial is 8.

Ans: 8

8. Find the value of $-3a^2b$ when $a = -2$ and $b = -1$. [2]

Put $a = -2$ and $b = -1$:

$$\begin{aligned} & -3(-2)^2(-1) \\ & = 12 \end{aligned}$$

Ans: 12

9. Add $-\frac{1}{3}y^2 + \frac{1}{3}yz + 4z^2$ and $-\frac{1}{4}y^2 - 2yz - \frac{5}{3}z^2$. [3]

$$\begin{aligned} & -\frac{1}{3}y^2 + \frac{1}{3}yz + 4z^2 - \frac{1}{4}y^2 - 2yz - \frac{5}{3}z^2 \\ & = (-\frac{1}{3} - \frac{1}{4})y^2 + (\frac{1}{3} - 2)yz + (4 - \frac{5}{3})z^2 \end{aligned}$$

$$\text{For } y^2: -\frac{1}{3} - \frac{1}{4} = \frac{-4-3}{12} = -\frac{7}{12}$$

$$\text{For } yz: \frac{1}{3} - 2 = \frac{1-6}{3} = -\frac{5}{3}$$

$$\text{For } z^2: 4 - \frac{5}{3} = \frac{12-5}{3} = \frac{7}{3}$$

$$= -\frac{7}{12}y^2 - \frac{5}{3}yz + \frac{7}{3}z^2$$

$$\text{Ans: } -\frac{7}{12}y^2 - \frac{5}{3}yz + \frac{7}{3}z^2$$

10. Add $9x + 5y$, $9y + 7t$ and $9x + 5t$ by the vertical method. [3]

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

$$\begin{array}{r} 9x \quad +5y \\ \quad 9y \quad +7t \\ 9x \quad \quad +5t \\ \hline 18x \quad +14y \quad +12t \end{array}$$

$$\text{Sum} = 18x + 14y + 12t$$

$$\text{Ans: } 18x + 14y + 12t$$

11. Subtract $3q - 9r$ from $4q + 9r$. [2]

$$(4q + 9r) - (3q - 9r)$$

$$= 4q + 9r - 3q + 9r$$

$$= (4 - 3)q + (9 + 9)r$$

$$= q + 18r$$

$$\text{Ans: } q + 18r$$

12. If $A = 7a^2 + \frac{5}{2}ac + 2c^2$ and $B = 4a^2 - \frac{1}{6}ac - \frac{1}{4}c^2$, find (i) $2A - 3B$ (ii) $4B - A$. [5]

$$(i) 2(7a^2 + \frac{5}{2}ac + 2c^2) - 3(4a^2 - \frac{1}{6}ac - \frac{1}{4}c^2)$$

$$= 14a^2 + 5ac + 4c^2 - 12a^2 + \frac{1}{2}ac + \frac{3}{4}c^2$$

$$= (14 - 12)a^2 + (5 + \frac{1}{2})ac + (4 + \frac{3}{4})c^2$$

$$\text{For } ac: 5 + \frac{1}{2} = \frac{10+1}{2} = \frac{11}{2}$$

$$\text{For } c^2: 4 + \frac{3}{4} = \frac{16+3}{4} = \frac{19}{4}$$

$$= 2a^2 + \frac{11}{2}ac + \frac{19}{4}c^2$$

$$(ii) 4(4a^2 - \frac{1}{6}ac - \frac{1}{4}c^2) - (7a^2 + \frac{5}{2}ac + 2c^2)$$

$$= 16a^2 - \frac{2}{3}ac - c^2 - 7a^2 - \frac{5}{2}ac - 2c^2$$

$$= (16 - 7)a^2 + (-\frac{2}{3} - \frac{5}{2})ac + (-1 - 2)c^2$$

$$\text{For } ac: -\frac{2}{3} - \frac{5}{2} = \frac{-4-15}{6} = -\frac{19}{6}$$

$$= 9a^2 - \frac{19}{6}ac - 3c^2$$

$$\text{Ans: (i) } 2a^2 + \frac{11}{2}ac + \frac{19}{4}c^2 \text{ (ii) } 9a^2 - \frac{19}{6}ac - 3c^2$$

13. Subtract $4x^3 - 6y^3 + xy + 5$ from $4x^3 - 5y^3 + 7$ by the vertical method. [3]

Write $4x^3 - 5y^3 + 7$ on top and the expression to be subtracted below it, like terms in the same column.

$$\begin{array}{r} 4x^3 \quad -5y^3 \quad +7 \\ 4x^3 \quad -6y^3 \quad +5 \quad +xy \\ (-) \quad (+) \quad (-) \quad (-) \\ \hline y^3 \quad +2 \quad -xy \end{array}$$

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

The x^3 terms cancel.

$$= y^3 + 2 - xy$$

$$\text{Ans: } y^3 + 2 - xy$$

14. Find $7a^2b^2 \times (-5a^2bc)$. [1]

$$= (7 \times (-5))(a^2 \times a^2)(b^2 \times b)c$$

$$= -35a^4b^3c$$

$$\text{Ans: } -35a^4b^3c$$

15. Multiply: $6a^2b(-6ac + 3c)$ [2]

$$= (6a^2b)(-6ac) + (6a^2b)(3c)$$

$$= -36a^3bc + 18a^2bc$$

$$\text{Ans: } -36a^3bc + 18a^2bc$$

16. Multiply: $(3x - 1)(2x + 8)$ [3]

$$= 6x^2 + 24x - 2x - 8$$

$$= 6x^2 + 22x - 8$$

$$\text{Ans: } 6x^2 + 22x - 8$$

17. Simplify: $(a - 1)(a^2 + a + 2) - a(a + 2)$ [5]

$$\begin{aligned} &= (a^3 + a^2 + 2a - a^2 - a - 2) - (a^2 + 2a) \\ &= a^3 + a^2 + 2a - a^2 - a - 2 - a^2 - 2a \\ &= a^3 + (1 - 1 - 1)a^2 + (2 - 1 - 2)a - 2 \\ &= a^3 - a^2 - a - 2 \end{aligned}$$

Ans: $a^3 - a^2 - a - 2$

18. Subtract $7pq(p - 2q)$ from $5pq(2p + 2q)$. [2]

$$\begin{aligned} &5pq(2p + 2q) - 7pq(p - 2q) \\ &= 10p^2q + 10pq^2 - 7p^2q + 14pq^2 \\ &= (10 - 7)p^2q + (10 + 14)pq^2 \\ &= 3p^2q + 24pq^2 \end{aligned}$$

Ans: $3p^2q + 24pq^2$

19. Simplify: $ab(2a + b) - 5b(2a^2 - ab) + 3a^2(2b - b^2) + 5a(ab - b^2)$ [5]

$$\begin{aligned} &= 2a^2b + ab^2 - 10a^2b + 5ab^2 + 6a^2b - 3a^2b^2 + 5a^2b - 5ab^2 \\ &= (2 - 10 + 6 + 5)a^2b + (1 + 5 - 5)ab^2 - 3a^2b^2 \\ &= 3a^2b + ab^2 - 3a^2b^2 \end{aligned}$$

Ans: $3a^2b + ab^2 - 3a^2b^2$

20. Simplify: $4a - [b + \{c - (6b + 3a)\}]$ [5]

Remove the innermost brackets first.

$$\begin{aligned} &= 4a - [b + \{c - 6b - 3a\}] \\ &= 4a - [b + c - 6b - 3a] \\ &= 4a - [-5b + c - 3a] \\ &= 4a + 5b - c + 3a \\ &= 7a + 5b - c \end{aligned}$$

Ans: $7a + 5b - c$
