

# Algebraic Expressions

## Question Paper, Set 09

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

## Key sheet

| Q  | Answer                                                                                       |
|----|----------------------------------------------------------------------------------------------|
| 1  | $12p + 11q$                                                                                  |
| 2  | $-7r^3$                                                                                      |
| 3  | $-\frac{nt^3}{2}, 2t^3n, -8nt^3$                                                             |
| 4  | $7p - 5q$                                                                                    |
| 5  | Binomial                                                                                     |
| 6  | 9                                                                                            |
| 7  | 5                                                                                            |
| 8  | 37                                                                                           |
| 9  | $\frac{7}{2}b^2 + \frac{17}{6}bc + 6c^2$                                                     |
| 10 | $-3x + z + 4y$                                                                               |
| 11 | $-3x + 4z$                                                                                   |
| 12 | (i) $14a^2 - \frac{37}{6}ac + \frac{49}{2}c^2$ (ii) $6a^2 - \frac{7}{3}ac + \frac{19}{2}c^2$ |
| 13 | $-2y^2 + 5z^2 + 6 - 2yz$                                                                     |
| 14 | $-35m^3n^4$                                                                                  |
| 15 | $56b^3c - 56b^2z$                                                                            |
| 16 | $4x^2 + 2x - 6$                                                                              |
| 17 | $2a^2 + 6ab - 4ac - 8b^2 + 24bc$                                                             |
| 18 | $-10a^2b + 8ab^2$                                                                            |
| 19 | $-4a^2c - 2a^2c^2 + 7ac^2$                                                                   |
| 20 | $-4a - 3b + 6c$                                                                              |

## Solutions

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1. Write in symbolic form: 12 times  $p$  added to 11 times  $q$ . [1]

12 times  $p$  is  $12p$ , 11 times  $q$  is  $11q$ ; added gives the sum.

Symbolic form:  $12p + 11q$

**Ans:**  $12p + 11q$

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2. Write the co-efficient of  $pq^3$  in  $-7pq^3r^3$ . [1]

$$-7pq^3r^3 = (-7r^3) \times pq^3$$

The co-efficient of  $pq^3$  is the product of the other factors,  $-7r^3$ .

**Ans:**  $-7r^3$

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3. From the terms  $8nt$ ,  $-\frac{nt^3}{2}$ ,  $2t^3n$ ,  $-7n^3t$ ,  $-8nt^3$ , write the like terms. [1]

Like terms have the same literal factors.

$-\frac{nt^3}{2}$ ,  $2t^3n$ ,  $-8nt^3$  all have the literal factors  $nt^3$  (note  $t^3n = nt^3$ ).

$8nt$  and  $-7n^3t$  have different literal factors, so they are unlike.

Like terms:  $-\frac{nt^3}{2}$ ,  $2t^3n$ ,  $-8nt^3$

**Ans:**  $-\frac{nt^3}{2}$ ,  $2t^3n$ ,  $-8nt^3$

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4. Simplify:  $9p - 8q - 6p + 3q + 4p$  [2]

$$9p - 8q - 6p + 3q + 4p$$

$$= (9 - 6 + 4)p + (-8 + 3)q$$

$$= 7p - 5q$$

**Ans:**  $7p - 5q$

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5. Is  $8mt + 6t$  a monomial, a binomial or a trinomial? [1]

The terms are  $8mt$ ,  $6t$ ; each is a monomial (whole number powers).

Two monomials, so it is a binomial.

**Ans:** Binomial

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6. Find the degree of  $-\frac{1}{3}x^4y^4z$ . [1]

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

$$4 + 4 + 1 = 9$$

So the degree of  $-\frac{1}{3}x^4y^4z$  is 9.

**Ans:** 9

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

Degrees of the terms: 6: 0,  $p^4r$ : 5,  $3r$ : 1,  $-5p^4$ : 4.

Greatest among  $\{0, 5, 1, 4\}$  is 5.

So the degree of the polynomial is 5.

**Ans:** 5

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8. Find the value of  $4x^2 - 2xy + 3y^2$  when  $x = -1$  and  $y = 3$ . [2]

Put  $x = -1$  and  $y = 3$ :

$$4(-1)^2 - 2(-1)(3) + 3(3)^2$$

$$= 4 + 6 + 27$$

$$= 37$$

**Ans:** 37

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9. Add  $b^2 + \frac{1}{3}bc + 3c^2$  and  $\frac{5}{2}b^2 + \frac{5}{2}bc + 3c^2$ . [3]

$$b^2 + \frac{1}{3}bc + 3c^2 + \frac{5}{2}b^2 + \frac{5}{2}bc + 3c^2$$

$$= (1 + \frac{5}{2})b^2 + (\frac{1}{3} + \frac{5}{2})bc + (3 + 3)c^2$$

$$\text{For } b^2: 1 + \frac{5}{2} = \frac{2+5}{2} = \frac{7}{2}$$

$$\text{For } bc: \frac{1}{3} + \frac{5}{2} = \frac{2+15}{6} = \frac{17}{6}$$

$$= \frac{7}{2}b^2 + \frac{17}{6}bc + 6c^2$$

$$\text{Ans: } \frac{7}{2}b^2 + \frac{17}{6}bc + 6c^2$$

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10. Add  $-9x + 3z$ ,  $6x - 4y$  and  $8y - 2z$  by the vertical method. [3]

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

$$\begin{array}{rrr} -9x & +3z & \\ 6x & & -4y \\ & -2z & +8y \\ \hline -3x & +z & +4y \end{array}$$

$$\text{Sum} = -3x + z + 4y$$

$$\text{Ans: } -3x + z + 4y$$

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11. Subtract  $6x - z$  from  $3x + 3z$ . [2]

$$(3x + 3z) - (6x - z)$$

$$= 3x + 3z - 6x + z$$

$$= (3 - 6)x + (3 + 1)z$$

$$= -3x + 4z$$

$$\text{Ans: } -3x + 4z$$

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

$$\begin{aligned} \text{(i)} & 5(4a^2 - \frac{5}{6}ac + 4c^2) - 3(2a^2 + \frac{2}{3}ac - \frac{3}{2}c^2) \\ &= 20a^2 - \frac{25}{6}ac + 20c^2 - 6a^2 - 2ac + \frac{9}{2}c^2 \\ &= (20 - 6)a^2 + (-\frac{25}{6} - 2)ac + (20 + \frac{9}{2})c^2 \end{aligned}$$

$$\text{For } ac: -\frac{25}{6} - 2 = \frac{-25-12}{6} = -\frac{37}{6}$$

$$\text{For } c^2: 20 + \frac{9}{2} = \frac{40+9}{2} = \frac{49}{2}$$

$$= 14a^2 - \frac{37}{6}ac + \frac{49}{2}c^2$$

$$\begin{aligned} \text{(ii)} & 2(4a^2 - \frac{5}{6}ac + 4c^2) - (2a^2 + \frac{2}{3}ac - \frac{3}{2}c^2) \\ &= 8a^2 - \frac{5}{3}ac + 8c^2 - 2a^2 - \frac{2}{3}ac + \frac{3}{2}c^2 \\ &= (8 - 2)a^2 + (-\frac{5}{3} - \frac{2}{3})ac + (8 + \frac{3}{2})c^2 \end{aligned}$$

$$\text{For } ac: -\frac{5}{3} - \frac{2}{3} = \frac{-5-2}{3} = -\frac{7}{3}$$

$$\text{For } c^2: 8 + \frac{3}{2} = \frac{16+3}{2} = \frac{19}{2}$$

$$= 6a^2 - \frac{7}{3}ac + \frac{19}{2}c^2$$

$$\text{Ans: (i) } 14a^2 - \frac{37}{6}ac + \frac{49}{2}c^2 \text{ (ii) } 6a^2 - \frac{7}{3}ac + \frac{19}{2}c^2$$

**13.** Subtract  $3y^2 + z^2 + 2yz - 4$  from  $y^2 + 6z^2 + 2$  by the vertical method. [3]

Write  $y^2 + 6z^2 + 2$  on top and the expression to be subtracted below it, like terms in the same column.

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

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

$$= -2y^2 + 5z^2 + 6 - 2yz$$

$$\text{Ans: } -2y^2 + 5z^2 + 6 - 2yz$$

**14.** Find  $7mn^2 \times (-5m^2n^2)$ . [1]

$$\begin{aligned} &= (7 \times (-5))(m \times m^2)(n^2 \times n^2) \\ &= -35m^3n^4 \end{aligned}$$

$$\text{Ans: } -35m^3n^4$$

**15.** Multiply:  $7b(8b^2c - 8bz)$  [2]

$$\begin{aligned} &= (7b)(8b^2c) + (7b)(-8bz) \\ &= 56b^3c - 56b^2z \end{aligned}$$

$$\text{Ans: } 56b^3c - 56b^2z$$

**16.** Multiply:  $(x - 1)(4x + 6)$  [3]

$$\begin{aligned} &= 4x^2 + 6x - 4x - 6 \\ &= 4x^2 + 2x - 6 \end{aligned}$$

$$\text{Ans: } 4x^2 + 2x - 6$$

**17.** Simplify:  $(a + 4b)(2a - 2b + 4c) - 4c(2a - 2b)$  [5]

$$\begin{aligned}
 &= (2a^2 - 2ab + 4ac + 8ab - 8b^2 + 16bc) - (8ac - 8bc) \\
 &= 2a^2 - 2ab + 4ac + 8ab - 8b^2 + 16bc - 8ac + 8bc \\
 &= 2a^2 + (-2 + 8)ab + (4 - 8)ac - 8b^2 + (16 + 8)bc \\
 &= 2a^2 + 6ab - 4ac - 8b^2 + 24bc \\
 \text{Ans: } &2a^2 + 6ab - 4ac - 8b^2 + 24bc
 \end{aligned}$$


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**18.** Subtract  $6ab(2a - b)$  from  $2ab(a + b)$ . [2]

$$\begin{aligned}
 &2ab(a + b) - 6ab(2a - b) \\
 &= 2a^2b + 2ab^2 - 12a^2b + 6ab^2 \\
 &= (2 - 12)a^2b + (2 + 6)ab^2 \\
 &= -10a^2b + 8ab^2 \\
 \text{Ans: } &-10a^2b + 8ab^2
 \end{aligned}$$


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**19.** Simplify:  $a^2(2c - c^2) + a^2(c - c^2) + a(ac - c^2) - 4ac(2a - 2c)$  [5]

$$\begin{aligned}
 &= 2a^2c - a^2c^2 + a^2c - a^2c^2 + a^2c - ac^2 - 8a^2c + 8ac^2 \\
 &= (2 + 1 + 1 - 8)a^2c + (-1 - 1)a^2c^2 + (-1 + 8)ac^2 \\
 &= -4a^2c - 2a^2c^2 + 7ac^2 \\
 \text{Ans: } &-4a^2c - 2a^2c^2 + 7ac^2
 \end{aligned}$$


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

Remove the innermost brackets first.

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


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