

VISWABHARATHI WISEWOODS

ALGEBRAIC EXPRESSIONS – PRACTICE SHEET

GRADE : VII – VII

SUBJECT : MATHEMATICS

Key points :

- ✚ Expressions are formed from **variables** and **constants**.
- ✚ Terms are added to form **expressions**. Terms themselves are formed as product of **factors**.
- ✚ Expressions that contain exactly one, two and three terms are called **monomials**, **binomials** and **trinomials** respectively. In general, any expression containing one or more terms with non-zero coefficients (and with variables having non- negative integers as exponents) is called a **polynomial**.
- ✚ **Like** terms are formed from the same variables and the powers of these variables are the same, too. Coefficients of like terms need not be the same.
- ✚ While adding (or subtracting) polynomials, first look for like terms and add (or subtract) them; then handle the unlike terms.
- ✚ There are number of situations in which we need to multiply algebraic expressions: for example, in finding area of a rectangle, the sides of which are given as expressions.
- ✚ A monomial multiplied by a monomial always gives a monomial.
- ✚ While multiplying a polynomial by a monomial, we multiply every term in the polynomial by the monomial.
- ✚ In carrying out the multiplication of a polynomial by a binomial (or trinomial), we multiply term by term, i.e., every term of the polynomial is multiplied by every term in the binomial (or trinomial).
Note that in such multiplication, we may get terms in the product which are like and have to be combined.
- ✚ An **identity** is an equality, which is true for all values of the variables in the equality. On the other hand, an equation is true only for certain values of its variables. An equation is not an identity.
- ✚ The following are the standard identities:
 $(a + b)^2 = a^2 + 2ab + b^2$ (I)
 $(a - b)^2 = a^2 - 2ab + b^2$ (II)
 $(a + b)(a - b) = a^2 - b^2$ (III)
- ✚ Another useful identity is $(x + a)(x + b) = x^2 + (a + b)x + ab$ (IV)
- ✚ The above four identities are useful in carrying out squares and products of algebraic expressions. They also allow easy alternative methods to calculate products of numbers and so on.

I. Answer the following :

1. Classify the following expression as monomials, binomials and trinomials :

$4a^2$	_____	$5a^2b + 3$	_____
$7b^3$	_____	$8a^2 + 7ab + b^2$	_____
$4x^2 + 1$	_____	$a^2 + b^2$	_____

2. Write the degrees of the following polynomials.

(a) $2x^2 + 3xy + 5y^2 + 2$	(b) $7x^2y + 3xy^2 + 4xy$
(c) $x^3y^3 - 4x^2y + 5xy^2 + x^2y^2$	(d) $4x^5 + 5x^3 + 7x^2 + 2$

3. Add

(a) $(10x^2 + 5x - 3) + (7x^2 - 2x + 7) =$
(b) $(3x^2y + 4x^2y^2 - 7xy^2) + (9x^2y - x^2y^2 + 3xy^2) =$
(c) $(10x^2y - 3xy^2 + 5x^2y^2 + 22) + (3x^2y^2 + 7) =$

4. Subtract $2x^2 + 5x - 7$ from $7x^2 - 5x + 3$.

5. Subtract $2ab + 7a^2 + 8b^2$ from $10b^2 + 7ab + a^2$.

6. Write the degrees of the following polynomials.

(a) $4xy + 2x^2y + 3y^2 + 5x^2y^2$	(b) $4xy + 3$
(c) $7x + 2$	(d) $32 + 22xy + 3x^2 + 7y^2 + x^2y^2$

7. Tick the pairs of like terms.

(a) $3a^2b, -5ba^2$	(b) $7abc, 8ab$	(c) $15xy, -7yz$	(d) $5a^2b^2c, 12b^2ca^2$
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8. Add the following :

(a) $3a^2 + 4ab - b^2, 7b^2 - 4ab + 2a^2, a^2 + b^2$
(b) $5xy - 7x^2 - 3y^2 + 4x^2y, 5x^2y - xy + x^2 + y^2$
(c) $5a^3 - 2b^3 + 3a^2b + 7ab^2, 3a^2b - 5ab^2, a^3 + b^3 - a^2b$

9. Subtract $3x^2 - 4y^2$ from the sum of $x^2 + y^2 - 2xy$ and $3x^2 - 4xy + 7y^2$.

10. Subtract $4a^3 - 3a^2b + ab^2 - b^3$ from $a^3 + b^3 - 3a^2b + 7ab^2$.

(a) Add $x^3 - 5x^2 + 7x + 2, 15x^2 + 10x - 7$ and $x^3 - 13x + 2$.
(b) Add $3x^2y + 4x^3y - xy^2 + x^2y^2, 11x^2y - x^3y + 5x^2y^2$ and $5x^3y - x^2y^2 + 7x^2y - 3xy^2$
(c) Subtract $5a^3 - 2a^2 + 7$ from the sum of $a^3 - 3a^2 + 5a + 1$ and $7a^2 + a + 3$.
(d) What should be added to $x^4 + 2x^2 - 7$ to obtain $4x^4 - 3x^3 + x^2 + 2$?
(e) What must be subtracted from $4x^2y^2 + 3xy + 3xy^2$ to obtain $8xy^2 - 4x^2y + 7x^2y^2 + 10xy$

11. Find the products of the following expressions.

(a) $(3x^2y) \times \left(\frac{-1}{5}xyz\right) \left(\frac{3}{5}y^2z\right)$	(b) $\left(\frac{1}{8}ab\right) \times \left(\frac{-8}{11}bc\right) \times \left(\frac{-22}{3}ca\right)$
(c) $\left(\frac{3}{8}x^2y\right) \times \left(\frac{-4}{7}y^2z\right) \times \left(\frac{-7}{11}z^2x\right)$	(d) $\left(\frac{1}{5}ab\right) \times \left(\frac{-3}{5}a^2b\right) \times \left(\frac{5}{22}b^2c\right)$

12. Find the volume of the box whose dimensions are $3xy^2, \frac{1}{7}x^3$ and $\frac{4}{5}x^2y$.

13. Find the area of a field whose length is $3x^2y + y^2$ and breadth is $\frac{5}{8}x^2$.

14. Find the products of the following expressions :

(a) $(2x - 1)(x + 2)$	(b) $(p^2 + q^2)(p + q)$	(c) $\left(\frac{2}{3}x + y\right)(x^2 - y^2)$
(d) $(2x - 1)(x^2 + x + 1)$	(e) $(3a + 1)\left(\frac{a^3}{5} - a + 1\right)$	(f) $(x + xy)\left(\frac{x^2}{2} + xy + y^2\right)$

15. Write the squares of the following binomials :

(a) $(2x + 5)$	(b) $(3x - 5)$	(c) $\left(x - \frac{1}{x}\right)$	(d) $\left(2x + \frac{3}{y}\right)$
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16. Find the following products using an identity :

(a) $(2a + b)(2a - b)$	(b) $\left(3x + \frac{1}{y}\right)\left(3x - \frac{1}{y}\right)$
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17. Evaluate the following by using the formulae for $(a + b)^2$ and $(a - b)^2$.

(a) $(101)^2$ (b) $(99)^2$ (c) $(198)^2$

18. Evaluate the following using suitable identities :

(a) $82^2 - 18^2$ (b) 95×105 (c) 196×204 (d) $\frac{65^2 - 20^2}{85}$

19. Find the value of $x^2 + \frac{1}{x^2}$ if $x + \frac{1}{x} = 3$

20. Find the value of $x^2 + \frac{1}{x^2}$ if $x - \frac{1}{x} = 4$

21. If $x^2 + \frac{1}{x^2} = 9$, find the value of $x^4 + \frac{1}{x^4}$.

22. Evaluate the following using suitable identities :

(a) $(196)^2$ (b) 52×48 (c) $(205)^2$ (d) $(108)^2$

23. If $x + \frac{1}{x} = 5$, find the value of $x^2 + \frac{1}{x^2}$ and $x^4 + \frac{1}{x^4}$.

24. If $x^2 + \frac{1}{x^2} = 7$ find the value of $x + \frac{1}{x}$, $x > 0$.

25. If $x + y = 5$ and $xy = 6$. Find the value of $x^2 + y^2$ and $x - y$.

26. Find the following products :

(a) $(x + 2)(3x + 1)(x - 3)$ (b) $(5x + 1)(2x - 3)(x + 5)$
(c) $(2x + y)(x - y)(x + y)$ (d) $(3a + b)(2a + b)(a - b)$

27. Factorise the following using suitable identities :

(a) $49x^2 - 9^2$ (b) $16x^2 - 25$ (c) $x^2 - 2x + 1$ (d) $9x^2 - 6x + 1$
(e) $x^2 - (y + z)^2$

28. Multiply the following :

(a) $11x^2y$ and $2x^2y^2$ (b) $3y^2$ and $7y^5$ (c) $5x^3$ and $4x^9$ (d) $-9xy$ and $4x^2z$

29. Find the product of

(a) $(-2xy^2)(5y(-3z^2))$ (b) $(ab)(bc)(ca)$ (c) $(6a^2b)(-2b^2c)(3ac^2)$
(d) $\left(\frac{5}{9}ab\right)\left(\frac{9}{7}bc\right)\left(\frac{-7}{5}ca\right)$

30. Find the value of $(3p^2q) \times (8q^3)$, when $p = 1$ and $q = \left(-\frac{1}{4}\right)$

31. Find the value of $(-8x^2y^2) \times \left(\frac{1}{5}xy^2\right)$, where $x = -1$ and $y = 2$.

32. Find the product of $(3a^2b^3)$, $(-7a^2)$ and $(5a^2b^2)$, and then verify the result for $a = 2$ and $b = 3$

33. Find the product of $\left(-\frac{3}{4}xy^2z\right)$ and $(-2z^2)$, the verify the result for $x = 1$, $y = 2$ and $z = 3$.

34. Verify $a^2b^2c^2 = (ab) \times (bc) \times (ca)$ for $a = 3$ and $b = 4$.

35. Find the product and then verify the following for $a = 2$ and $b = -5$.

(a) $a(a^2 - ab^2)$ (b) $\frac{2}{7}a\left(ab - \frac{7}{6}ab^2\right)$

36. Find the product of the following :

(a) $2x(3x + y^2)$ (b) $(-3y)(x^2 + 3xy)$ (c) $3a^2(4a - 5a^2)$
(d) $-8a^2b(-3a^2 - 2b)$ (e) $\frac{-5}{9}abc\left(\frac{18}{15}a^2bc - \frac{3}{10}abc^2\right)$ (f) $7a(0.1a^2 - 0.5b)$

37. Multiply $\frac{5}{9}y^2z$, $\frac{7}{10}x^2$ and $(-3xz^2)$ and then verify the result for $x = \frac{1}{2}$, $y = \frac{1}{3}$ and $z = \frac{1}{4}$.

38. Find the following products are verify the results for $x = -1$ and $y = -2$.

(a) $(3x^2 + 2y^2)(x + y)$ (b) $(x^2 - y^2)(x^2 + y^2)$ (c) $\left(3x^2 + \frac{1}{3}y^2\right)(2y - 3x^2)$
(d) $(x^4 - y^4)(x + y)$ (e) $\left(\frac{1}{2}x - y\right)\left(\frac{3}{5}x + y\right)$ (f) $(0.7x - 0.6y)(2.3x - 2y)$

39. Find the products of the following :

(a) $(3x - 2)(5x^2 + 6x + 2)$ (b) $(x^2 + y^2 + z^2)(xy + yz)$ (c) $(x + y)(x^2 - xy + y^2)$
(d) $(5x^2 + y)(3x + 2y)$ (e) $(x^3 + y^3)(x^2 - xy + y^2)$ (f) $\left(\frac{3}{5}x^2 - 3y + 5\right)\left(\frac{1}{3}x - y\right)$

40. Simplify :

(a) $(3y + 2)(y - 2) - (7y + 3)(y - 4)$ (b) $(2x - 3y)(x + y) - (5x + 2y)(x - y)$
(c) $(x^2 + (3x - y)(3x + y + y^2)$
(d) $(a^2 - 3a + 5)(2a - 3) - (5a^2 + 3a - 3)(a - 1)$

41. Find the products of the following :

(a) $(2x - y)(3x + y^2)$ (b) $(x - 3y)(x^2 + 3xy)$ (c) $\left(x^3 + \frac{1}{x^3}\right)\left(x + \frac{1}{2}\right)$
(d) $(x^2 - a^2)(x - a)$ (e) $\left(\frac{2}{7}x + \frac{3}{5}y\right)(x^2 + y^2)$ (f) $(a^2b + ab^2)(b^2c + c^2b)$

42. Find the following products by using identities :

(a) $(5x + 9)(5x - 9)$ (b) $(x^3 + y^2)(x^3 - y^2)$
(c) $(x^2y + 3z)(x^2y - 3z)$ (d) $\left(x + \frac{1}{x}\right)\left(x - \frac{1}{x}\right)$

43. Find the following products :

(a) $(5x - 3y)(5x - 3y)$ (b) $(y - 3)(y - 3)$
(c) $(x^2 - 5)(x^2 - 5)$ (d) $\left(\frac{3}{4}x - \frac{5}{6}y\right)\left(\frac{3}{4}x - \frac{5}{6}y\right)$

44. Find the following products :

(a) $(x + 3)(x + 3)$ (b) $(2a + 3b)(2a + 3b)$
(c) $\left(\frac{7}{9}x + y\right)\left(\frac{7}{9}x + y\right)$ (d) $\left(\frac{2}{3}x + 5\right)\left(\frac{2}{3}x + 5\right)$

45. Simplify using identities :

(a) $133 \times 133 - 121 \times 121$ (b) $5.89 \times 5.89 - 0.11 \times 0.11$
(c) $\frac{93 \times 93 - 5 \times 5}{88}$ (d) $\frac{3.29 \times 3.29 - 0.17 \times 0.17}{3.12}$
