

CLASS 10 MATHEMATICS

OPERATIONS WITH VARIABLES

Algebra Language

A variable represents a number. A coefficient is the number multiplying a variable. A constant has no variable. A term is a part separated by + or -.

Example: In $5x + 3$: coefficient = 5, variable = x, constant = 3, terms = $5x$ and 3.

Quick Check: In $7a - 4 + 2b$, identify the variables, coefficients, constant and terms.

Class Practice

1. Identify the terms in $3x + 7$.
2. Identify the coefficient of x in $9x - 4$.
3. Identify the constant in $5a + 8$.
4. Identify the variables in $3x + 2y - 7$.
5. Identify the coefficient of y in $6x - 5y + 2$.

Like and Unlike Terms

Like terms have the SAME variables with the SAME powers.

Example: $3x$ and $7x \rightarrow$ Like; $3x$ and $7y \rightarrow$ Unlike; $4x^2$ and $5x^2 \rightarrow$ Like; $4x^2$ and $5x \rightarrow$ Unlike.

Same variable + same power = LIKE

Practice

1. Classify $5a$ and $-2a$ as like or unlike.
2. Classify $3x$ and $4x^2$.
3. Classify $7xy$ and $-3xy$.
4. Classify $5a^2$ and $8a^2$.
5. Classify $4mn$ and $7nm$.
6. Classify $6p^2q$ and $-2pq^2$.
7. Which terms can be combined: $3x$, $5y$, $-7x$, $2y$?

Homework

1. Classify $8m$ and $-3m$.
2. Classify $4x^2$ and $9x$.

3. Classify $5ab$ and $-2ab$.
4. Classify $7pq^2$ and $3p^2q$.
5. Group the like terms in: $3x + 5y - 2x + 7 - 3y$.

Addition and Subtraction

Add or subtract the COEFFICIENTS. Keep the variable and its power unchanged.

Example: $3x + 5x = (3+5)x = 8x$

$9a - 4a = (9-4)a = 5a$

Class Practice

1. $3x + 5x$
2. $9a - 4a$
3. $7m + 2m - 5m$
4. $8p - 3p + 6p$
5. $4x + 7y + 3x - 2y$
6. $9a - 5b + 2a + 3b$
7. $6x^2 + 4x^2 - 3x^2$
8. $8ab - 3ab + 5ab$

Homework

1. $12x + 7x - 5x$
2. $15a - 8a + 3a$
3. $7p + 4q - 2p + 6q$
4. $9x^2 - 4x^2 + 2x^2$
5. $5mn + 7mn - 3mn$
6. $8a - 3b + 4a + 5b - 2a$

Multiplication

Multiply the numerical coefficients. Then multiply the variables.

Example: $4x \times 3y = 12xy$

$2x \times 5x = 10x^2$

Class Practice

1. $3x \times 4$

2. $5a \times 6$

3. $4x \times 3y$

4. $6m \times 2n$

5. $2x \times 5x$

6. $3a \times 4a$

7. $5pq \times 2p$

8. $7xy \times 3x$

Homework

1. $8x \times 3$

2. $7a \times 5b$

3. $4m \times 6m$

4. $3p \times 8q$

5. $5x \times 2x$

6. $6ab \times 4a$

7. $2xy \times 7y$

8. $9mn \times 3m$

Powers of Variables

x^2 means $x \times x$. For the same base: multiplication $\rightarrow$ ADD powers; division $\rightarrow$ SUBTRACT powers.

Example: $x^2 \times x^3 = x^5$

$$x^6 \div x^2 = x^4$$

$\times \rightarrow$ ADD powers | $\div \rightarrow$ SUBTRACT powers

Class Practice

1. $x^2 \times x^3$

2. $a^3 \times a^2$

3. $m^4 \times m^3$

4. $y^5 \div y^2$

5. $p^7 \div p^3$

6. $x^2 \times x \times x^3$

7. $2x^2 \times 3x^3$

8. $5a^4 \div a^2$

Homework

1. $x^3 \times x^4$

2. $b^5 \times b^2$

3. $m^8 \div m^3$

4. $p^6 \div p^2$

5. $3x^2 \times 4x^3$

6. $2a^5 \times 5a$

7. $12y^6 \div 3y^2$

8. $7m^4 \times 2m^2$

Removing Brackets

The outside number multiplies EVERY term inside the bracket.

Example: $3(x + 4) = 3x + 12$

Example: $-2(x - 3) = -2x + 6$

Class Practice

1. $5(x + 2)$

2. $4(x - 3)$

3. $2(a + 7)$

4. $3(2x + 5)$

5. $5(2a - 3)$

6. $-2(x + 4)$

7. $-3(2x - 5)$

8. $4(3a - 2b)$

Common Mistake: $2(x + 5) \neq 2x + 5$. The 2 must multiply BOTH terms.

Homework

1. $6(x + 3)$

2. $7(a - 2)$

3. $3(2x + 4)$

4. $5(3a - 2)$

5. $-2(x + 6)$
6. $-4(2x - 3)$
7. $3(2a + 5b)$
8. $-2(3x - 4y)$

Substitution

Replace $\rightarrow$ Bracket $\rightarrow$ Calculate.

Example: If $x = 3$, then $2x + 5 = 2(3) + 5 = 11$.

Class Practice

1. If $x = 4$, find $3x + 2$.
2. If $a = 5$, find $2a - 3$.
3. If $m = 6$, find $4m + 1$.
4. If $x = 2$ and $y = 3$, find $2x + 3y$.
5. If $a = 4$ and $b = 2$, find $3a - 2b$.
6. If $x = 5$, find $x^2 + 2x$.

Homework

1. If $x = 7$, find $2x + 3$.
2. If $a = 8$, find $3a - 5$.
3. If $m = 4$, find $m^2 + 3$.
4. If $x = 3$ and $y = 5$, find $2x + y$.
5. If $a = 6$ and $b = 2$, find $4a - 3b$.
6. If $x = 2$ and $y = 4$, find $x^2 + 2y$.

Mixed Operations

Brackets $\rightarrow$ Powers $\rightarrow$ Multiplication/Division $\rightarrow$ Addition/Subtraction.

Example: $3x + 2(4x - 5) = 3x + 8x - 10 = 11x - 10$

Class Practice

1. $5x + 3x - 2x$
2. $4(x + 3) + 2x$
3. $5x + 3(2x - 4) - x$

4. $2(3a + 5) - 4a$

5. $3x^2 + 2x^2 - x^2$

6. $4(2x + 3) - 2(x - 1)$

7. $2(3a - 4) + 5a - 2$

Homework

1. $7x + 5x - 3x$

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

3. $6x - 2(x + 3)$

4. $4(2a - 1) + 3a$

5. $5x^2 - 2x^2 + 4x^2$

6. $3(2x + 5) - 2(x - 1)$

7. $2(3a - 4) + 5a - 7$

ERROR DETECTIVE

1. $3x + 4y = 7xy$. Find the error.

2. $2(x + 5) = 2x + 5$. Find the error.

3. $3x \times 4x = 12x$. Find the error.

4. $5x + 2x = 7x^2$. Find the error.

5. $x^2 \times x^3 = x^6$. Find the error.

1-Minute Recall

1. What are like terms?

2. Simplify $4x + 7x$.

3. Calculate $3x \times 5y$.

4. Simplify $x^2 \times x^3$.

5. Expand $4(x + 2)$.

6. If $x = 5$, find $2x + 1$.

Final Recall

- Same variable + same power $\rightarrow$ LIKE terms
- Addition/Subtraction $\rightarrow$ operate on coefficients

- Multiplication $\rightarrow$ multiply coefficients and variables
- Same base $\times \rightarrow$ ADD powers
- Same base $\div \rightarrow$ SUBTRACT powers
- Bracket $\rightarrow$ multiply EVERY term
- Substitution $\rightarrow$ Replace $\rightarrow$ Bracket $\rightarrow$ Calculate