

ALGEBRA 1

UNIT 1 • LESSON 2

Expressions and Operations

Order of Operations • Distributive Property • Simplifying Expressions

Goal: apply operation rules, distribute accurately, and simplify algebraic expressions with confidence.

Access IDEAS presents a customized session for Algebra 1, Unit 1, Lesson 2.



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Agenda

- Sample Math Competition Problem
- Homework Review
- Order of Operations
- Distributive Property and Factoring
- Simplifying Expressions
- Homework Review and Extra Problems

Sample Math Competition Problem

A book has 300 pages. How many times does the digit 2 appear in the page numbers from 1 to 300?
(Example: Page 122 has two “2”)

Please post your answer in chat.

Math Competition Problem — Solution

A book has 300 pages. How many times does the digit 2 appear in the page numbers from 1 to 300?

SOLUTION

- **From 1 to 100:**
 - Ones place: The digit 2 appears 10 times (2, 12, 22, ..., 92).
 - Tens place: The digit 2 appears 10 times (20, 21, 22, ..., 29).
 - Subtotal: $10 + 10 = \mathbf{20 \text{ times}}$.
- **From 101 to 200:**
 - Exactly the same pattern happens here.
 - Subtotal: **20 times**.
- **From 201 to 300:**
 - The hundreds place: Every single number from 201 to 300 starts with a 2. There are 100 numbers in this range, so the digit 2 appears **100 times** just in the hundreds place.
 - The tens and ones places: This block (201 to 300) has the exact same tens and ones patterns as 1 to 100, which adds another $10 + 10 = \mathbf{20 \text{ times}}$.

Answer: $20 + 20 + 120 = 160 \text{ times}$.

Homework Review

8. Convert $\frac{3}{7}$ to a decimal.

9. Convert $\frac{62}{99}$ to a decimal.

10. Convert 0.272727... to a fraction and simplify.

Attendance

Please post your name in Zoom Chat.
Also, let me know how many videos you watch for this week's lesson.

Example: Jack Chung, 3 videos

Order of Operations

Follow a consistent sequence so every expression has one value.

1 GROUPING

Simplify **parentheses**, brackets, and fraction bars first.

2 EXPONENTS

Evaluate **powers** before other operations.

3 MULTIPLY & DIVIDE

Work from **left to right**.

4 ADD & SUBTRACT

Work from **left to right** after multiplication and division.

5 ONE LINE AT A TIME

Rewrite the entire expression after each step.

Use “PEMDAS”

Parenthesis - **E**xponent - **M**ultiply/**D**ivide - **A**dd/**S**ubtract

Order of Operations — Problem 1

Evaluate: $8 + 3 \times 4$

Order of Operations — Problem 1 Solution

Evaluate: $8 + 3 \times 4$

SOLUTION

$$8 + 3 \times 4$$

$$8 + 12$$

$$20$$

Multiply first: $3 \times 4 = 12$

Add: $8 + 12 = 20$

Answer: 20

Order of Operations — Problem 2

Evaluate: $3 + 2(5^2 - 7)$

Please post your answer in chat.

Order of Operations — Problem 2 Solution

Evaluate: $3 + 2(5^2 - 7)$

SOLUTION

$$3 + 2(5^2 - 7)$$

$$3 + 2(25 - 7)$$

$$3 + 2(18)$$

$$3 + 36$$

$$39$$

$$5^2 = 25$$

$$25 - 7 = 18$$

$$2 \times 18 = 36$$

Add 3

Answer: 39

Order of Operations — Problem 3

Evaluate: $48 \div 6(2 + 2)$

Please post your answer in chat.

Order of Operations — Problem 3 Solution

Evaluate: $48 \div 6(2 + 2)$

SOLUTION

$$48 \div 6(2 + 2)$$

$$48 \div 6(4)$$

$$8 \times 4$$

$$32$$

$$2 + 2 = 4$$

$$48 \div 6 = 8$$

Work left to right, multiply by 4

Answer: 32

Multiplication and Division have equal priority, so work left to right.

Order of Operations — Problem 4

Evaluate: $-3^2 + (-3)^2$

Please post your answer in chat.

Order of Operations — Problem 4 Solution

Evaluate: $-3^2 + (-3)^2$

SOLUTION

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

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

$$-9 + 9$$

$$0$$

Exponent before sign

$$3^2 = 9$$

$$(-3)^2 = 9$$

Combine: $-9 + 9 = 0$

Answer: 0

Parentheses determine whether the negative sign is squared.

$-x = (-1)(x)$, which is multiply

Order of Operations — Problem 5

Evaluate: $18 \div 3 + 2(5 - 1)$

Please post your answer in chat.

Order of Operations — Problem 5 Solution

Evaluate: $18 \div 3 + 2(5 - 1)$

SOLUTION

$$18 \div 3 + 2(5 - 1)$$

$$18 \div 3 + 2(4)$$

$$6 + 8$$

$$14$$

Parentheses: $5 - 1 = 4$

Divide and multiply

Add: $6 + 8 = 14$

Answer: 14

Order of Operations — Problem 6

Evaluate: $3 + 2[5^2 - (7 + 4)] \div 7$

Please post your answer in chat.

Order of Operations — Problem 6 Solution

Evaluate: $3 + 2[5^2 - (7 + 4)] \div 7$

SOLUTION

$$3 + 2[5^2 - (7 + 4)] \div 7$$

$$3 + 2[25 - 11] \div 7$$

$$3 + 2(14) \div 7$$

$$3 + 28 \div 7$$

$$3 + 4$$

$$7$$

$$5^2 = 25; 7 + 4 = 11$$

$$25 - 11 = 14$$

$$2 \times 14 = 28$$

$$28 \div 7 = 4$$

$$3 + 4 = 7$$

Answer: 7

Distributive Property

The distributive property multiplies one factor by every term in a group.

1 EXPAND

Multiply the factor by every term.

2 NEGATIVE

A negative factor changes every product's sign.

3 FACTOR

Reverse distribution with the greatest common factor.

4 GCF

Use the greatest common factor to factor.

Distributive Property — Problem 1

Expand: $4(x + 3)$

Distributive Property — Problem 1 Solution

Expand: $4(x + 3)$

SOLUTION

$$4(x + 3)$$

$$4 \cdot x + 4 \cdot 3$$

$$4x + 12$$

Multiply 4 by x and 3

Simplify each product

Answer: $4x + 12$

Distributive Property — Problem 2

Expand: $-3(2x - 5)$

Please post your answer in chat.

Distributive Property — Problem 2 Solution

Expand: $-3(2x - 5)$

SOLUTION

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

$$(-3)(2x) + (-3)(-5)$$

$$-6x + 15$$

Distribute -3 to both terms

Negative $\times$ negative is positive

Answer: $-6x + 15$

Factor — Problem 1

Factor completely: $7x + 21$

Factor — Problem 1 Solution

Factor completely: $7x + 21$

SOLUTION

Greatest common factor: 7

$$7x + 21 = 7(x + 3)$$

Check: $7 \cdot x + 7 \cdot 3$

Answer: $7(x + 3)$

Factor — Problem 2

Factor completely: $72x + 48$

Please post your answer in chat.

Factor — Problem 2 Solution

Factor completely: $72x + 48$

SOLUTION

$$72=9\cdot 8=2\cdot 2\cdot 2\cdot 3\cdot 3; \quad 48=16\cdot 3=2\cdot 2\cdot 2\cdot 2\cdot 3$$

Greatest common factor: 24

$$72x + 48 = 24(3x + 2)$$

$$\text{Check: } 24\cdot 3x + 24\cdot 2$$

$$\text{Answer: } 24(3x + 2)$$

Factor — Problem 3

Factor completely: $4x^2 + 6x$

Please post your answer in chat.

Factor — Problem 3 Solution

Factor completely: $4x^2 + 6x$

SOLUTION

Greatest common factor: $2x$

$$4x^2 + 6x = 2x(2x + 3)$$

Check: $2x \cdot 2x + 2x \cdot 3$

$$4x^2 + 6x$$

Answer: $2x(2x + 3)$

Simplifying Expressions

Like terms have identical variable parts and exponents.

1 IDENTIFY

$3x$ and $-8x$ match;
 $3x$ and $3x^2$ do not.

2 COMBINE

Add or subtract coefficients;
keep variables unchanged.

3 CONSTANTS

Numbers without variables
combine with constants.

4 DISTRIBUTE

Remove grouping symbols
before combining.

5 STANDARD FORM

Write terms in descending
powers.

Simplifying Expressions — Problem 1

Simplify: $3x + 5x$

Simplifying Expressions — Problem 1 Solution

Simplify: $3x + 5x$

SOLUTION

$$3x + 5x$$

$$(3 + 5)x$$

$$8x$$

*Both terms are like terms
Add the coefficients*

Answer: $8x$

Simplifying Expressions — Problem 2

Simplify: $7x - 3 + 4x + 9$

Please post your answer in chat.

Simplifying Expressions — Problem 2 Solution

Simplify: $7x - 3 + 4x + 9$

SOLUTION

$$\begin{aligned} &7x - 3 + 4x + 9 \\ &(7x + 4x) + (-3 + 9) \\ &11x + 6 \end{aligned}$$

Answer: $11x + 6$

Simplifying Expressions — Problem 3

Simplify: $4(3m - 2) - 2(m + 5)$

Please post your answer in chat.

Simplifying Expressions — Problem 3 Solution

Simplify: $4(3m - 2) - 2(m + 5)$

SOLUTION

$$\begin{aligned} &4(3m - 2) - 2(m + 5) \\ &12m - 8 - 2m - 10 \\ &(12m - 2m) + (-8 - 10) \\ &10m - 18 \end{aligned}$$

Answer: $10m - 18$

Simplifying Expressions — Problem 4

Simplify: $3(2y - 5) - 4(y + 1)$

Please post your answer in chat.

Simplifying Expressions — Problem 4 Solution

Simplify: $3(2y - 5) - 4(y + 1)$

SOLUTION

$$\begin{aligned} &3(2y - 5) - 4(y + 1) \\ &6y - 15 - 4y - 4 \\ &(6y - 4y) + (-15 - 4) \\ &2y - 19 \end{aligned}$$

Answer: $2y - 19$

Simplifying Expressions — Problem 5

Simplify: $2(3x - 4y) - 5(x + 2y)$

Please post your answer in chat.

Simplifying Expressions — Problem 5 Solution

Simplify: $2(3x - 4y) - 5(x + 2y)$

SOLUTION

$$2(3x - 4y) - 5(x + 2y)$$

$$6x - 8y - 5x - 10y$$

$$(6x - 5x) + (-8y - 10y)$$

$$x - 18y$$

Distribute 2 and -5

Group like terms

Combine

Answer: $x - 18y$

Simplifying Expressions — Problem 6

Simplify: $5a^2 + 2a - 3a^2 + 7 - 4a$

Please post your answer in chat.

Simplifying Expressions — Problem 6 Solution

Simplify: $5a^2 + 2a - 3a^2 + 7 - 4a$

SOLUTION

$$\begin{aligned} &5a^2 + 2a - 3a^2 + 7 - 4a \\ &(5a^2 - 3a^2) + (2a - 4a) + 7 \\ &2a^2 - 2a + 7 \end{aligned}$$

Answer: $2a^2 - 2a + 7$

Simplifying Expressions — Problem 7

Simplify: $3(2x - 5y) + 4x - 2(x + y)$

Please post your answer in chat.

Simplifying Expressions — Problem 7 Solution

Simplify: $3(2x - 5y) + 4x - 2(x + y)$

SOLUTION

$$3(2x - 5y) + 4x - 2(x + y)$$

$$6x - 15y + 4x - 2x - 2y$$

$$(6x + 4x - 2x) + (-15y - 2y)$$

$$8x - 17y$$

Distribute 3 and -2

Group like terms

Combine

Answer: $8x - 17y$

Questions and Homework Help

- Please let me know if you have any questions on the lesson today.
- Please let me know if you have any questions on your Algebra-related homework.

Extra Problems - More Challenging

What is $(x + y)(x + y)$?

[Hint: Do this first. $Z(x + y)$]

Sample Math Competition Problem

If $x + y = 10$ and $x^2 + y^2 = 40$, what is the value of xy ?

[Hint: $(x + y)^2 = (x + y)(x + y)$. Then use previous problem.]

Math Competition Problem — Worked Solution

If $x + y = 10$ and $x^2 + y^2 = 40$, what is the value of xy ?

SOLUTION

$$(x + y)^2 = x^2 + 2xy + y^2$$

$$(x + y)^2 = x^2 + y^2 + 2xy$$

$$10^2 = 40 + 2xy$$

$$100 = 40 + 2xy$$

$$60 = 2xy$$

$$30 = xy$$

Use the square-of-a-sum identity

Commutative Property of Addition

Substitute the given values

$$10^2 = 100$$

Subtract 40

Divide by 2

Answer: $xy = 30$



THANK YOU

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