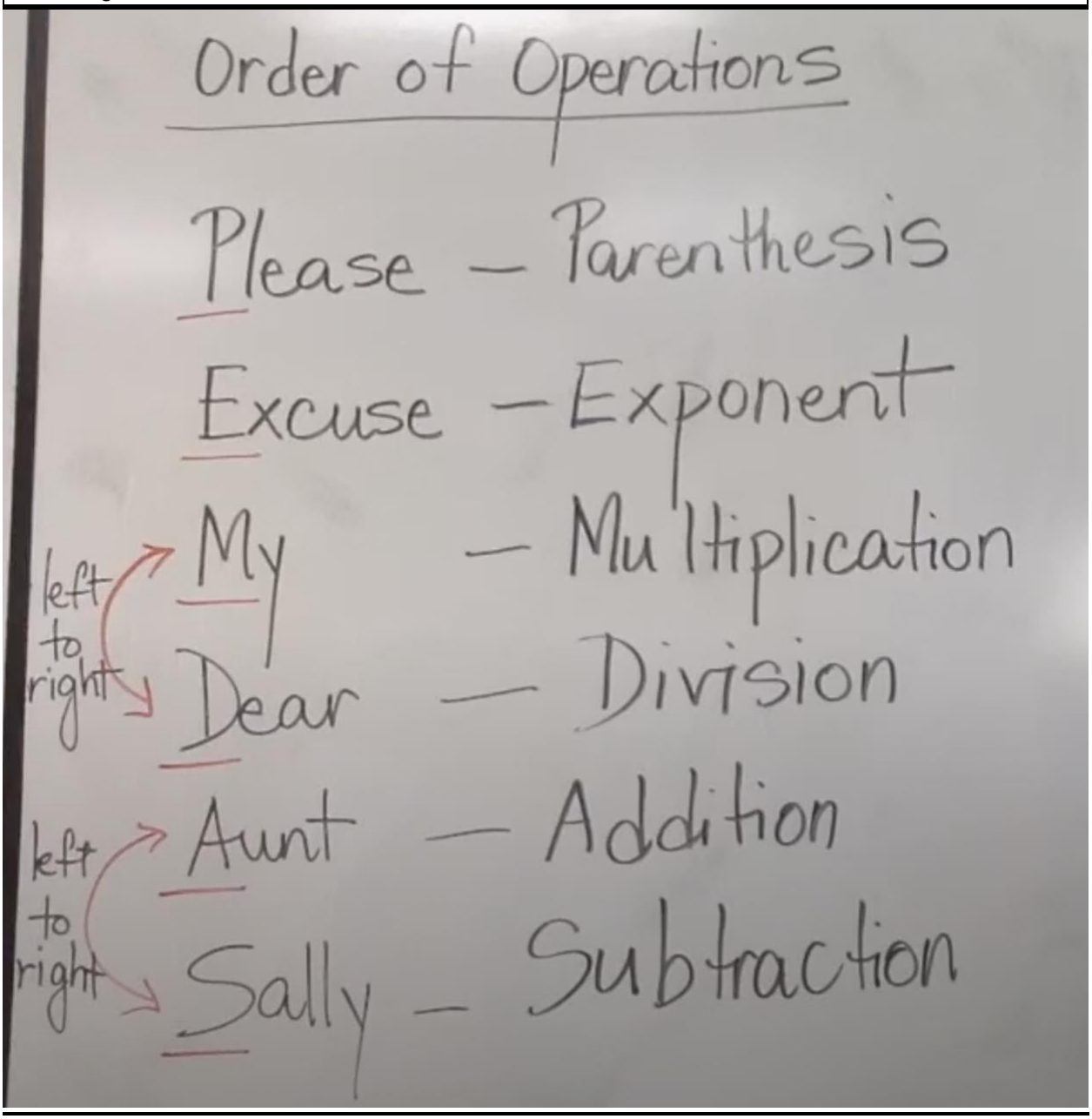
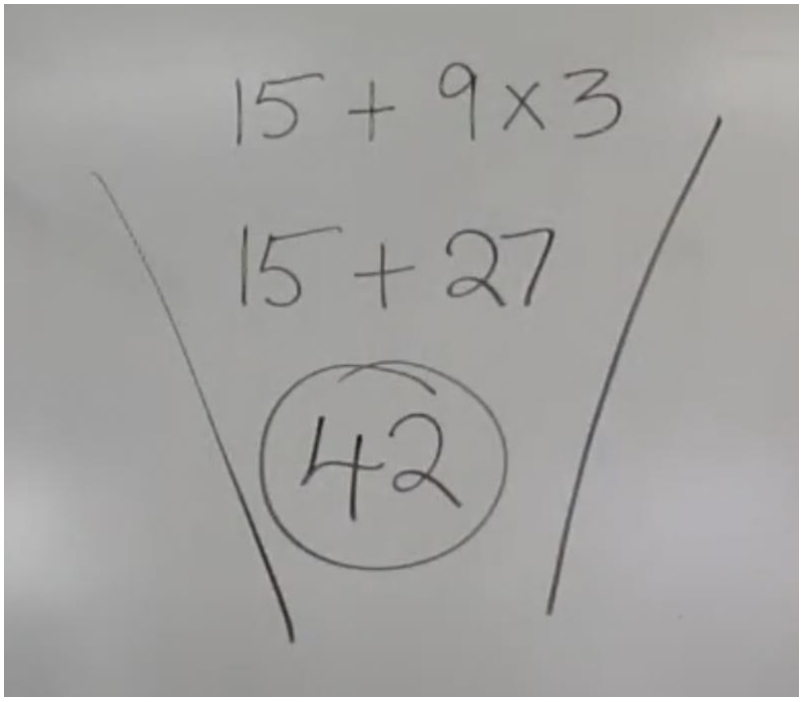
Indicator 21 Class Notes by Mrs. Joshi

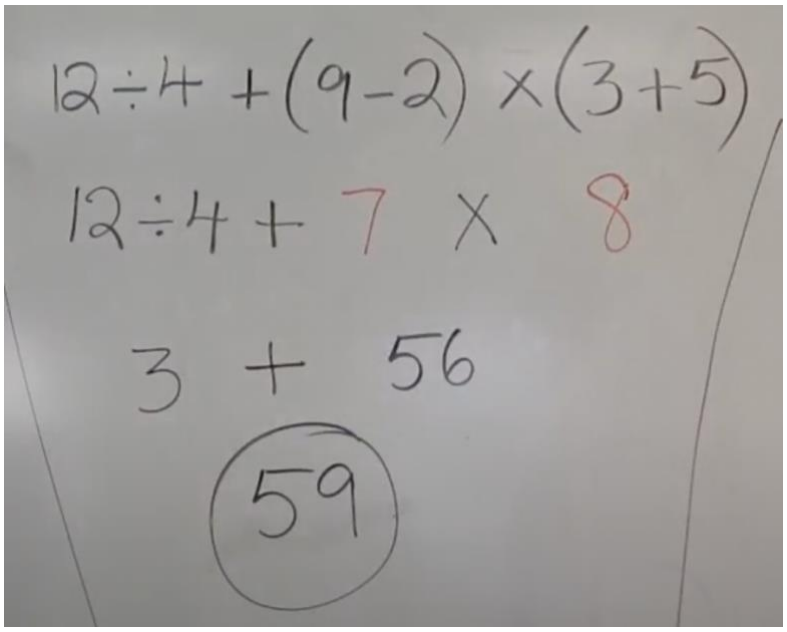
Evaluating Expressions and Formulas (Alabama Standard: 15d)

I can use order of operations.
I can use order of operations to evaluate algebraic expressions when given values for the variables. This includes geometric formulas.

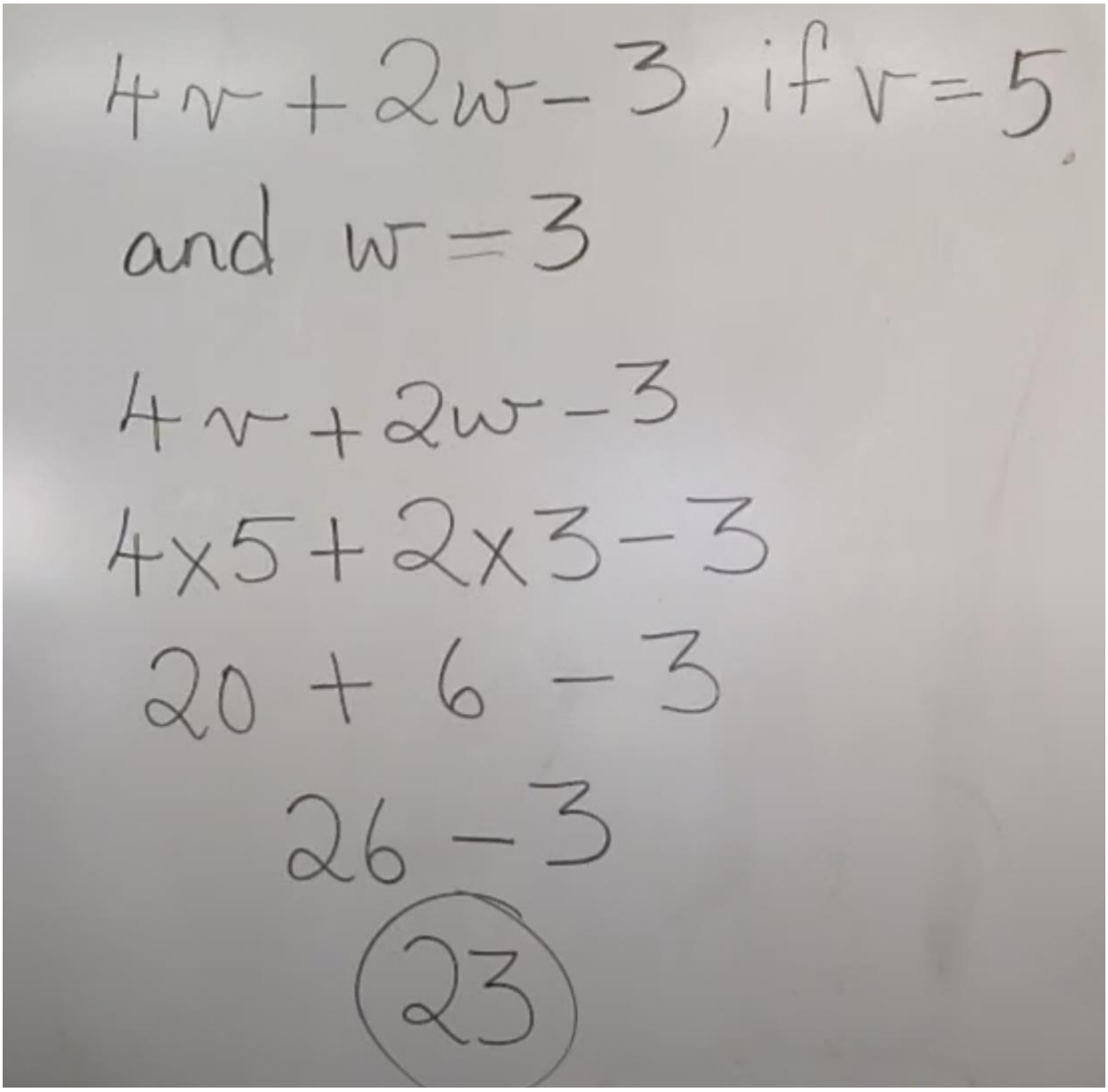


Indicator 21 Class Notes by Mrs. Joshi





Indicator 21 Class Notes by Mrs. Joshi



Indicator 21 Class Notes by Mrs. Joshi

1.1 Lesson

Check It Out
Lesson Tutorials
BigIdeasMath.com

Key Vocabulary
numerical expression, *p. 4*
algebraic expression, *p. 4*
evaluate, *p. 4*

A **numerical expression** contains only numbers and operations. An **algebraic expression** may contain numbers, operations, and one or more variables. Here are some examples.

Numerical Expression	*Algebraic Expression*
$15 + 9 \cdot 3$	$45 \div p - q$

To **evaluate** an algebraic expression, substitute a number for each variable. Then use the order of operations to find the value of the numerical expression.

EXAMPLE 1 Evaluating Algebraic Expressions

a. Evaluate $k + 10$ when $k = 25$.

$k + 10 = 25 + 10$ — Substitute 25 for k.

$= 35$ — Add 25 and 10.

b. Evaluate $4 \cdot n$ when $n = 12$.

$4 \cdot n = 4 \cdot 12$ — Substitute 12 for n.

$= 48$ — Multiply 4 and 12.

Study Tip
You can write the product of 4 and n in several ways.
$4 \cdot n$
$4n$
$4(n)$

EXAMPLE 2 Evaluating an Expression with Two Variables

Evaluate $a \div b$ when $a = 27$ and $b = 3$.

Substitute 27 for a.

$a \div b = 27 \div 3$

Substitute 3 for b.

$= 9$ — Divide 27 by 3.

Indicator 21 Class Notes by Mrs. Joshi

EXAMPLE 3 Evaluating Expressions with Two Operations

a. Evaluate $3x - 14$ when $x = 5$.

$3x - 14 = 3(5) - 14$	Substitute 5 for x.
$= 15 - 14$	Using order of operations, multiply 3 and 5.
$= 1$	Subtract 14 from 15.

b. Evaluate $z^2 + 8.5$ when $z = 2$.

$z^2 + 8.5 = (2)^2 + 8.5$	Substitute 2 for z.
$= 4 + 8.5$	Using order of operations, evaluate 2^2.
$= 12.5$	Add 4 and 8.5.

EXAMPLE 4 Real-Life Application

You are saving for a skateboard. Your aunt gives you $45 to start and you save $3 each week. The expression $45 + 3w$ gives the amount of money you save after w weeks.

a. How much will you have after 4 weeks, 10 weeks, and 20 weeks?

b. After 20 weeks, can you buy the skateboard? Explain.

a. Substitute the given number of weeks for w.

Number of Weeks, w	$45 + 3w$	Amount Saved
4	$45 + 3(4)$	$45 + 12 = \$57$
10	$45 + 3(10)$	$45 + 30 = \$75$
20	$45 + 3(20)$	$45 + 60 = \$105$

b. After 20 weeks, you have \$105. So, you cannot buy the \$125 skateboard.

Indicator 21 Class Notes by Mrs. Joshi

1.5 Lesson

Check It Out
Lesson Tutorials
BigIdeasMath.com

Key Vocabulary
formula, *p. 30*
solve a formula, *p. 30*

A **formula** is an equation that tells you how one variable is related to one or more other variables. To **solve a formula**, find the value of one variable by substituting numbers for the other variables.

EXAMPLE 1 Using a Simple Formula

The formula $M = 220 - a$ gives a person's maximum heart rate M, where a is the person's age in years. Malcolm is 12 years old. His uncle is 40 years old. What is the difference between their maximum heart rates?

Malcolm	*His Uncle*	
$M = 220 - a$	$M = 220 - a$	Write the formula.
$= 220 - 12$	$= 220 - 40$	Substitute their ages for a.
$= 208$	$= 180$	Subtract.

The difference between their maximum heart rates is $208 - 180$, or 28 beats per minute.

EXAMPLE 2 Using an Area Formula

Find the area of the rectangular jumping surface of the trampoline.

Use the formula for the area of a rectangle.

$A = bh$	Write the formula.
$= 14 \times 7$	Substitute 14 for b and 7 for h.
$= 98$	Multiply.

The area of the jumping surface is 98 square feet.

Indicator 21 Class Notes by Mrs. Joshi

EXAMPLE 3 Using an Area Formula

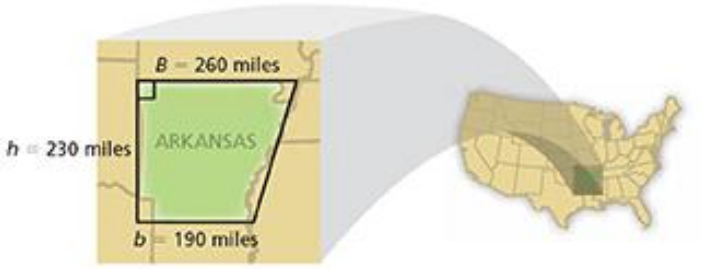
A trapezoid can be used to approximate the shape of Arkansas, as shown on the map.

a. Use the formula $A = h(b + B) \div 2$ to find the area.

b. Mississippi has an area of about 46,907 square miles. Is the area of Arkansas greater than or less than the area of Mississippi?

Remember

The corner mark ⌝ in a figure means that the angle formed by the sides is a right angle.



a. $A = h(b + B) \div 2$ — Write the formula.

$= 230(190 + 260) \div 2$ — Substitute 230 for h, 190 for b, and 260 for B.

$= 230(450) \div 2$ — Add inside parentheses.

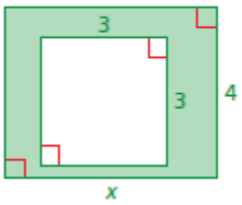
$= 103{,}500 \div 2$ — Multiply 230 and 450.

$= 51{,}750$ — Divide.

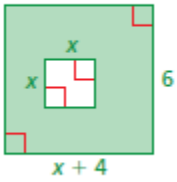
∴ The area of Arkansas is about 51,750 square miles.

b. Because 51,750 is greater than 46,907, the area of Arkansas is greater than the area of Mississippi.

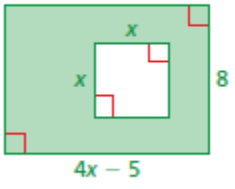
Write a formula for the area of the shaded region in terms of x.



$4x - 9$



$6x + 24 - x^2$



$32x - 40 - x^2$