

Algebra 1 Notes...

Date: _____

8.1 Using the "Product Rule" for Exponents

VOCABULARY

Terms are separated by Addition + Subtraction

EXAMPLE (3 terms): $3x - 4y + 10$

LIKE TERMS
have the same variables raised to the same exponents

EX] $5x + 2x = 7x$

Factors are separated by multiplication signs

EXAMPLES: (a) 4 Numeric Factors: $3 \cdot 3 \cdot 3 \cdot 3$

(b) 4 Factors with Variables $4 \cdot x \cdot y \cdot z$

FACTORS ARE USED WITH EXPONENTS

Expression:

are combination of operations (+, -, x, ÷) numbers, variables and symbols of inclusion (), []

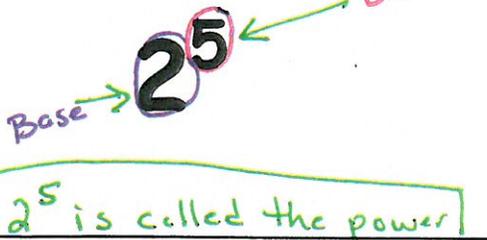
EX: $3 \cdot 3 \cdot 3 \cdot 3 \rightarrow 3^4$

EXAMPLE: $2(3+5) = 2(8) = 16$

To find the answer to an expression problem (fill in)... "EVALUATE" an expression

Expressions with exponents

1) Label the Base, Exponent



1) **Expand Power to a product of Factors**

$2^5 \rightarrow 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$

2) **Evaluate the Power** (32)

3) **Calculator Command to Evaluate the Power**

$2^5 \rightarrow 2 \wedge 5 = (32)$

mentally
2-2
4-2
8-2
16-2
(32)

EXAMPLE 1: Write in words, expand to a product of factors, and evaluate.

Power	Words	Expand to a product of factors	Evaluate
a. 10^1	10 TO THE 1 ST	10	$10^1 \rightarrow 10$
b. 12^2	12 SQUARED	$12 \cdot 12$	$12^2 = 144$
c. 5^3	5 CUBED	$5 \cdot 5 \cdot 5$	$5^3 = 125$

EXAMPLE 2: Evaluate powers with negative numbers.

a) Evaluate X^4 when $X = -2$...

$X^4 = (-2)^4$

Show substitution.

$(-2) \cdot (-2) \cdot (-2) \cdot (-2)$

Expand to a product of factors

(16)

Evaluate and circle answer

b) Evaluate X^3 when $X = -2$...

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

Show substitution.

$(-2) \cdot (-2) \cdot (-2)$

Expand to a product of factors

(-8)

Evaluate and circle answer

Rules:

- ① Neg # raised to a EVEN exponent is Positive $(-2)^4 \rightarrow +$
- ② Neg # raised to an ODD exponent is Negative $(-2)^3 \rightarrow -$

Using the "Product Rule"

EXPLORATION:

- a) **Expand both numeric powers:** $4^3 \cdot 4^2 = (4 \cdot 4 \cdot 4) \cdot (4 \cdot 4)$
- b) **Then rewrite as a single power:** $= 4^5$ *Simplify BASE = 4*

THE PRODUCT RULE FOR POSITIVE NUMERIC EXPONENTS:

Words: To multiply powers having the same base, ADD EXPONENTS.

Example 1: Simplify (SHOW WORK): $2^2 \cdot 2^3 = 2^{2+3} = 2^5$ ← Exponential form

Base = 2

Then Evaluate: $= 32$ ← EVALUATE

Example 2: Simplify (SHOW WORK): $2^1 \cdot 2^3 = 2^{1+3} = 2^4$

implied 1

Base = 2

Then Evaluate: $= 16$

THE PRODUCT RULE FOR POSITIVE NUMERIC EXPONENTS:

Words: To multiply powers having the same base, ADD EXPONENTS

Example 3: Simplify (SHOW WORK): $(-2)^2 \cdot (-2)^4 = (-2)^{2+4} = (-2)^6$ ← Answer is Pos (+)

Base: -2

Then Evaluate: $= 64$

Example 4: Simplify (SHOW WORK): $(-5)^1 \cdot (-5)^2 = (-5)^{1+2} = (-5)^3$ ← Answer is Neg (-)

Base: -5

Then Evaluate: $= -125$

THE PRODUCT RULE FOR VARIABLE EXPONENTS:

Words: To multiply powers having the same base, ADD THE EXPONENTS. (MULT. NUMBERS)

Example 5: Simplify (SHOW WORK): $x^4 \cdot x^6 = x^{4+6} = x^{10}$

Base = x

Example 6: Simplify (SHOW WORK): $5y^1 \cdot 8y^5 = 5 \cdot 8 y^{1+5} = 40y^6$

Base = y

implied 1

Example 7: Simplify (SHOW WORK): $3x \cdot y^5 \cdot 5x^2 = 3 \cdot 1 \cdot 5 \cdot x^{1+2} \cdot y^5 = 15x^3y^5$

Bases = x only