## Agenda:
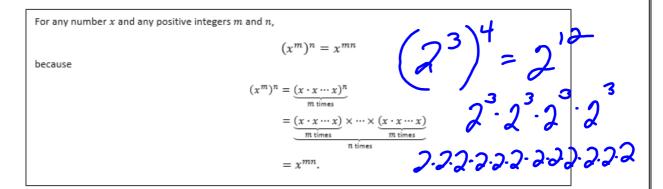
1) Bell Ringer: page 31

2) Lesson 3: Numbers in Exponential Form Raised to a Power

EQ: What is the rule for an exponent raised to a power?

3) Homework: Lesson 3 (1-6) (p.29 in booklet)

4) Exit Ticket (p.30 in booklet)

Sep 10-9:19 AM

## Lesson 3: Numbers in Exponential Form Raised to a Power    p. 27

### Classwork

For any number $x$ and any positive integers $m$ and $n$,

$$(x^m)^n = x^{mn}$$

because

$$(x^m)^n = \underbrace{(x \cdot x \cdots x)^n}_{m \text{ times}}$$

$$= \underbrace{\underbrace{(x \cdot x \cdots x)}_{m \text{ times}} \times \cdots \times \underbrace{(x \cdot x \cdots x)}_{m \text{ times}}}_{n \text{ times}}$$

$$= x^{mn}.$$

$$(2^3)^4 = 2^{12}$$

$$2^3 \cdot 2^3 \cdot 2^3 \cdot 2^3$$

$$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$$

**Exercise 1**

$(15^3)^9 =$ $15^{3 \cdot 9} = 15^{27}$

**Exercise 3**

$(3.4^{17})^4 =$ $3.4^{17 \cdot 4} = 3.4^{68}$

**Exercise 2**

$((-2)^5)^8 =$ $(-2)^{5 \cdot 8} = (-2)^{40}$

**Exercise 4**

Let $s$ be a number.

$(s^{17})^4 =$ $s^{17 \cdot 4} = s^{68}$

**Exercise 5**

Sarah wrote $(3^5)^7 = 3^{12}$. Correct her mistake. Write an exponential expression using a base of 3 and exponents of 5, 7 and 12 that would make her answer correct.

correct

$(3^5)^7 = 3^{5 \cdot 7} = 3^{35}$

Power Rule

$3^5 \cdot 3^7 = 3^{12}$

product Rule

For any numbers $x$ and $y$, and positive integer $n$,

$$(xy)^n = x^n y^n$$

because

$$(xy)^n = \underbrace{(xy) \cdots (xy)}_{n \text{ times}}$$

$$= \underbrace{(x \cdot x \cdots x)}_{n \text{ times}} \cdot \underbrace{(y \cdot y \cdots y)}_{n \text{ times}}$$

$$= x^n y^n.$$

Ex) $(3x^2)^4$

$3x^2 \cdot 3x^2 \cdot 3x^2 \cdot 3x^2$

$3 \cdot 3 \cdot 3 \cdot 3 \cdot x^2 \cdot x^2 \cdot x^2 \cdot x^2$

$3^4 x^8$

Ex) $(2x)^3 = 2x \cdot 2x \cdot 2x$

$= 2^3 x^3$

**Exercise 7**

$(11 \times 4)^9 = 11^9 \times 4^9$

$44^9$  OR

**Exercise 8**

$(3^2 \times 7^4)^5 = (3^2)^5 \times (7^4)^5$

$3^{10} \times 7^{20}$

**Exercise 9**

Let $a$, $b$, and $c$ be numbers.

$(3^2 a^4)^5 = (3^2)^5 (a^4)^5$

$3^{10} a^{20}$

**Exercise 10**

Let $x$ be a number.

$(5x)^7 = 5^7 x^7$

**Exercise 11**

Let $x$ and $y$ be numbers.

$(5xy^2)^7 = 5^7 x^7 (y^2)^7$

$5^7 x^7 y^{14}$

**Exercise 12**

Let $a$, $b$, and $c$ be numbers.

$(a^2 b c^3)^4 = (a^2)^4 b^4 (c^3)^4$

$a^8 b^4 c^{12}$

**Exercise 13**

Let $x$ and $y$ be numbers, $y \neq 0$, and let $n$ be a positive integer. How is $\left(\dfrac{x}{y}\right)^n$ related to $x^n$ and $y^n$?

$x = 1$
$y = 2$
$n = 3$

$$\left(\frac{1}{2}\right)^3 = \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = \frac{1^3}{2^3}$$

$$\left(\frac{4}{5}\right)^2 = \left(\frac{4}{5}\right)\left(\frac{4}{5}\right) = \frac{4^2}{5^2}$$

### Homework

Write each answer as a base raised to a power or as the product of bases raised to powers that is equivalent to the given one.

1.  $(9^3)^6 =$

2.  $(113^2 \times 37 \times 51^4)^3 =$

3.  Let $x, y, z$ be numbers. $(x^2yz^4)^3 =$

4. Let $x, y, z$ be numbers and let $m, n, p, q$ be positive integers. $(x^m y^n z^p)^q =$

5. $\dfrac{4^8}{5^8} =$

6. Show (prove) in detail why $(2 \cdot 3 \cdot 7)^4 = 2^4 3^4 7^4$.