

## The Zeroth Power

Thursday, September 6<sup>1</sup> – 5, 2016

### AIMS:

- ✓ SWBAT raise numbers to the zeroth power, and explain why the result is what it is.
- ✓ SWBAT use definitions to preserve the properties of exponents.

### AGENDA:

- I. Do Now (2 min)
- II. Open/Do Now Review (3 min)
- III. Class Notes: The Zeroth Power
- IV. Guided Practice
- V. Independent Practice
- VI. Sprint (IF TIME!)
- VII. Practicing our AIMS:
  - ✓ Exit Ticket (5 min)
  - ✓ Homework: ExPWN it! 4
- VIII. Close (2 min)

*Will your choices help us STRIVE?*

“There is  
NO SUBSTITUTE  
for HARD WORK.”

—THOMAS EDISON



**8<sup>th</sup> Grade  
Math**  
The Zeroth  
Power

Name: Key #:

Date: \_\_\_\_\_

Homeroom:  Cleveland State University



**EXPWN It! 4**

AIM(S):

- ✓ SWBAT raise numbers to the zeroth power, and explain why the result is what it is.
- ✓ SWBAT use definitions to preserve the properties of exponents.

**DO NOW**

Directions: Complete the following questions.

Fill in the other side of the equal sign for the rules of exponents we have learned:

We have shown that for any numbers  $x$ ,  $y$ , and any positive integers  $m$ ,  $n$ , the following holds:

- 1) Multiplying same bases

$$x^m \cdot x^n = x^{m+n}$$

- 2) Dividing same bases (when  $x \neq 0$ )

$$\frac{x^m}{x^n} = x^{m-n}$$

- 3) Power to a power

$$(x^m)^n = x^{m \cdot n}$$

- 4) Product to a power

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

- 5) Quotient to a power (when  $y \neq 0$ )

$$\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$$

## Class Notes: The Zeroth Power

Directions: Board Equals Paper!

Use What you Know!

What about...

$$x^0$$

Let's find out....

$$\frac{x^3}{x^3} = x^0 = 1$$

$$\frac{x^5}{x^5} = x^0 = 1$$

$$\frac{x^n}{x^n} = x^0 = 1$$

So  $x^0$  always equals 1

**NEW RULE:** A number raised to the zeroth power

$$x^0 = \underline{1}$$



### Why do these rules work with the zeroth power?

Check that  $x^m \cdot x^n = x^{m+n}$  is correct for the following cases knowing that  $x^0 = 1$ .

CASE A.  $m > 0$  and  $n = 0$

$$x^{m+0} = x^m \cdot 1 = x^m$$

CASE B.  $m = 0$  and  $n > 0$

$$x^{0+n} = x^n = x^n \cdot 1 = x^n$$

CASE C.  $m = n = 0$

$$x^{0+0} = 1 = 1 \cdot 1 = 1$$

Check that  $(x^m)^n = x^{m \cdot n}$  is correct for the following cases knowing that  $x^0 = 1$ .

CASE A.  $m > 0$  and  $n = 0$

$$(x^m)^0 = x^{m \cdot 0} = x^0 = 1$$

CASE B.  $m = 0$  and  $n > 0$

$$(x^0)^n = x^{0 \cdot n} = x^0 = 1$$

CASE C.  $m = n = 0$

$$(x^0)^0 = 1^0 = 1$$

Check that  $(xy)^n = x^n y^n$  is correct for the following cases knowing that  $x^0 = 1$ .

CASE A.  $m > 0$  and  $n = 0$

$$(xy)^0 = x^0 y^0 = 1 \cdot 1 = 1$$

CASE B.  $m = 0$  and  $n > 0$

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

CASE C.  $m = n = 0$

$$(xy)^0 = x^0 y^0 = 1 \cdot 1 = 1$$

## Guided Practice

Directions: Board=Paper!

1) Simplify the below expressions, showing each step.

a)  $(x^7 \cdot y^9)^0 =$

$$x^{7 \cdot 0} y^{9 \cdot 0} = x^0 y^0 = 1$$

b)  $\frac{1}{c^4} \cdot c^4$

$$\frac{c^4}{c^4} = 1$$

c)  $\left(\frac{5x^3y}{20xy^5}\right)^4$

~~$$\frac{5^4 x^{12} y^4}{20^4 x^4 y^{20}} = \frac{625 x^8 y^4}{160000 x^4 y^{20}}$$~~

$$\left(\frac{x^2}{4y^4}\right)^4 = \frac{x^8}{4^4 y^{16}}$$

## Independent Practice

Directions: Complete every question below! Do your best! When done, you may work on the  
ADVANCED WORK ONLY (not homework ☺)

1) Use the zeroth power rule to simplify the following expressions.

a)

$$2^0 \cdot 4 = 1 \cdot 4 = 4$$

b)

$$x^0 \cdot y^0 = 1$$

c)

$$\frac{8}{x^0} = \frac{8}{1} = 8$$

d)

$$\frac{15^{54}}{15^{54}} = 1$$

e)  $3^0 \cdot 3^0 = 1 \cdot 1 = 1$

f)  $X$

$$-(34c)^4$$

$$\left(\frac{x}{34c}\right)^4 \cdot \frac{x^4}{x^4} \cdot \frac{c^4}{c^4} = \frac{x^4}{34^4 c^4}$$

↓  
f: x

$$= \frac{1}{34^4}$$

Keep going! There are more challenges ahead!

2) Simplify the below expressions by first expanding them and cancelling, then writing the simplest exponential form for the expression.

$$a) \frac{2^4}{2^3} = \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot 2}{\cancel{2} \cdot \cancel{2} \cdot \cancel{2}} = 2$$

$$b) \frac{3^2 5^5}{3 \cdot 5^2} = \frac{\cancel{3} \cdot \cancel{3} \cdot \cancel{5} \cdot \cancel{5} \cdot \cancel{5} \cdot 5}{\cancel{3} \cdot \cancel{5} \cdot \cancel{5}} = 3 \cdot 5^3$$

$$c) \frac{x^8}{x^3} = \frac{\cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot x}{\cancel{x} \cdot \cancel{x} \cdot \cancel{x}} = x^5$$

$$d) \frac{2^3 x^3 y^4}{2 \cdot xy^2 z} = \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot \cancel{x} \cdot \cancel{x} \cdot \cancel{x} \cdot \cancel{y} \cdot \cancel{y} \cdot \cancel{y} \cdot y}{\cancel{2} \cdot \cancel{x} \cdot \cancel{y} \cdot \cancel{y} \cdot z} = \frac{2^2 x^2 y^2}{z}$$

3) Explain why you can **subtract** exponents when you are dividing two things with the same base.

We subtract the exponents because we are cancelling common factors, so we cancel as many as they share: finding the difference.

KEEP GOING!



4) Simplify the following expressions, and put them in exponential form

$$\frac{a^8}{a^3} \quad a^5$$

$$\frac{7^{11}}{7^8} \quad 7^3$$

$$\frac{7 \cdot b^5}{b^4} \quad 7b$$

$$\frac{x^{10}}{x^4} \quad x^6$$

$$\frac{12 \cdot g^8 \cdot h^4}{g^3 \cdot h^5} \quad \frac{12g^5}{h}$$

$$\frac{4 \cdot p^{11}}{8 \cdot p^6} \quad \frac{p^5}{2}$$

$$\frac{c^9}{6c^4} \quad \frac{c^5}{6}$$

$$\frac{2 \cdot x^3 y^8}{4 \cdot y^2} \quad \frac{x^3 y^6}{2}$$

$$\frac{3x^{14} y^{11}}{18x^2} \quad \frac{x^{12} y^{11}}{6}$$

$$\frac{x^5 y^6}{xy^2} \quad x^4 y^4$$

$$\frac{x^2 y^5}{xy^4} \quad xy$$

$$\left( \frac{4x^5 y}{16xy^4} \right)^3 \quad \frac{x^{12}}{4^3 y^9}$$

5) Simplify each expression using the exponent rules.

1.  $3 \cdot 4^3$  ← simplified already!

2.  $4x^3 \cdot 2x^3$   $2^3 x^6$

3.  $x^5 \cdot x^3$   $x^8$

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

5.  $\frac{6^5}{6^3}$   $6^2$

6.  $\frac{x^4}{x^7}$   $\frac{1}{x^3}$

7.  $8^0$   $1$

8.  $-(9x)^0$   $-1$

9.  $(y^4)^3$   $y^{12}$

10.  $(x^2 y)^4$   $x^8 y^4$

11.  $\frac{6x^7}{2x^4}$   $3x^3$

12.  $\frac{8x^5}{4x^2}$   $2x^3$



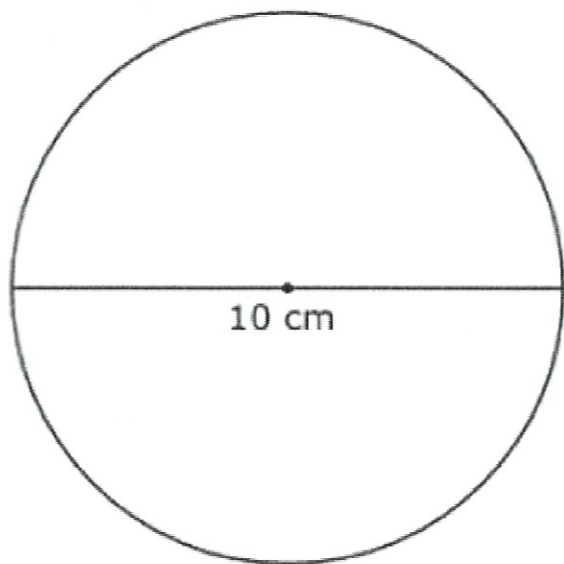
### 8<sup>th</sup> Grade Math Advanced Work (Due 9/2/16)

Directions: Complete this for dollars! Turn in advanced work with your homework.

Name: \_\_\_\_\_ #: \_\_\_\_\_ HR: \_\_\_\_\_

1)

A circle is shown.



What is the circumference of the circle, to the nearest tenth of a centimeter?

2)

A bowling alley charges  $x$  dollars per guest and a fixed \$50 rental fee for parties.

Which equation represents the total cost,  $y$ , for 9 guests?

- (A)  $y = 9x$
- (B)  $y = 9x + 41$
- (C)  $y = 9x + 50$
- (D)  $y = 50x + 9$



Name and Number:

Is this a re-submit? \_\_\_\_\_

Ms. Huber  
614-859-0019  
Mshubersmath.weebly.com



# HOMework

## 8<sup>th</sup> Grade Math

ExPWN it! 4  
The Zeroth Power

\_\_\_\_\_/ 5 = \_\_\_\_\_% DNG  
A      B      C      D      F

STRIVE Due Date:  
9/2/16

Accepted Until:  
9/9/16

ate:

Class:

Directions: Complete all of the below problems (FRONT AND BACK). If you have questions, first check the examples in your packet. Then, check the class website or ask a classmate or guardian for help. Then, you can call your teacher if you still have questions.

1) Let  $x, y$  be numbers and  $(x, y \neq 0)$ . Simplify each of the following expressions,

**SHOWING EACH STEP!**

a)  $\frac{y^{12}}{y^{12}} =$

b)  $9^{15} \cdot \frac{1}{9^{15}} =$

c)  $(7(432.25749003)^4)^0$

d)  $2^2 \cdot \frac{1}{2^5} \cdot 2^5 \cdot \frac{1}{2^2}$

e)  $\frac{x^{41}}{y^{15}} \cdot \frac{y^{15}}{x^{41}}$

**FLIP OVER!**



Directions: Choose the correct answer choice for each question.

2)  $\frac{x^{10}}{x^{10}} y =$

- (A)  $xy$
- (B)  $y$
- (C)  $0$
- (D)  $1$

3)  $(7^4)^0 7 =$

- (A)  $49$
- (B)  $7^4$
- (C)  $7^0$
- (D)  $7$

4)  $\frac{5^2}{2^5} 6 \cdot \frac{2^5}{5^2} =$

- (A)  $6$
- (B)  $1$
- (C)  $60$
- (D)  $12$

5)  $\frac{13^{10}}{13^{10}} \cdot 13^0 \cdot 13^4$

- (A)  $13^{40}$
- (B)  $13^4$
- (C)  $13^0$
- (D)  $1$

6) If  $n$  is  $> 0$  and  $m = 0$ , then  $x^n x^m =$

\_\_\_\_\_.

- (A)  $1$
- (B)  $x^n$
- (C)  $0$
- (D) Always a fraction

Name and Number:

Ms. Huber



# Exit Ticket

## 8<sup>th</sup> Grade Math

Date:

ExpWN it! 4

The Zeroth Power

\_\_\_\_ / 5 = \_\_\_\_ % DNG

Class:

A      B      C      D      F

Directions: Complete all of the below problems. Do not use notes. This is an independent task, so you may not get help from your teacher either. Try your best! Work on Advanced work when done.

1. Simplify the following expression as much as possible:

$$\frac{4^{10}}{4^{10}} \cdot 7^0 =$$

2. Let  $a$  and  $b$  be two numbers. Use the distributive law and then the definition of zeroth power to show that the numbers  $(a^0 + b^0)b^0$  and  $(a^0 + b^0)a^0$  are equal.

Reflect on your **understanding** of **TODAY'S LESSON**, and circle the most true statement

I don't get it at all

I just need some help

I understand

I could teach it!

Reflect on your **effort** in **TODAY'S CLASS**, and circle the most true statement

I wasn't working hard today

I was trying but off-task a little

I was on task

I was laser-focused on learning

**SPRINT! (IF TIME!)**

Directions: On a sprint, we practice our math facts for one minute. Then, we STOP, even if we're not done, so we can track our progress!

Find the value of  $x$  to balance the equation.

1) $x^3 = 343$  $x =$ _____	2) $1024 = 2^x$  $x =$ _____	3) $512 = x^3$  $x =$ _____
4) $729 = 3^x$  $x =$ _____	5) $225 = x^2$  $x =$ _____	6) $x^3 = 1331$  $x =$ _____
7) $x^2 = 196$  $x =$ _____	8) $625 = x^4$  $x =$ _____	9) $1024 = 4^x$  $x =$ _____
10) $32 = 2^x$  $x =$ _____	11) $x^3 = 729$  $x =$ _____	12) $1728 = x^3$  $x =$ _____
13) $x^4 = 1296$  $x =$ _____	14) $1000 = x^3$  $x =$ _____	15) $256 = 2^x$  $x =$ _____
16) $243 = 3^x$  $x =$ _____	17) $x^2 = 169$  $x =$ _____	18) $216 = x^3$  $x =$ _____
19) $64 = x^2$  $x =$ _____	20) $125 = 5^x$  $x =$ _____	21) $x^2 = 49$  $x =$ _____