

Warmup 10/  $\left(\frac{28}{2} + \frac{28}{4} + \frac{28}{7} + \frac{28}{14} + \frac{28}{28}\right)$

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**No calculator allowed!!!**

- 1) Guess: what do you think  $7^7$  is?
- 2) Guess: what do you think  $3^{20}$  is?
- 3) Guess: what do you think  $2^0$  is?
- 4) Guess: what do you think  $4^{-2}$  is?



Going over the Quiz: End of class if time!

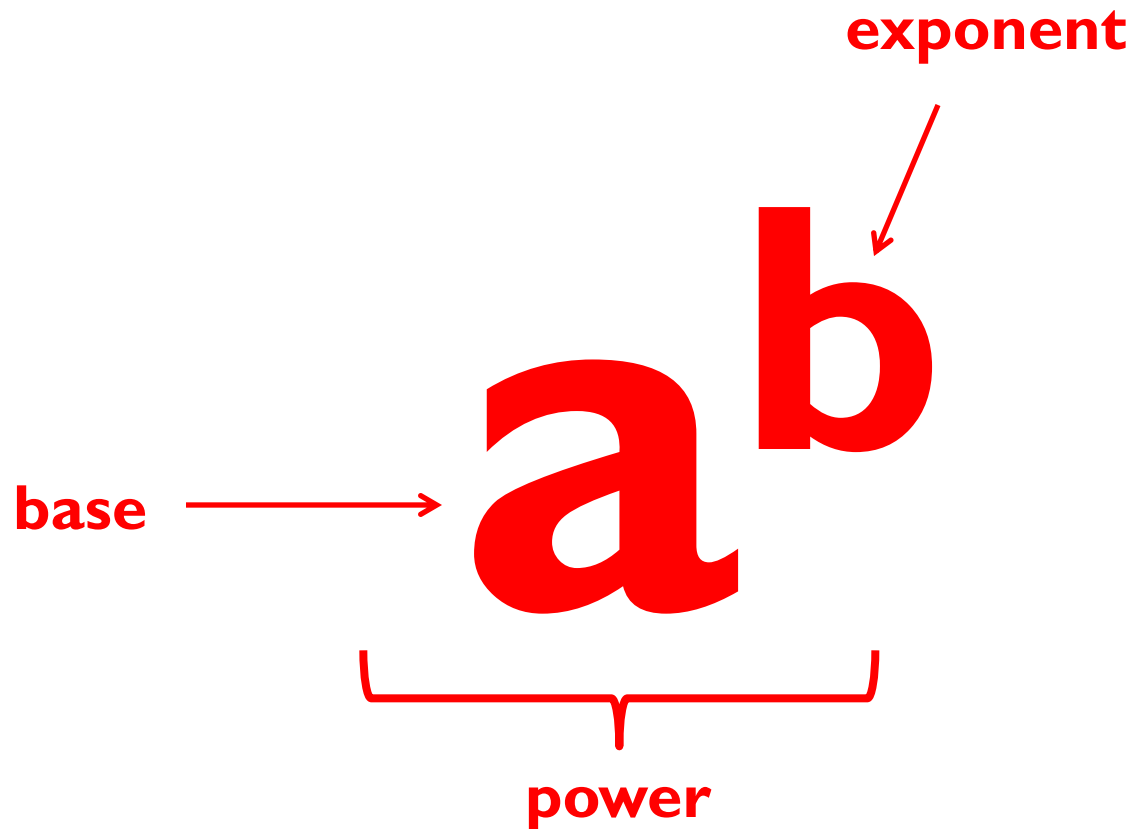
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# Vocab

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**“squared” = to the 2<sup>nd</sup> power**

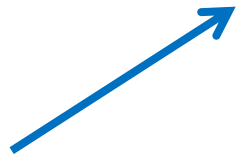
**“cubed” = to the 3<sup>rd</sup> power**

What is the number “out in front” called?

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$$7x^3$$

Coefficient



# Evaluate means “find the value of”...

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Evaluate the following:

1.  $5^4$

$5 \cdot 5 \cdot 5 \cdot 5$

$625$

2.  $2^7 + 2^2$

$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 + 2 \cdot 2 \rightarrow 128 + 4 \rightarrow 132$

3.  $(-3)^4$

$-3 \cdot -3 \cdot -3 \cdot -3$

$81$

4.  $(-4)^4$

$-4 \cdot -4 \cdot -4 \cdot -4$

$256$

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# What is the difference here?

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$$(-3)^2$$

vs.

$$-3^2$$

$$-3 \cdot -3$$

$$\boxed{9}$$

$$\downarrow$$
$$-(3^2)$$

$$\downarrow$$
$$-(3 \cdot 3)$$

$$\downarrow$$
$$\boxed{-9}$$



# IMPORTANT

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- ▶ When you plug a negative number in for  $x$  always put it in parentheses!!!
- ▶ Ex: Plug in  $-2$  into  $x^2$  and it would be  $(-2)^2$  NOT  $-2^2$





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## Evaluate the following

1.  $x^3$  for  $x = -2$      $(-2)^3$      $\boxed{-8}$

2.  $x^5$  for  $x = 3$      $3^5$      $\boxed{243}$

3.  $-5^2$      $-(5^2)$      $\boxed{-25}$

4.  $(-2)^7$      $\boxed{-128}$



# Finding a pattern

- ▶ Find a pattern and use it to complete the table:

Exponential Form	Standard Form
$2^5$	32
$2^4$	16
$2^3$	8
$2^2$	4
$2^1$	2
$2^0$	1
$2^{-1}$	$\frac{1}{2}$
$2^{-2}$	$\frac{1}{4}$
$2^{-3}$	$\frac{1}{8}$

Handwritten notes:  $\div 2$  (with arrows) between rows, and  $\div 2$  etc. next to the  $2^0$  row.

# Finding a pattern

- ▶ Find a pattern and use it to complete the table:

Exponential Form	Standard Form
$3^5$	243
$3^4$	81
$3^3$	27
$3^2$	9
$3^1$	3
$3^0$	$\frac{1}{1}$
$3^{-1}$	$\frac{1}{3}$
$3^{-2}$	$\frac{1}{9}$
$3^{-3}$	$\frac{1}{27}$

Handwritten notes:  $\div 3$  (with arrows pointing from 9 to 3, 3 to  $\frac{1}{3}$ , and  $\frac{1}{3}$  to  $\frac{1}{9}$ ), and  $\div 3$  etc.

The Rule:

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## Zero Exponents:

▶ Anything to the zero power is 1!

### Examples

1)  $9^0$

2)  $k^0$

3)  $\left(\frac{8x^3y^2}{0.27abc} + 12.5q\right)^0$

4)  $\frac{a^6}{a^6}$



# Examples

1.  $9^0$



2.  $k^0$



3.  $\left(\frac{3}{8}q\right)^0$



4.  $(5x)^0$



5.  $5x^0$

$5 \cdot 1 \rightarrow$  

▶ Examples – Zero Exponents

# The Rule:

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## Negative Exponents:

Rule:  $x^{-n} = \frac{1}{x^n}$

- ▶ Negative exponent: 1 over the same power with a positive exponent



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Basically...

▶ **NEGATIVE  
EXPONENTS =  
DIVIDING!!!**



» Any time you expand a power, there is really an “invisible 1” being multiplied by everything.

$$3^4 = 1 \cdot 3 \cdot 3 \cdot 3 \cdot 3$$

The “invisible 1”





## » POSITIVE EXPONENTS:

> Are 1 TIMES the base that many times

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

## » NEGATIVE EXPONENTS:

> Are 1 DIVIDED BY the base that many times

$$> 2^{-4} = 1 \div 2 \div 2 \div 2 \div 2$$

$$= \frac{1}{2 \cdot 2 \cdot 2 \cdot 2}$$

$$= \frac{1}{2^4}$$

## » ZERO EXPONENTS:

> Are the 1 not multiplied or divided by anything

$$> 2^0 = 1$$



Evaluate:

$$1) 4^{-2} \rightarrow \frac{1}{4^2} \rightarrow \boxed{\frac{1}{16}}$$

$$2) (-2)^{-3} \rightarrow \frac{1}{(-2)^3} \rightarrow \boxed{\frac{1}{-8}}$$

$$3) 10^{-3} \rightarrow \frac{1}{10^3} \rightarrow \boxed{\frac{1}{1000}}$$

$$4) 2^{-4} \rightarrow \frac{1}{2^4} \rightarrow \boxed{\frac{1}{16}}$$

$$5) (-7)^{-1} \rightarrow \frac{1}{(-7)^1} = \boxed{-\frac{1}{7}}$$

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► Write each using negative exponents:

6)  $\frac{1}{8^3}$        $8^{-3}$

7)  $\frac{1}{c^5}$        $c^{-5}$

8)  $\frac{1}{16}$        $4^{-2}$  or  $2^{-4}$  or  $16^{-1}$

9)  $\frac{1}{27}$        $3^{-3}$  or  $27^{-1}$

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Simplify:

$$10) x^{-2} \rightarrow \frac{1}{x^2}$$

$$11) \frac{1}{x^{-2}} \rightarrow x^2$$

$$12) a^{-3} \rightarrow \frac{1}{a^3}$$

$$13) \frac{1}{a^{-3}} \rightarrow a^3$$





Homework



Worksheet