You'll need your calculators today. Warm Up on the problems below.

Classwork - Write and evaluate expressions involving powers and exponents

Warm Up - Evaluate each expression if a = 4, b = -6, and c = -2

A) 3a - 16

$3(4) - 16$

$12 - 16$

-4

B) 11 - 2b - c

$11 - 2(-6) - (-2)$

$11 + 12 + 2$

25

C) ab -10

$4(-6) - 10$

$-24 - 10$

-34

D) 5(a - 6) + bc

$5(4 - 6) + (-6)(-2)$

$5(-2) + (-6)(-2)$

$-10 + 12$

2

Real-World Link

Savings Yogi decided to start saving money by putting a penny in his piggy bank, then doubling the amount he saves each week. Use the questions below to find how much money Yogi will save in 8 weeks.

1. Complete the table below to find the amount Yogi saved each week and the total amount in his piggy bank.

Week	0	1	2	3	4	5	6
Weekly Savings	1¢	2¢					
Total Savings	1¢	3¢					

2. How many 2s are multiplied to find his savings in Week 4? ☐

   Week 5? ☐

3. How much money will Yogi save in Week 8? _____

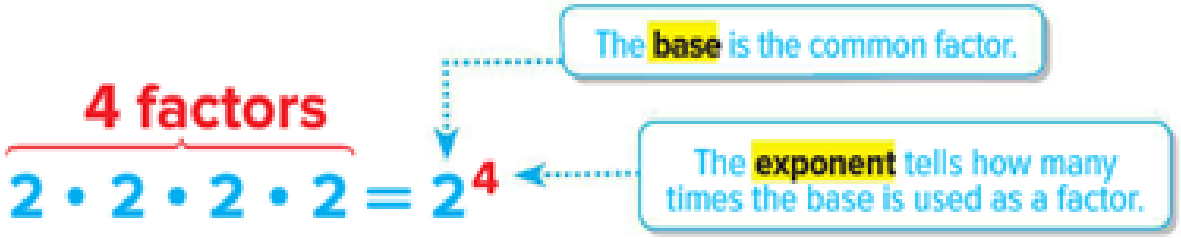
4. Continue the table to find when he will have enough to buy a pair of shoes for $80. _____

Week	7	8	9	10	11	12
Weekly Savings						
Total Savings						

Write and Evaluate Powers

p16

A product of repeated factors can be expressed as a **power**, that is, using an exponent and a base.



Powers are read in a certain way.

Read and Write Powers		
Power	**Words**	**Factors**
3^1	3 to the first power	3
3^2	3 to the second power or 3 squared	3 • 3
3^3	3 to the third power or 3 cubed	3 • 3 • 3
3^4	3 to the fourth power or 3 to the fourth	3 • 3 • 3 • 3
⋮	⋮	⋮
3^n	3 to the nth power or 3 to the nth	$\underbrace{3 \cdot 3 \cdot 3 \cdot \ldots \cdot 3}_{n \text{ factors}}$

Examples

Tutor

Write each expression using exponents.

1. $(-2) \cdot (-2) \cdot (-2) \cdot 3 \cdot 3 \cdot 3 \cdot 3$

The base -2 is a factor 3 times, and the base 3 is a factor 4 times.

$(-2) \cdot (-2) \cdot (-2) \cdot 3 \cdot 3 \cdot 3 \cdot 3 = (-2)^3 \cdot 3^4$

$(-2)^4 = 16$

$-2^4 = -16$

2. $a \cdot b \cdot b \cdot a \cdot b$

Use the properties of operations to rewrite and group like bases together. The base a is a factor 2 times, and the base b is a factor 3 times.

$a \cdot b \cdot b \cdot a \cdot b = a \cdot a \cdot b \cdot b \cdot b$

$= a^2 \cdot b^3$

$a^2 b^3$

$-1 \cdot 2 \cdot 2 - 2 \cdot 2$

Got it? **Do these problems to find out.**

a. $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}$

$\left(\frac{1}{2}\right)^4$

b. $4 \cdot 4 \cdot 4 \cdot 5 \cdot 5$

$4^3 \cdot 5^2$

c. $m \cdot m \cdot n \cdot n \cdot m$

$m^3 n^2$

Example

3. Evaluate $\left(-\frac{2}{3}\right)^4$.

$$\left(-\frac{2}{3}\right)^4 = \left(-\frac{2}{3}\right) \cdot \left(-\frac{2}{3}\right) \cdot \left(-\frac{2}{3}\right) \cdot \left(-\frac{2}{3}\right)$$ Write the power as a product.

$$= \frac{16}{81}$$ Multiply.

$(-2)^4 \rightarrow (-2)(-2)(-2)(-2) = 16$

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

$4(-2) = -8$

Got it? Do these problems to find out.

d. 4^4 256

e. $(-2)^6$ 64

f. $\left(\frac{1}{5}\right)^3$ $\frac{1}{125}$

$\frac{1^3}{5^3} = \frac{1}{125}$