



Grade 8

NUMBER SENSE AND NUMERATION: EXPONENTS

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1. Fill in the chart.

Power	Base	Exponent	Value
10^2			
4^3			
3^1			
9^0			
7^5			
1^{12}			

Recall some of the rules of exponents:

- $x^0 = 1, x \neq 0$
- $x^1 = x$
- $x^m \times x^n = x^{m+n}$
- $x^m \div x^n = x^{m-n}, x \neq 0$
- $(x^m)^n = x^{m \times n}$

2. Write in exponential form.

- a. $5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5$ b. $7 \times 7 \times 7 \times 7 \times 7$
 c. 3 d. $2 \times 2 \times 2 \times 3 \times 3$
 e. $11 \times 11 \times 11 \times 11 \times 11 \times 7 \times 7 \times 7 \times 7$ f. $3 \times 3 \times 5 \times 5 \times 5 \times 13 \times 13 \times 13 \times 13$

3. Complete these patterns, then rewrite them in exponential form.

- a. 2, 4, 8, 16, _____, _____, _____
 b. 3, 27, 243, _____, _____, _____
 c. 15 625, 3125, 625, _____, _____, _____
 d. $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8},$ _____, _____, _____

4. Simplify.

Leave the answer in exponential form.

- a. $4^{12} \times 4^3$ b. $8^9 \times 8^5$
 c. $5^7 \times 5^2$ d. $2^{15} \div 2^8$
 e. $4^8 \div 4^2$ f. $10^9 \div 10^3$
 g. $(13^4)^5$ h. $(101^7)^3$

Did You Know?

Descartes is known as the inventor of the exponent notation:

$$\begin{array}{c} \text{Exponent} \curvearrowright \\ x^m = z \\ \text{Base} \curvearrowleft \end{array}$$

5. Rewrite and leave the answer in the exponential form a^b .

- a. $(2^3)^2$ b. $(4^3)^5$ c. $(23^3)^1$ d. $(5^9)^3$

6. Write each of the following as a single power.

a. $b^a \times b^b$

b. $a^a \div a^b$

c. $a^a \div a^a$

d. $((ab)^a)^b$

7. Write the expression in exponential form as a single power, then evaluate for $a = 3$ and $b = 2$.

a. $b^a \times b^a$

b. $a^b \div a^a$

c. $(a^a)^b$

d. $((4a \div b^2)^a)^b$

8. Determine the value of the following expressions.

a. $5^2 \div (12 - 7)$

b. $12 + (16 \div 4) - 8^2$

c. $\frac{(13 - 5)^2 \div 4}{8 + 3^2}$

d. $\frac{6^2 - 4 \times 3}{2^2 - 8}$

e. $\left(1 + \frac{1}{2}\right)^2 - \frac{25 \div 5}{2}$

f. $6 \times \left(3 + \left(\frac{7}{4} - \frac{6}{8}\right) \times 4\right)^3$



9. Add a pair of brackets to make each statement true.

a. $4 \times 2^2 \div 8 \div 4 = 8$

b. $4 \times 4^2 \div 8 \div 4 = 32$

c. $4 \times 4^2 \div 8 \div 2 = 4$

10. Arman is driving a vehicle with a mass of 10^3 kg alongside a transport truck that has a mass of 10^5 kg. How many times greater is the mass of the transport truck than the mass of Arman's vehicle?

11. My rich uncle gave me a dollar for my 3rd birthday. On each birthday after that, he tripled his previous gift.

a. How much money did I receive from my uncle on my 12th birthday?

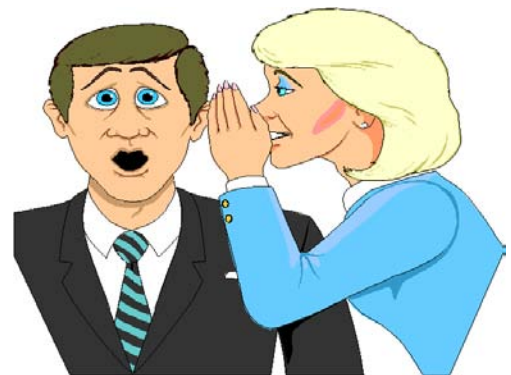
b. How much money would I have received from my uncle in total including my 12th birthday?

CHALLENGE YOURSELF!

12. In a game of "Pass it on", every person that receives a hidden message must then retell that message to three people who have not heard the message in four minutes. The game begins with a person making up a hidden message.

a. Write the number of people that would know the message after an hour. Express your answer in exponential form.

b. There are approximately 6.2 billion people on the Earth. How long would it take before everyone on Earth knew the message?



13. Ramone spilled a large bucket of water onto his driveway to rinse it out. The water from the bucket covered twice as much area every 2 seconds after it initially hit the ground. After 20 seconds, the whole driveway was covered. How long did it take the water to cover half of Ramone's driveway?

TRY THIS!

Try the Exponents quiz a couple of times

http://www.softschools.com/quiz_time/math/exponents/theme6.html

You could also go to www.wiredmath.ca for the link



EXTENSIONS

14. Determine the value of the following, if $a^b = 3$

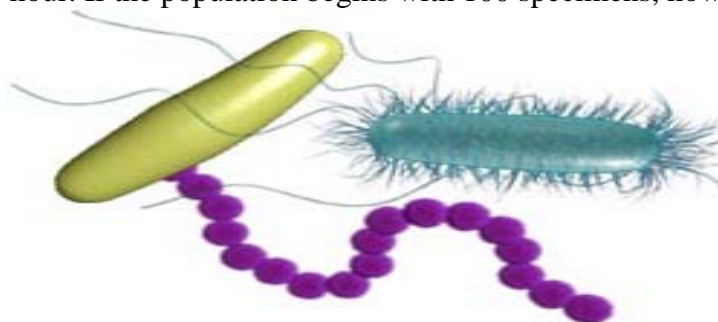
a. $a^{4b} - 5$

b. $15 - a^b \times a^{5b}$

c. $4a^{5b} - 9a^{3b}$

d. $\frac{17a^{4b}}{a^b + a^{3b}}$

15. A population of bacteria grows by 35% every hour. If the population begins with 100 specimens, how many are there after 6 hours?



16. a. A fully inflated beachball loses 6% of its air every day. If the beachball originally contains 4000 cubic centimeters of air, how many cubic centimeters of air are left after 10 days, to the nearest tenth of a cubic centimeter?
- b. Estimate the number of days it takes until the beach ball has half of its original volume.