Name: Key	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
Exponents	In the case of repeated multiplication with the same number, we can rewrite the expression using **exponents.** For example: $4 \cdot 4 \cdot 4 = 4^3$ **Parts of an exponential expression:** base → x^n ← power **Read as:** x to the n^{th} power

Examples

Directions: Write each expression using exponents, then evaluate (if possible).

	Expanded Notation	Exponential Expression	Value
1.	$11 \cdot 11$	11^2	121
2.	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	2^7	64
3.	$(-5) \cdot (-5) \cdot (-5) \cdot (-5)$	$(-5)^4$	625
4.	$\left(\frac{1}{4}\right) \cdot \left(\frac{1}{4}\right) \cdot \left(\frac{1}{4}\right)$	$\left(\frac{1}{4}\right)^3$	$\frac{1}{64}$
5.	$7 \cdot 7 \cdot 4 \cdot 4 \cdot 4$	$7^2 \cdot 4^3$	3136
6.	$8 \cdot (-2) \cdot (-2) \cdot 8 \cdot (-2) \cdot 8 \cdot 8$	$8^4 \cdot (-2)^3$	$-32,768$
7.	$\left(\frac{2}{3}\right) \cdot 9 \cdot \left(\frac{2}{3}\right) \cdot 9$	$9^2 \cdot \left(\frac{2}{3}\right)^2$	36
8.	$a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a$	a^9	
9.	$xy \cdot xy \cdot xy \cdot xy \cdot xy$	$(xy)^5$	$x^5 y^5$
10.	$r \cdot s \cdot s \cdot s \cdot t \cdot s \cdot t \cdot t \cdot s \cdot r$	$r^2 s^5 t^3$	
11.	$k \cdot 9 \cdot k \cdot k \cdot 9 \cdot k \cdot k \cdot k \cdot 9$	$9^3 k^6$	$729k^6$
12.	$(-7) \cdot m \cdot m \cdot n \cdot m \cdot (-7) \cdot n$	$(-7)^2 m^3 n^2$	$49m^3n^2$
13.	$(p-2) \cdot (p-2) \cdot (p-2)$	$(p-2)^3$	
14.	$(a+b) \cdot 6 \cdot 6 \cdot (a+b) \cdot 6$	$6^3 (a+b)^2$	$216(a+b)^2$

5
5
49
×64
196
2940
3136

2
64
×64
256
3840
4096

4096

Zero Exponent

Any number, except 0, raised to the zero power is defined as 1.

$1^0 = 1$ $2^0 = 1$ $3^0 = 1$ $4^0 = 1$ $x^0 = 1$ $(x \neq 0)$

Negative Exponent

Negative Exponent Rule: $x^{-n} = \frac{1}{x^n}$ (if $x \neq 0$)

Examples

Directions: Write each expression using positive exponents, then evaluate (if possible).

15. 5^{-2} $\frac{1}{5^2} = \frac{1}{25}$

16. 8^{-2} $\frac{1}{8^2} = \frac{1}{64}$

17. 9^{-1} $\frac{1}{9^1} = \frac{1}{9}$

18. 4^{-4} $\frac{1}{4^4} = \frac{1}{256}$

19. 10^{-3} $\frac{1}{10^3} = \frac{1}{1000}$

20. 2^{-7} $\frac{1}{2^7} = \frac{1}{64}$

21. $4^{-3} \cdot 7^{-1}$ $\frac{1}{4^3 \cdot 7^1} = \frac{1}{448}$

22. $5^{-4} \cdot 3^{-2}$ $\frac{1}{5^4 \cdot 3^2} = \frac{1}{5{,}625}$

23. $3^4 \cdot 9^{-2}$ $\frac{3^4}{9^2} = \frac{81}{81} = 1$

24. $8^{-3} \cdot 10^2 \cdot 4^0$ $\frac{10^2 \cdot 1}{8^3} = \frac{100}{512} = \frac{25}{128}$

25. x^{-9} $\frac{1}{x^9}$

26. a^{-4} $\frac{1}{a^4}$

27. $r^{-6} s^0 t^{11}$ $\frac{t^{11}}{r^6}$

28. $3^{-3} m^{-4} n^5$ $\frac{n^5}{3^3 m^4} = \frac{n^5}{27m^4}$

Summary: