Exponent Rules Pattern Investigation

(1)

2/24

(name / date / period)

Remember

Identify the base in 4^3. What information does it give you?

4

Identify the exponent in 4^3. What information does it give you?

3

Understand

Explain how 2^3 different from $2 \cdot 3$?

$2 \cdot 2 \cdot 2 = 8$

$2 \cdot 3 \quad 6$

Analyze and Create: Write the **Problem** expression in **E•x•p•a•n•d•e•d F•o•r•m**, then simplify the expression by writing the correct **Exponential Form**. At the bottom of each section, write a rule explaining to other people how to simply expressions with many exponents.

Multiplying Numbers with Exponents

Problem	E•x•p•a•n•d•e•d F•o•r•m	Exponential Form
1. $2^2 \cdot 2^3$	$\underline{2 \cdot 2} \cdot \underline{2 \cdot 2 \cdot 2}$	2^5
2. $3^4 \cdot 3^2$	$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$	3^6
3. $4^2 \cdot 4^5$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$	4^7
4. $5^2 \cdot 5^4 \cdot 5^3$	$5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5$	5^9
5. $(10^3)(10)$	$10 \cdot 10 \cdot 10 \cdot 10$	10^4
6. $(10^5)(10^3)(10^2)$	$10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$	10^{10}
7. $(x^2)(x^3)$	$x \cdot x \cdot x \cdot x \cdot x$	x^5
8. $(p^4)(p^5)(p)$	$p \cdot p \cdot p \cdot p \cdot p \cdot p \cdot p \cdot p \cdot p$	p^{10}

Look at the original exponents in the **Problem** *and the exponents in the* **Exponential Form**. *Write the rule for multiplying numbers with integer exponents:*

Same base - add exponents when multiplying

Exponents Raised to an Exponent (a.k.a. Power to a Power)

Problem	E•x•p•a•n•d•e•d F•o•r•m	Exponential Form
1. $(2^3)^2$	$2^3 \cdot 2^3 = \underline{2 \cdot 2 \cdot 2} \cdot \underline{2 \cdot 2 \cdot 2}$	2^6
2. $(2^2)^3$	$2^2 \cdot 2^2 \cdot 2^2 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	2^6
3. $(2^2)^4$	$2^2 \cdot 2^2 \cdot 2^2 \cdot 2^2 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	2^8
4. $(2^3)^3$	$2^3 \cdot 2^3 \cdot 2^3 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	2^9
5. $(2^2)^4$	$2^2 \cdot 2^2 \cdot 2^2 \cdot 2^2 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$	2^8
6. $(a^5)^2$	$a^5 \cdot a^5 = a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a \cdot a$	a^{10}
7. $(w^5)^3$	$w^5 \cdot w^5 \cdot w^5 = w \cdot w \cdot w \cdot w \cdot w \cdot w \cdot w \cdot w \cdot w \cdot w \cdot w \cdot w \cdot w \cdot w \cdot w$	w^{15}
8. $(g^5)^3$	$g^5 \cdot g^5 \cdot g^5 = g \cdot g \cdot g \cdot g \cdot g \cdot g \cdot g \cdot g \cdot g \cdot g \cdot g \cdot g \cdot g \cdot g \cdot g$	g^{15}

Look at the original exponents in the **Problem** *and the exponents in the* **Exponential Form**. *Write the rule for an exponent raised to an exponent:*

Power to a power you multiply the exponents

Dividing Numbers with Exponents

Problem	E•x•p•a•n•d•e•d F•o•r•m	Exponential Form
1. $2^5 \div 2^2 = \frac{2^5}{2^2}$	$\frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2}$	2^3
2. $4^6 \div 4^2 = \frac{4^6}{4^2}$	$\frac{4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4}{4 \cdot 4}$	4^4
3. $5^6 \div 5^2 = \frac{5^6}{5^2}$	$\frac{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5}$	5^4
4. $3^5 \div 3^3 = \frac{3^5}{3^3}$	$\frac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{3 \cdot 3 \cdot 3}$	3^2
5. $10^7 \div 10^4 = \frac{10^7}{10^4}$	$\frac{10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10}{10 \cdot 10 \cdot 10 \cdot 10}$	10^3
6. $r^4 \div r^2 = \frac{r^4}{r^2}$	$\frac{r \cdot r \cdot r \cdot r}{r \cdot r} =$	r^2
7. $s^7 \div s^3 = \frac{s^7}{s^3}$	$\frac{s \cdot s \cdot s \cdot s \cdot s \cdot s \cdot s}{s \cdot s \cdot s}$	s^4
8. $m^{10} \div m^3 = \frac{m^{10}}{m^3}$	$\frac{m \cdot m \cdot m \cdot m \cdot m \cdot m \cdot m \cdot m \cdot m \cdot m}{m \cdot m \cdot m}$	m^7

Look at the original exponents in the **Problem** *and the exponents in the* **Exponential Form**. *Write the rule for dividing numbers with integer exponents:*

Dividing numbers with exponents, you subtract the exponents

Create and Evaluate

Rewrite your rule for multiplying numbers with exponents.

Add exponents

Which rule is the same as your rule?

A. $x^a \cdot x^b = x^{a+b}$
B. $\frac{x^a}{x^b} = x^{a-b}$
C. $(x^a)^b = x^{a \cdot b}$

Rewrite your rule for a power raised to a power.

Multiply

Which rule is the same as your rule?

A. $\frac{x^a}{x^b} = x^{a-b}$
B. $(x^a)^b = x^{a \cdot b}$
C. $x^a \cdot x^b = x^{a+b}$

Rewrite your rule for dividing numbers with exponents.

Subtract

Which rule is the same as your rule?

A. $x^a \cdot x^b = x^{a+b}$
B. $(x^a)^b = x^{a \cdot b}$
C. $\frac{x^a}{x^b} = x^{a-b}$

Algebra 1 Show all work Name_____ ID: 1

At home exponent review

Date_____ Period____

Simplify. Your answer should contain only positive exponents.

3 problems a day for 10 days

1) $2 \cdot 2^2$

A) 2^4 B) 2
C) 2^7 D) 2^3

2) $2 \cdot 2^3$

A) 2^6 B) 2^5
C) 2^4 D) 2^3

3) $2 \cdot 2^4$

A) 2^3 B) 2^5
C) 2^7 D) 2^6

4) $n^2 n^2$

A) $12n^7$ B) $4n^4$
C) n^4 D) $16n^4$

5) $k^3 \cdot 3k$

A) k B) $3k^4$
C) $12k^8$ D) $8k^7$

6) $x^2y^3 \cdot 3y^3 \cdot 3yx^3$

A) $8x^2y^5$ B) $8x^4y$
C) $9x^5y^7$ D) $4x^5y^5$

7) $3 \cdot 3^4$

A) 3^7 B) 3^9
C) 3^5 D) 3^8

8) $2^3 \cdot 2^2$

A) 2^9 B) 2^4
C) 2^{10} D) 2^5

9) $3x^0y^3 \cdot y^4$

A) $6x^4$ B) $6y^5x^4$
C) $3y^7$ D) $4x^4$

10) $(4^3)^3$

A) $\frac{1}{4^2}$ B) 4^9
C) 4^8 D) 4^{12}

11) $(4^4)^0$

A) 4^6 B) 1
C) 4^8 D) $\frac{1}{4^4}$

12) $(4^{-3})^0$

A) 4^8 B) 4^4
C) $\frac{1}{4^{16}}$ D) 1

13) $3r^4 \cdot 4r^2$

A) $8r^3$ B) $12r^4$
C) $12r^6$ D) $4r^4$

14) b^3b^4

A) $4b^5$ B) b^7
C) $3b^7$ D) $12b^3$

15) $3n^2 \cdot 2n^3 \cdot 2n^2$

A) $12n^7$ B) $4n^8$
C) $3n^5$ D) $12n^2$

16) $2b^4 \cdot b^2$

A) $2b^6$ B) $12b^6$
C) $8b^3$ D) $2b^3$

Dividing Numbers with Exponents

Problem	Expanded Form	Exponential Form
1. $2^5 \div 2^2 = \frac{2^5}{2^2}$	$\frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2}$	2^3
2. $4^6 \div 4^2 = \frac{4^6}{4^2}$	$\frac{4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4}{4 \cdot 4}$	4^4
3. $5^6 \div 5^2 = \frac{5^6}{5^2}$	$\frac{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5}$	5^4
4. $3^5 \div 3^3 = \frac{3^5}{3^3}$	$\frac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{3 \cdot 3 \cdot 3}$	3^2
5. $10^7 \div 10^4 = \frac{10^7}{10^4}$	$\frac{10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10}{10 \cdot 10 \cdot 10 \cdot 10}$	10^3
6. $r^4 \div r^2 = \frac{r^4}{r^2}$	$\frac{r \cdot r \cdot r \cdot r}{r \cdot r} =$	r^2
7. $s^7 \div s^3 = \frac{s^7}{s^3}$	$\frac{s \cdot s \cdot s \cdot s \cdot s \cdot s \cdot s}{s \cdot s \cdot s}$	s^4
8. $m^{10} \div m^3 = \frac{m^{10}}{m^3}$	$\frac{m \cdot m \cdot m \cdot m \cdot m \cdot m \cdot m \cdot m \cdot m \cdot m}{m \cdot m \cdot m}$	m^7

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Dividing numbers with exponents, you subtract the exponents

Create and Evaluate

Rewrite your rule for multiplying numbers with exponents.

Add exponents

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A. $x^a \cdot x^b = x^{a+b}$
B. $\frac{x^a}{x^b} = x^{a-b}$
C. $(x^a)^b = x^{a \cdot b}$

Rewrite your rule for a power raised to a power.

Multiply

Which rule is the same as your rule?

A. $\frac{x^a}{x^b} = x^{a-b}$
B. $(x^a)^b = x^{a \cdot b}$
C. $x^a \cdot x^b = x^{a+b}$

Rewrite your rule for dividing numbers with exponents.

Subtract

Which rule is the same as your rule?

A. $x^a \cdot x^b = x^{a+b}$
B. $(x^a)^b = x^{a \cdot b}$
C. $\frac{x^a}{x^b} = x^{a-b}$

17) $2x^3y^4 \cdot xy^0$

A) $16x^3y^3$ B) $8x^8y^4$
C) $2x^4y^4$ D) $9x^4y^8$

18) $4x \cdot 3yx^4$

A) $6x^7y^3$ B) $12x^5y$
C) $8x^2y^4$ D) $6x^9y^3$

19) $yx^0 \cdot x^3$

A) yx^3 B) x^4y^4
C) $3x^8y^4$ D) $4x^3y^8$

20) $3m^4 \cdot 2n$

A) $16m^3n^5$ B) $24m^7n^4$
C) $8m^2n^9$ D) $6m^4n$

21) $\frac{4^4}{4^4}$

A) 1 B) $\frac{1}{4^3}$
C) $\frac{1}{4}$ D) 4

22) $\frac{4^3}{4}$

A) 4^2 B) $\frac{1}{4}$
C) 4 D) $\frac{1}{4^3}$

23) $\frac{4^3}{4^4}$

A) 4 B) 1
C) 4^2 D) $\frac{1}{4}$

24) $\frac{3^3}{3^3}$

A) $\frac{1}{3^2}$ B) 1
C) 3^2 D) 3

25) $\frac{3n^3}{4n^4}$

A) $\frac{n^3}{4}$ B) n
C) $\frac{1}{2n^2}$ D) $\frac{3}{4n}$

26) $\frac{2m^0}{4m^3}$

A) $\frac{2}{m}$ B) $\frac{1}{4m}$
C) $\frac{1}{2m^3}$ D) 1

27) $\frac{2n}{2n^4}$

A) n^3 B) $4n^2$
C) $\frac{1}{4n}$ D) $\frac{1}{n^3}$

28) $\frac{4y^2}{x^4y^2}$

A) $\frac{2x^3}{y}$ B) $\frac{1}{2x^4}$
C) $\frac{4}{x^4}$ D) $\frac{4}{3x^2}$

29) $\frac{3ab^4}{4a^3b^3}$

A) $\frac{3b}{4a^2}$ B) $\frac{2b}{a}$
C) $\frac{4}{3a^3}$ D) $2ab$

30) $\frac{3n^0}{3m^4n^4}$

A) $2m^2$ B) $\frac{m^3}{3}$
C) $\frac{m^2}{3}$ D) $\frac{1}{m^4n^4}$