8.3: Investigating Division Properties of Exponents

After this lesson you will be able to: use properties of exponents involving quotients to simplify expressions.

Exploration A: Finding quotients of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Remaining After Canceling	Simplified expression
$\dfrac{6^{10}}{6^7}$	$\dfrac{6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6}{6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6}$	$6 \cdot 6 \cdot 6$	6^3
$\dfrac{(-4)^6}{(-4)^2}$	$\dfrac{(-4)(-4)(-4)(-4)(-4)(-4)}{(-4)(-4)}$	$-4 \cdot -4 \cdot -4 \cdot -4$	$(-4)^4$
$\dfrac{x^4 \cdot x^3}{x^2}$	$\dfrac{x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x}{x \cdot x}$	$x \cdot x \cdot x \cdot x \cdot x$	x^5
$\dfrac{1}{y^5} \cdot y^8$	$\dfrac{1}{y \cdot y \cdot y \cdot y \cdot y} \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y$	$y \cdot y \cdot y$	y^3

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column.

Exponents subtracts

Exploration B: Finding powers of quotients.

3. Complete the table.

Expression	Expanded Expression	Expression as repeated multiplication	Simplified expression
$\left(\dfrac{3}{2}\right)^7$	$\left(\dfrac{3}{2}\right)\left(\dfrac{3}{2}\right)\left(\dfrac{3}{2}\right)\left(\dfrac{3}{2}\right)\left(\dfrac{3}{2}\right)\left(\dfrac{3}{2}\right)\left(\dfrac{3}{2}\right)$	$\dfrac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}$	$\dfrac{3^7}{2^7}$
$\left(\dfrac{a}{b}\right)^2$	$\left(\dfrac{a}{b}\right)\left(\dfrac{a}{b}\right)$	$\dfrac{a \cdot a}{b \cdot b}$	$\dfrac{a^2}{b^2}$
$\left(\dfrac{x^3}{x}\right)^3$	$\left(\dfrac{x^3}{x}\right)\left(\dfrac{x^3}{x}\right)\left(\dfrac{x^3}{x}\right)$	$\dfrac{x^3 \cdot x^3 \cdot x^3}{x \cdot x \cdot x} \quad \dfrac{x^9}{x^3}$	$\dfrac{x^3}{x^3} = x^6$
$\left(\dfrac{x}{2y^4}\right)^2$	$\left(\dfrac{x}{2y^4}\right)\left(\dfrac{x}{2y^4}\right)$	$\dfrac{x \cdot x}{2y^4 \cdot 2y^4}$	$\dfrac{x^2}{2y^{4^2}}$

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column.

Distribute top & bottom

Exploration 3: Using both Powers of Products and Quotients

Name:_____

5. Complete the table.

Expression	Expression as Repeated Multiplication	Rewritten as a Fraction	Remaining After Canceling	Simplified expression
$\left(\frac{1}{3}\right)^4 \cdot 3^7$	$\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)3\cdot3\cdot3\cdot3\cdot3\cdot3\cdot3$	$\frac{3\cdot3\cdot3\cdot3\cdot3\cdot3\cdot3}{3\cdot3\cdot3\cdot3}$	$3\cdot3\cdot3$	3^3
$4^9 \cdot \left(\frac{1}{4}\right)^5$	$4\cdot4\cdot4\cdot4\cdot4\cdot4\cdot4\cdot4$ $\left(\frac{1}{4}\right)\left(\frac{1}{4}\right)\left(\frac{1}{4}\right)\left(\frac{1}{4}\right)\left(\frac{1}{4}\right)$	$\frac{4\cdot4\cdot4\cdot4\cdot4\cdot4\cdot4\cdot4\cdot4}{4\cdot4\cdot4\cdot4\cdot4}$	$4\cdot4\cdot4$	4^4
$\frac{1}{y^8} \cdot y^{10}$	$\frac{y^{10}}{y^8}$		$y\cdot y$	y^2
$\left(\frac{x^2}{3y^3}\right)^2$	$\left(\frac{x^2}{3y^3}\right)\left(\frac{x^2}{3y^3}\right)$	$\frac{x^2\cdot x^2}{3y^3\cdot 3y^3}$		$\frac{x^4}{9y^6}$

Homework:

For each problem, write the expression as repeated multiplication and simplify like you did in the above tables.

		Expression as Repeated Multiplication	Simplified Expression
1.	$\frac{2^{11}}{2^6}$	$2\cdot2\cdot2\cdot2\cdot2\cdot2\cdot2\cdot2\cdot2\cdot2\cdot2$	5^5
2.	$\frac{(-12)^9}{(-12)^3}$		6^6
3.	$\frac{6^7\cdot6^4}{6^6}$	$\frac{6\cdot6\cdot6\cdot6\cdot6\cdot6\cdot6\cdot6\cdot6\cdot6\cdot6}{6\cdot6\cdot6\cdot6\cdot6\cdot6}$	5^5
4.	$\frac{x^5\cdot x^{10}}{x^3}$	$\frac{x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x}{x\cdot x\cdot x}$	12^{12}
5.	$\frac{1}{y^8}\cdot y^{15}$		y^7
6.	$\left(\frac{c^5}{d^2}\right)^3$	$\left(\frac{c^5}{d^2}\right)\left(\frac{c^5}{d^2}\right)\left(\frac{c^5}{d^2}\right)$ $\frac{c^5\cdot c^5\cdot c^5}{d^2\cdot d^2\cdot d^2}$ $\frac{c^{15}}{d^6}$	$\frac{c^{15}}{d^6}$
7.	$\left(\frac{4c}{2d^2}\right)^3$	$\left(\frac{4c}{2d^2}\right)\left(\frac{4c}{2d^2}\right)\left(\frac{4c}{2d^2}\right)$ $\frac{12c}{6d^2}$	$\frac{12c}{6d^2}$
8.	$\left(\frac{2x^3}{y}\right)^3 \cdot \frac{1}{6x^3}$	$\left(\frac{2x^3}{y}\right)\left(\frac{2x^3}{y}\right)\left(\frac{2x^3}{y}\right)\cdot\frac{1}{6x^3}$ $\frac{6x^3}{2y}\cdot\frac{1}{6x^3}$	
9.	$\frac{3}{8m^5}\cdot\left(\frac{m^4}{n^2}\right)^3$	$\frac{3}{8m^5}\cdot\left(\frac{m^4}{n^2}\right)\left(\frac{m^4}{n^2}\right)\left(\frac{m^4}{n^2}\right)$	$\frac{3}{8m^5}\cdot\frac{3^4}{3^2}$

8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \cdot 7^5$	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	7^9
$(-4)^2 \cdot (-4)^3$	$[(-4) \cdot (-4)] \cdot [(-4) \cdot (-4) \cdot (-4)]$	5	$+4^5$
$x^1 \cdot x^5$	$x \cdot x \cdot x \cdot x \cdot x \cdot x$	6	x^6
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	7	$2x^7$

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column. *add all of them together*

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	6^8
$(x^3)^3$	$x^3 \cdot x^3 \cdot x^3$	$(x \cdot x \cdot x) \cdot (x \cdot x \cdot x) \cdot (x \cdot x \cdot x)$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column. *number of factors is the same as the simplified*

multiply

Exploration 3: Finding Powers of a Product

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	2^7 x^7	$(128) x^7$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	4^6 x^6	$(4096)(x^6)$
$(-10x^6)^2$	$(10x \cdot 10x \cdot 10x) (10x \cdot 10x \cdot 10x)$	$10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot x \cdot x \cdot x \cdot x \cdot x$	(10^6) x^6	$1,000,000 x^6$

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column.
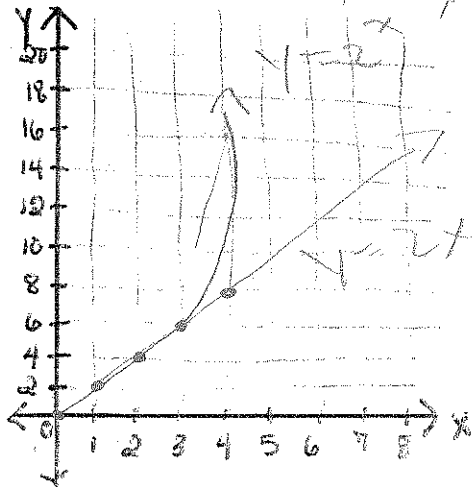
Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \cdot 3^6$	$(3 \cdot 3 \cdot 3 \cdot 3)(3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)$	$3^{10}, 59049$
2.	$(2^3)^2$	$(2 \cdot 2 \cdot 2)(2 \cdot 2 \cdot 2)$	$2^6, 64$
3.	$x \cdot x^6$	$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	x^7
4.	$(2x)^2$	$2x \cdot 2x$	$4x$
5.	$(-2x^4n^6)^2$		$Nx^8 N 12$
6.	$[(-5xy)^2]^5$	$-5xy 5 - 5xy 5$	$25^5 x^{10} y^{10}$

7. a. Complete the table of values.

x	0	1	2	3	4
$2x$	0	2	4	6	8
2^x	0	2	4	8	16

b. Sketch the graphs of y=2x and y=2^x
   in the same coordinate plane.

c. Compare the graphs.
   How are they the same?
   How are they different?

Name: Stacey Yang
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8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \bullet 7^5$	$(7 \bullet 7 \bullet 7 \bullet 7) \bullet (7 \bullet 7 \bullet 7 \bullet 7 \bullet 7)$	9	7^9
$(-4)^2 \bullet (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	-4^5
$x^1 \bullet x^5$	$[x] \bullet [x \cdot x \cdot x \cdot x \cdot x]$	6	x^6
$(2x)^3 \bullet (2x)^4$	$[2x \cdot 2x \cdot 2x] \cdot [2x \cdot 2x \cdot 2x \cdot 2x]$	7	$2x^7$

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column. The exponents multiplied

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \bullet (5^3)$	$(5 \bullet 5 \bullet 5) \bullet (5 \bullet 5 \bullet 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2]$	$(-6 \bullet -6) \bullet (-6 \bullet -6) \bullet (-6 \bullet -6) \bullet (-6 \bullet -6)$	8	-6^8
$(x^3)^3$	$(x^3) \cdot (x^3) \cdot (x^3)$	$(x \cdot x \cdot x) \cdot (x \cdot x \cdot x)(x \cdot x \cdot x)$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column.

The exponent multiplied

Exploration 3: Finding Powers of a Product

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$ $x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(2^7)(x^7)$	$128x^7$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(4^6)(x^6)$	$4096x^6$
$(-10x^6)^2$	$-10x \cdot -10x \cdot -10x \cdot -10x \cdot -10x \cdot -10x$ $[-10x \cdot -10x \cdot -10x \cdot 10x \cdot -10x$ $-10x]$	$-10 \cdot -10 \cdot -10 \cdot -10 \cdot -10 \cdot -10 \cdot$ $-10 \cdot -10 \cdot -10 \cdot -10 \cdot -10 \cdot -10$ $x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(-10^{12})(x^{12})$	

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column. The final exponent expression
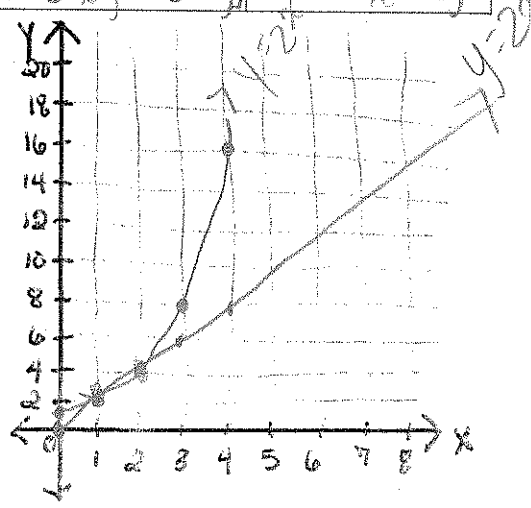
Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \cdot 3^6$	$(3 \cdot 3 \cdot 3 \cdot 3)(3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)$	(3^{10})
2.	$(2^3)^2$	$(2 \cdot 2 \cdot 2)(2 \cdot 2 \cdot 2)$	(2^6)
3.	$x \cdot x^6$	$(x)(x \cdot x \cdot x \cdot x \cdot x \cdot x)$	(x^7)
4.	$(2x)^2$	$2 \cdot 2 \cdot x \cdot x$	2^2x^2
5.	$(-2x^4n^6)^2$	$[-2x \cdot 2x \cdot -2x \cdot -2x \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n]$ $[-2x \cdot -2x \cdot -2x \cdot 2x \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n]$	$4x^8(n^{12})$
6.	$[(-5xy)^2]^5$	$[-5xy \cdot -5xy][-5xy \cdot -5xy]$ $[-5xy \cdot -5xy][-5xy \cdot -5xy][-5xy \cdot -5xy]$	$5^5x^{10}y^{10}$

7. a. Complete the table of values.

x	0	1	2	3	4
2x	0	2	4	6	8
2^x	1	2	4	8	16

b. Sketch the graphs of y=2x and y=2^x in the same coordinate plane.

c. Compare the graphs.

How are they the same?

How are they different?

8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \cdot 7^5$	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	7^9
$(-4)^2 \cdot (-4)^3$	$[(-4) \cdot (-4)] \cdot [(-4) \cdot (-4) \cdot (-4)]$	5	$(-4)^5$
$x^1 \cdot x^5$	$[(1)] \cdot [(x)(x)(x)(x)(x)]$	6	x^6
$(2x)^3 \cdot (2x)^4$	$[(2x)(2x)(2x)] \cdot [(2x)(2x)(2x)(2x)]$	7	$4x^7$

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column.

exponents added

not sure times by the same the power number changes

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	$(-6)^8$
$(x^3)^3$	$(x^3) \cdot (x^2) \cdot (x^3)$	$[(1x) \cdot (1x) \cdot (1x)][(1x)(1x)(1x)][(2)(x)(x)]$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column.

Number of factors is the same as the simplified expression

Name: _Shelby Ericson_

Exploration 3: Finding Powers of a Product

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(2)^7 \cdot (x)^6$	$2x^{13}$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(4^8 \cdot (x)^6$	$4x^{12}$
$(-10x^6)^2$	$(-10x_6 \cdot -10x_6 \cdot -10x_6 \cdot -10x_6 \cdot -10x_6 \cdot -10x_6)$ $(x2)$	$-10 \cdot -10 \cdot -10 \cdot -10 \cdot -10 \cdot -10 \cdot x \cdot y$ and so on	$(-10)^{12}(x)^6$	$-10x^6$

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column.
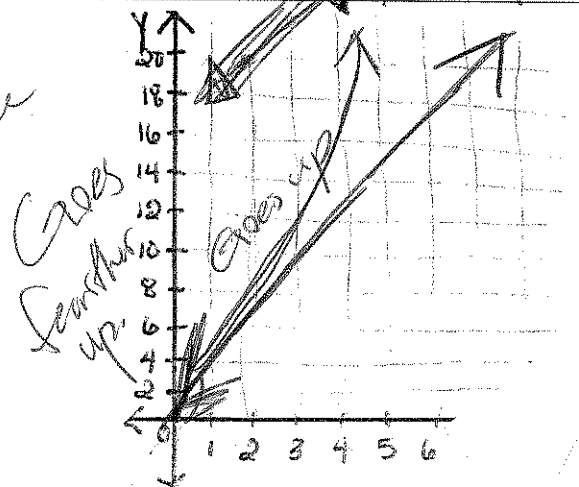
Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \bullet 3^6$	$[3 \cdot 3 \cdot 3 \cdot 3] \cdot [3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3]$	$3^{10}, 59049$
2.	$(2^3)^2$	$(2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2)$	$2^6, 64$
3.	$x \bullet x^6$	$[(x)] \cdot [x \cdot x \cdot x \cdot x \cdot x \cdot x]$	x^7
4.	$(2x)^2$	$(2 \cdot 2) \cdot (x \cdot x)$	$2^2x^2, 4x^2$
5.	$(-2x^4n^6)^2$	$(-2 \cdot 2 \cdot -2 \cdot -2) (n \cdot n \cdot n \cdot n \cdot n \cdot n)$ $x2$	$-2^8 \cdot 8n^{12}$
6.	$[(-5xy)^2]^5$	$[(-5) \cdot (5) \cdot (x)(x)(y)(y)] x5$	$[-5^{10}x^{10}y^{10}$

7. a. Complete the table of values.

x	0	1	2	3	4
2x	2·0	2·1	2·2	2·3	2·4
2^x	2^0	2^1	2^2	2^3	2^4

Did it so wrong

b. Sketch the graphs of y=2x and y=2^x in the same coordinate plane.

c. Compare the graphs.

How are they the same?

How are they different?

they are all almost the same

Goes further up   Goes up

Name: Breanna.R

1st HR

8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \cdot 7^5$	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	7^9
$(-4)^2 \cdot (-4)^3$	$[(-4) \cdot (-4)] \cdot [(-4) \cdot (-4) \cdot (-4)]$	5	$(-4)^5$
$x^1 \cdot x^5$	$x \cdot [x \cdot x \cdot x \cdot x \cdot x]$	6	x^6
$(2x)^3 \cdot (2x)^4$	$[2x \cdot 2x \cdot 2x][2x \cdot 2x \cdot 2x \cdot 2x]$	7	$2x^7$

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column.

Keep the main # or variable and add the little #'s together

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	-6^8
$(x^3)^3$	$[(x^3) \cdot (x^3) \cdot (x^3)]$	$(x \cdot x \cdot x)(x \cdot x \cdot x)(x \cdot x \cdot x)$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column.

Times (x or ●) the exponents

Numbers of factors is the same as the simplified expression exponet

Exploration 3: Finding Powers of a Product

Name: Joel Hobson

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(2)^7(x)^7$	$128x^7$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(4^6)(x^6)$	$4096x^6$
$(-10x^6)^2$	$(-10x) \cdot (-10x) \cdot (-10x) \cdot (-10x) \cdot (-10x)(10x)$ $\cdot (-10x) \cdot (-10x)(-10x) \cdot (-10x) \cdot (-10x)(-10x)$			

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column.

Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \cdot 3^6$	$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$	$3^{10}, 59,049$
2.	$(2^3)^2$	$(2^3)(2^3) = (2 \cdot 2 \cdot 2)(2 \cdot 2 \cdot 2)$	$2^6, 64$
3.	$x \cdot x^6$	$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	x^7
4.	$(2x)^2$	$(2x)$	$2^2 x^2, 4x^2$
5.	$(-2x^4n^6)^2$	work?	$4x^8 n^{12}$
6.	$[(-5xy)^2]^5$	work?	$2.5^5 x^{10}y^{10}$

7. a. Complete the table of values.

x	0	1	2	3	4
2x	0	2	4	6	8
2^x	1	2	4	8	16

b. Sketch the graphs of y=2x and y=2ˣ
in the same coordinate plane.

c. Compare the graphs.
How are they the same?
How are they different?

8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \cdot 7^5$	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	7^9
$(-4)^2 \cdot (-4)^3$	$[(-4) \cdot (-4)] \cdot [(-4) \cdot (-4) \cdot (-4)]$	5	$(-4)^5$
$x^1 \cdot x^5$	$(x) \ (x \cdot x \cdot x \cdot x \cdot x)$	6	x^6
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x)(2x \cdot 2x \cdot 2x \cdot 2x)$	7	2^7

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column.

    The exponent add

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	-6^8
$(x^3)^3$	$(x)^3 \cdot (x)^3 \cdot (x)^3$	$(x \cdot x \cdot x)(x \cdot x \cdot x)(x \cdot x \cdot x)$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column.

    The exponents multiplied

Name: Aja Morgan

Exploration 3: Finding Powers of a Product

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(2^7)(x^7)$	$128 x^7 \cdot$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(4^6)(x^6)$	$4096 x^6$
$(-10x^6)^2$	$(\ )$			

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column.
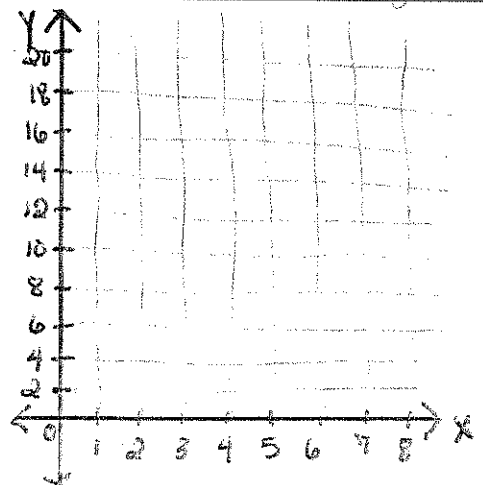
?

Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \cdot 3^6$	$(3 \cdot 3 \cdot 3 \cdot 3)(3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)$	3^{10}
2.	$(2^3)^2$	$(2 \cdot 2 \cdot 2) \quad (2 \cdot 2 \cdot 2)$	2^6
3.	$x \cdot x^6$	$(x)(x \cdot x \cdot x \cdot x \cdot x \cdot x)$	x^7
4.	$(2x)^2$	$(2x) \cdot (2x)$	$2^2x^2; 4x$
5.	$(-2x^4n^6)^2$	work?	$4x^8n^{12}$
6.	$[(-5xy)^2]^5$	work?	$25^5x^{10}y^{10}$

7. a. Complete the table of values.

x	0	1	2	3	4
2x					
2^x					

b. Sketch the graphs of y=2x and y=2^x in the same coordinate plane.

c. Compare the graphs.

How are they the same?

How are they different?

Name: Zo Hming Mawi

8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \cdot 7^5$	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	7^9
$(-4)^2 \cdot (-4)^3$	$[(-4) \cdot (-4)] \cdot [(-4) \cdot (-4) \cdot (-4)]$	5	$(-4)^5$
$x^1 \cdot x^5$	$x \cdot x \cdot x \cdot x \cdot x \cdot x$	6	x^6
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	7	$(2x)^7$

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column.

The exponent added.

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	$(-6)^8$
$(x^3)^3$	$(x^3) \cdot (x^3)(x^3)$	$(x \cdot x \cdot x)(x \cdot x \cdot x)(x \cdot x \cdot x)$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column.

The exponent multiplication

Exploration 3: Finding Powers of a Product

9/10

Name: _____

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(2^7)(x^7)$	$128x^7$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(4^6)(x^6)$	$4196x^6$
$(-10x^6)^2$	$(-10x^6)(-10x^6)$	$-10 \cdot -10 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(-10^2) \cdot x^{12}$	$-100 \cdot x^{12}$

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column.

?

Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

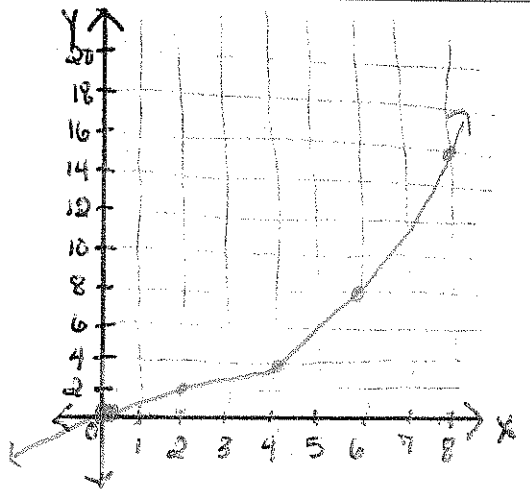| #	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \cdot 3^6$	$(3 \cdot 3 \cdot 3 \cdot 3) \cdot (3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)$	59049
2.	$(2^3)^2$	$(2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2)$	64
3.	$x \cdot x^6$	$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	x^7
4.	$(2x)^2$	$2x \cdot 2x$	$4x^2$
5.	$(-2x^4n^6)^2$	$(-2 \cdot x \cdot x \cdot x \cdot x \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n)(-2 \cdot x \cdot x \cdot x \cdot x \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n)$	$4x^8n^{12}$
6.	$[(-5xy)^2]^5$	$[(-5xy)^2] \cdot [(-5xy)^2] \cdot [(-5xy)^2][(-5xy)^2][(-5xy)^2]$	?

7. a. Complete the table of values.

x	0	1	2	3	4
2x	0	2	4	6	8
2^x	0	2	4	8	16

b. Sketch the graphs of y=2x and y=2^x in the same coordinate plane.

c. Compare the graphs.
   How are they the same? $(0,0)(2,2)(4,4)$
   How are they different? $(6,8)(8,16)$

8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \cdot 7^5$	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	7^9
$(-4)^2 \cdot (-4)^3$	$[(-4) \cdot (-4)] \cdot [(-4) \cdot (-4) \cdot (-4)]$	5	-4^5
$x^1 \cdot x^5$	$(x) \cdot (x \cdot x \cdot x \cdot x \cdot x)$	6	x^6
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	7	$2x^7$

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column. The exponents added.

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	-6^8
$(x^3)^3$	$(x^3) \cdot (x^3) \cdot (x^3)$	$(x \cdot x \cdot x) \cdot (x \cdot x \cdot x) \cdot (x \cdot x \cdot x)$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column. multiplied the powers

Name:_____

Exploration 3: Finding Powers of a Product

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \, x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(2^7)(x^7)$	$128\,x^7$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(4^6)(x^6)$	$4096\,x^6$
$(-10x^6)^2$	$-10x \cdot -10x \cdot -10x \cdot -10x \cdot -10x \cdot (-10x)$ $-10x \cdot -10x \cdot -10x \cdot -10x \cdot -10x \cdot (-10x)$			

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column.

Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.
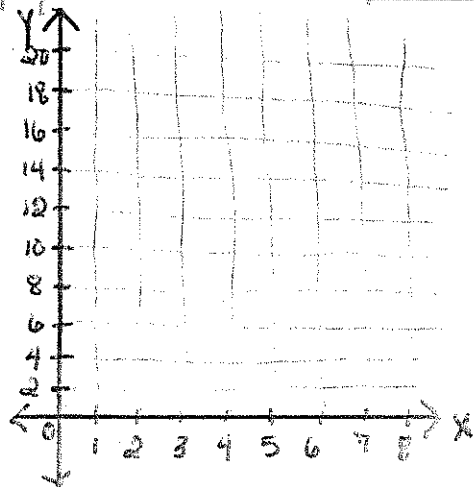
#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \cdot 3^6$	$(3 \cdot 3 \cdot 3 \cdot 3) \cdot (3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)$	3^{10}
2.	$(2^3)^2$	$(2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2)$	2^6
3.	$x \cdot x^6$	$(x) \cdot (x \cdot x \cdot x \cdot x \cdot x \cdot x)$	x^7
4.	$(2x)^2$	$2 \cdot 2 \cdot x \cdot x$	$4x^2$
5.	$(-2x^4n^6)^2$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n$ $2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n$	$128\,x^7\,n^{12}$
6.	$[(-5xy)^2]^5$	$(5 \cdot 5 \cdot x \cdot x \cdot y \cdot y) \cdot (5 \cdot 5 \cdot x \cdot x \cdot y \cdot y) \cdot (5 \cdot 5 \cdot x \cdot xy \cdot y)$ $(5 \cdot 5 \cdot x \cdot x \cdot y \cdot y) \cdot (5 \cdot 5 \cdot x \cdot x \cdot y \cdot y)$	9765625 $x^{10}\,y^{10}$

7. a. Complete the table of values.

x	0	1	2	3	4
2x					
2^x					

b. Sketch the graphs of $y=2x$ and $y=2^x$ in the same coordinate plane.

c. Compare the graphs.

How are they the same?

How are they different?

8.1: Investigating Powers and Products

Name: \text{Loua Yang}

Hr.1

2/29/12

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \cdot 7^5$	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	7^9
$(-4)^2 \cdot (-4)^3$	$[(-4) \cdot (-4)] \cdot [(-4) \cdot (-4) \cdot (-4)]$	5	$(-4)^5$
$x^1 \cdot x^5$	$(x) \cdot (x)(x)(x)(x)(x)$	6	x^6
$(2x)^3 \cdot (2x)^4$	$[(2x) \cdot (2x) \cdot (2x)]$ $[(2x) \cdot (2x) \cdot (2x)(2x)]$	7	x^7

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column.

$$\text{exponents adds up}$$

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	$(-6)^8$
$(x^3)^3$	$(x^3)(x^3)(x^3)$	$[x \cdot x \cdot x][x \cdot x \cdot x][x \cdot x \cdot x]$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column.

$$\text{exponents mup-}$$

Exploration 3: Finding Powers of a Product

8/10

Name:_____

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(2^7)(x^7)$	$128x^7$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(4^6)(x^6)$	$16384x^6$
$(-10x^6)^2$	$[(-10x)(-10x)(-10x)(-10)(-10)$ $\cdot -10 \cdot -10 \cdot -10 \cdot -10 \cdot -10$ $\cdot -10 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$ $(-10) \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$		$(-10^{12})(x^{12})$	-1200000000000 x^{12}

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column.
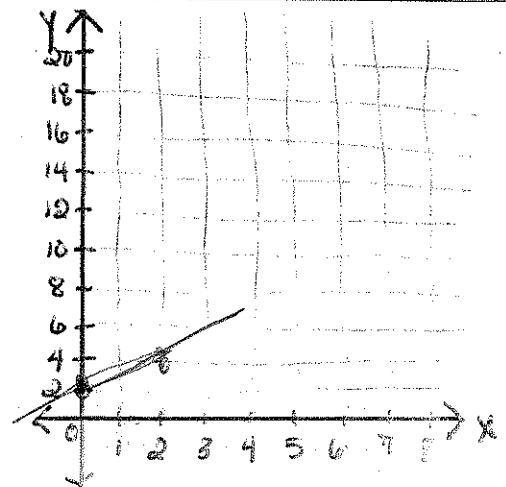
Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \bullet 3^6$	$(3 \cdot 3 \cdot 3 \cdot 3) \cdot (3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)$	3^{10}
2.	$(2^3)^2$	$(2^3)(2^3) (2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2)$	2^6
3.	$x \bullet x^6$	$(x) \cdot (x \cdot x \cdot x \cdot x \cdot x \cdot x)$	x^7
4.	$(2x)^2$	$(2x \cdot 2x)$ $2 \cdot 2 \cdot x \cdot x$	$2^1 x^1$
5.	$(-2x^4n^6)^2$	$(-2x \cdot 2x \cdot 2x \cdot 2x) \cdot (n \cdot n \cdot n \cdot n \cdot n \cdot n)$	?
6.	$[(-5xy)^2]^5$	Work?	?

7. a. Complete the table of values.

x	0	1	2	3	4
2x	0x	1x	2x	3x	4x
2^x	0^x	1^x	2^x	3^x	4^x

b. Sketch the graphs of y=2x and y=2^x
   in the same coordinate plane.

c. Compare the graphs.
   How are they the same?
   How are they different?

8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \cdot 7^5$	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	7^9
$(-4)^2 \cdot (-4)^3$	$[(-4) \cdot (-4)] \cdot [(-4) \cdot (-4) \cdot (-4)]$	5	$(-4)^5$
$x^1 \cdot x^5$	$x \cdot x \cdot x \cdot x \cdot x$	5	x^5
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	7	$2x^7$

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column.

Both columns Both simplify into powers From larger equations

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	$(-6)^8$
$(x^3)^3$	$(x^3) \cdot (x^3) \cdot (x^3)$	$(x \cdot x \cdot x) \cdot (x \cdot x \cdot x) \cdot (x \cdot x \cdot x)$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column.

when you times the exponents by each other thay make the simplified exponent.

Exploration 3: Finding Powers of a Product

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(2^7)(x^7)$	$128x^7$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(4^6)(x^6)$	$4096x^6$
$(-10x^6)^2$	$(-10x^6)(-10x^6)$	$-10 \cdot -10 \cdot x \cdot x \cdot x \cdot x \cdots$	$(10^2)(x^{12})$	$100x^{12}$

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column. *If you can divide the exponents by each other, you add them. If not you multiply.*

Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

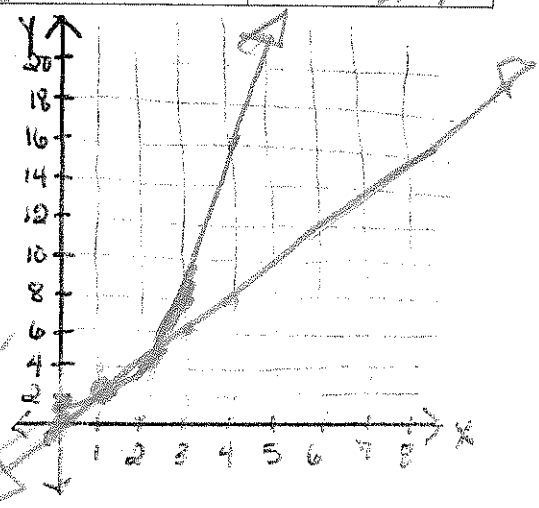| #	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \cdot 3^6$	$(3 \cdot 3 \cdot 3 \cdot 3) \cdot (3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)$	3^{10}
2.	$(2^3)^2$	$(2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2)$	2^6
3.	$x \cdot x^6$	$x \cdot x \cdot x \cdot x \cdot x \cdot x$	x^6
4.	$(2x)^2$	$(2x) \cdot (2x) = (2^2)(x^2)$ $2 \cdot 2 \cdot x \cdot x$	$4x^2$
5.	$(-2x^4n^6)^2$	$(-2 \cdot -2 \cdot x \cdot x \cdot x \cdot x \cdot n \cdots)$	$(2^2)(x^8)(n^{12})$ $-128x^8n^{12}$
6.	$[(-5xy)^2]^5$	$[(-5xy \cdot -5xy)] \cdot [(-5xy \cdot -5xy)] \cdots$	$(5^{10})(x^{10})(y^{10})$ $9765625x^{10}y^{10}$

7. a. Complete the table of values.

x	0	1	2	3	4
2x	0	2	4	6	8
2^x	1	2	4	8	16

b. Sketch the graphs of $y=2x$ and $y=2^x$ in the same coordinate plane.

c. Compare the graphs.

How are they the same? *Both start off around the same area*

How are they different? *One is straight and that one is a curve.*

Name: Shabaka Bailey

8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \cdot 7^5$	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	7^9
$(-4)^2 \cdot (-4)^3$	$[(-4) \cdot (-4)] \cdot [(-4) \cdot (-4) \cdot (-4)]$	5	$(-4)^5$
$x^1 \cdot x^5$	$(x \cdot x) \cdot (x5 \cdot x5 \cdot x5 \cdot x15 \cdot x5)$	6	x^6
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2 \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	7	$2x^6$

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column. They are exponents added

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	$(-6)^8$
$(x^3)^3$	$(x^3) \cdot (x^3) \cdot (x^3)$	$(x \cdot x \cdot x) \cdot (x \cdot x \cdot x) \cdot (x \cdot x \cdot x)$	9	(x^9)

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column. Number factors is the same as simplified expression multiplied.

Exploration 3: Finding Powers of a Product

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(2^6)(x^6)$	$64x^6$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(4^6)(x^6)$	$4096x^6$
$(-10x^6)^2$	$[(-10x)\cdots(-10x)\cdots]$ $[(-10x)\cdots(-10x)\cdots]$	$-10 \cdots -10 \cdots$ $\cdots x \cdot x$	$(-10^2)(x^{12})$	1×10^{10}

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column.

Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.
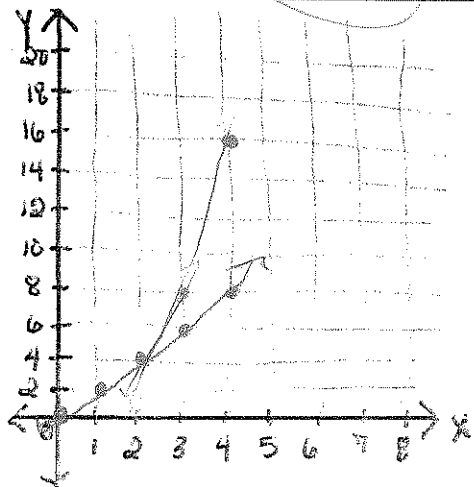
#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \bullet 3^6$	$(3 \cdot 3 \cdot 3 \cdot 3) \cdot (3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)$	3^{10}
2.	$(2^3)^2$	$(2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2)$	2^6
3.	$x \bullet x^6$	$(x) \cdot (x \cdot x \cdot x \cdot x \cdot x \cdot x)$	x^7
4.	$(2x)^2$	$[(2 \cdot 2) \cdot (x \cdot x)]$	$4x^2$
5.	$(-2x^4n^6)^2$	$[(-2 \cdot -2) \cdot (x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x) \cdot (n \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n)]$	$4x^8n^{12}$
6.	$[(-5xy)^2]^5$	$[(-5x \cdot -5) \cdot (x \cdot x) \cdot (y \cdot y)]^5$	$-3125x^{10}y^{10}$

7. a. Complete the table of values.

x	0	1	2	3	4
2x	0	2	4	6	8
2^x	0	2	4	8	16

b. Sketch the graphs of y=2x and y=2^x in the same coordinate plane.

c. Compare the graphs.

How are they the same? Begins with 0,2,4,

How are they different? Exponents break off at (3,8)

8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \cdot 7^5$	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	7^9
$(-4)^2 \cdot (-4)^3$	$[(-4) \cdot (-4)] \cdot [(-4) \cdot (-4) \cdot (-4)]$	5	-4^5
$x^1 \cdot x^5$	$[x] \cdot (x \cdot x \cdot x \cdot x \cdot x)$	6	x^6
$(2x)^3 \cdot (2x)^4$	$[2x \cdot 2x \cdot 2x] \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	7	$2x^7$

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column.

You add them together

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	-6^8
$(x^3)^3$	$[x \cdot x \cdot x][x \cdot x \cdot x] \cdot [x \cdot x \cdot x]$	$(x)^3] \cdot [(x)^3][(x)^3)$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column.

Name:_____

Exploration 3: Finding Powers of a Product

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x x x \cdot x x x x$ $(2^7)(x^8)$		$?$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$ $(4^6)(x^6)$		$4?$
$(-10x^6)^2$	$-10 \cdot -10 \cdot -10 \cdot -10 \cdot ... -10$ $(-10)(-10x)(10x)(-10x)(-10x)$	$-10 \cdot x \cdot x \cdot -10 \cdot x \cdot -10 \cdot x \cdot x \cdot x$		$?$

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column.

$?$

Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.
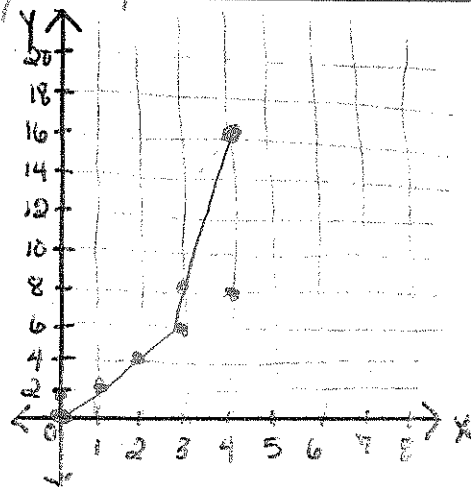
#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \bullet 3^6$	$[(3 \cdot 3 \cdot 3 \cdot 3)] \bullet [(3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)]$	$?$
2.	$(2^3)^2$	$[(2 \cdot 2 \cdot 2)] \cdot [(2 \cdot 2 \cdot 2)]$	$?$
3.	$x \bullet x^6$	$[(x)] \cdot [(x \cdot x \cdot x \cdot x \cdot x \cdot x)]$	x^6
4.	$(2x)^2$	$(2x \cdot 2x)$	$4x$
5.	$(-2x^4n^6)^2$	$[(-2x \cdot -2x \cdot -2x \cdot -2x)] n \cdot n \cdot n \cdot n \cdot n \cdot n$	$?$
6.	$[(-5xy)^2]^5$	$[(-5xy) \cdot (-5xy)] \cdot [-5xy \cdot -5xy]$	$?$

7. a. Complete the table of values.

x	0	1	2	3	4
2x	0	2	4	6	8
2^x	1	2	4	8	16

$2 \cdot 2 \cdot 2 \cdot 4$

b. Sketch the graphs of y=2x and y=2^x in the same coordinate plane.

c. Compare the graphs.
   How are they the same?
   How are they different?

Name: Alex · Gomez

8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \bullet 7^5$	$(7 \bullet 7 \bullet 7 \bullet 7) \bullet (7 \bullet 7 \bullet 7 \bullet 7 \bullet 7)$	9	7^9
$(-4)^2 \bullet (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	$(-4)^5$
$x^1 \bullet x^5$	$(x) \bullet (x \bullet x \bullet x \bullet x \bullet x)$	6	x^6
$(2x)^3 \bullet (2x)^4$	$(2x \bullet 2x \bullet 2x) \bullet (2x \bullet 2x \bullet 2x \bullet 2x)$	7	$(2x)^7$

2. . Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column. When you add the exponents in the first column you get your exponents for the last problem.

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \bullet (5^3)$	$(5 \bullet 5 \bullet 5) \bullet (5 \bullet 5 \bullet 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2]$	$(-6 \bullet -6) \bullet (-6 \bullet -6) \bullet (-6 \bullet -6) \bullet (-6 \bullet -6)$	8	-6^8
$(x^3)^3$	$(x^3) \bullet (x^3) \bullet (x^3)$	$(x \bullet x \bullet x) \bullet (x \bullet x \bullet x) \bullet (x \bullet x \bullet x)$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column. When you multiply the first exponent you will get the exponent in the last column.

Name: Alex. Gomez

Exploration 3: Finding Powers of a Product

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x$	$(2^7)(x^7)$	$128x^7$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(4^6)(x^6)$	$4096x^6$
$(-10x^6)^2$	$(-10x)(-10x)(-10x)(-10x)(-10x)(-10x)$ $(-10x)(-10x)(-10x)(-10x)(-10x)(-10x)$	$-10 \cdot 10 \cdot -10 \cdot 10 \cdot -10 \cdot -10 \cdot -10 \cdot 10 \cdot -10 \cdot 10 \cdot -10 \cdot 10 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(-10^{12})(x^{12})$	$\dfrac{2,000,000}{x^{12}}$

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column. When you add up the expression you get your simplified expression is bigger.

Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

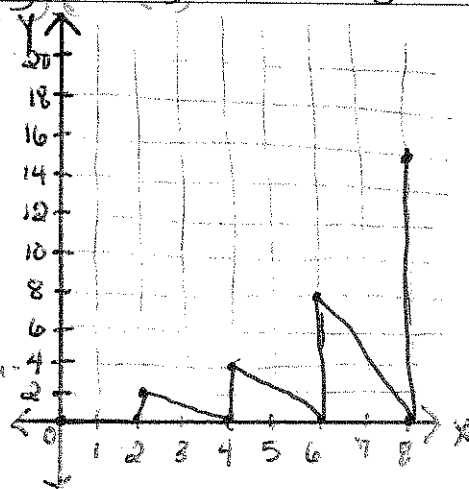| #	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \cdot 3^6$	$3 \cdot 3 \cdot 3 \cdot 3$ $3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$	3^{10}
2.	$(2^3)^2$	$2 \cdot 2 \cdot 2$	2^6
3.	$x \cdot x^6$	$x \cdot x \cdot x \cdot x \cdot x \cdot x$	x^6
4.	$(2x)^2$	$(2x \cdot 2x)$	$(2x)^4$
5.	$(-2x^4n^6)^2$	$-2x \cdot -2x \cdot -2x \cdot 2x$ $(n \cdot n \cdot n \cdot n \cdot n \cdot n)$	$(-2xn^{48})$
6.	$[(-5xy)^2]^5 \cdot$ $-5xy \cdot -5xy$	$(25xy)(25xy)(25xy)(25xy)(25xy)$	$25xy^{10}$

7. a. Complete the table of values.

x	0	1	2	3	4
2x	0	2	4	6	8
2^x	0	2	4	8	16

b. Sketch the graphs of $y=2x$ and $y=2^x$ in the same coordinate plane.

c. Compare the graphs.

How are they the same? Some cordinates are with the same number.

How are they different? And some aren't

8.1: Investigating Powers and Products

Name _Suzanne_

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \cdot 7^5$	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	7^9
$(-4)^2 \cdot (-4)^3$	$[(-4) \cdot (-4)] \cdot [(-4) \cdot (-4) \cdot (-4)]$	5	4^5
$x^1 \cdot x^5$	$(x) \cdot (x \cdot x \cdot x \cdot x \cdot x)$	6	x^6
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	8	$2x^8$

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column. If you add the exponents together in the expression you will get the exponent in the simplified expression

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	$(-6)^8$
$(x^3)^3$	$(x^3)(x^3)(x^3)$	$(x \cdot x \cdot x) \cdot (x \cdot x \cdot x)(x \cdot x \cdot x)$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column. If you multiply the exponent inside parenthes ex. $(5^3)^3$ multiply you will get the number of factors and the exponent in the simplified expression

Name: _Sheyanna_

Exploration 3: Finding Powers of a Product

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(2^7)(x^7)$	$14x^7$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(4^6)(x^6)$	$24x^6$
$(-10x^6)^2$			$(10^2)(x^{12})$	$120x^{12}$

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column. When ya get the number w/ exponent + no variable, ya multiply them together + keep the exponent on the variable
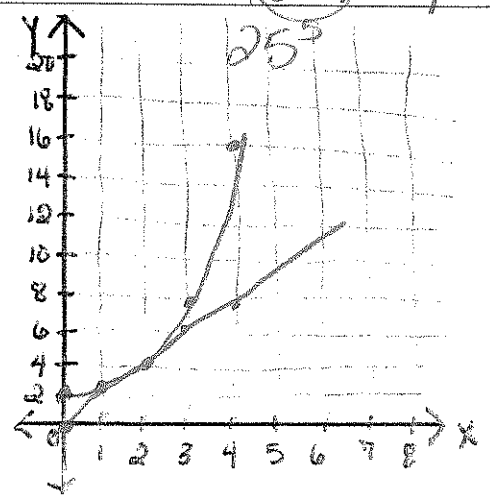
Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \bullet 3^6$	$(3 \cdot 3 \cdot 3 \cdot 3) \cdot (3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)$	3^{10}
2.	$(2^3)^2$	$(2 \cdot 2 \cdot 2)(2 \cdot 2 \cdot 2)$	2^6
3.	$x \bullet x^6$	$(x) \cdot (x \cdot x \cdot x \cdot x \cdot x \cdot x)$	x^7
4.	$(2x)^2$	$(2x) \cdot (2x)$	$2x^2$
5.	$(-2x^4n^6)^2$	$(2x \cdot 2x \cdot 2x \cdot 2x \cdot n \cdot n \cdot n \cdot n \cdot n \cdot n)$	$4x^8 n^{12}$
6.	$[(-5xy)^2]^5$	$(-5xy)(5xy)$	$50 x^{10} y^{10}$

7. a. Complete the table of values.

x	0	1	2	3	4
2x	0	2	4	6	8
2^x	1	2	4	8	16

b. Sketch the graphs of y=2x and y=2^x in the same coordinate plane.

c. Compare the graphs.

How are they the same?

How are they different?

8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \cdot 7^5$	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	7^9
$(-4)^2 \cdot (-4)^3$	$[(-4) \cdot (-4)] \cdot [(-4) \cdot (-4) \cdot (-4)]$	5	$(-4)^5$
$x^1 \cdot x^5$	$x \cdot$ $x \cdot x \cdot x \cdot x \cdot x$	6	x^6
$(2x)^3 \cdot (2x)^4$	$(2 \cdot x \cdot 2 \cdot x \cdot 2 \cdot x)(2 \cdot x \cdot 2 \cdot x \atop 2 \cdot x \cdot 2x)$	7	$2x^7$

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column. that i simply the number and counted the # and then the variable 2nd put in togther.

the exponents added.

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \cdot 5 \cdot 5) \cdot (5 \cdot 5 \cdot 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	6^8
$(x^3)^3$	$(x^3)(x^3)(x^3)$	$(x \cdot x \cdot x)(x \cdot x \cdot x) \cdot (x \cdot x \cdot x)$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column. put and cout that it the number and exponet multiply number factor is the same as the simplified expression exponet

Exploration 3: Finding Powers of a Product

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$ $(2^7)(x^7)$		
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$ $(4^6)(x^6)$		
$(-10x^6)^2$	$[(-10x)(-10x)(-10x)(-10x)(-10x)(-10x)]$ $(-10x)(-10x)$	$-10 \cdot -10 \cdot -10 \cdot -10 \cdot -10 \cdot -10$ $10 \cdot 10 \cdot 10 \cdot x \cdot x \cdot x \cdot x \cdot x$ (-10^2) (x^{12})		

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column.
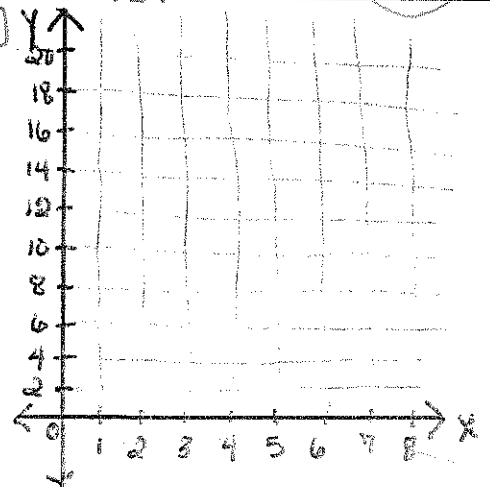
Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \cdot 3^6$	$(3 \cdot 3 \cdot 3 \cdot 3)$ $(3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)$	
2.	$(2^3)^2$		
3.	$x \cdot x^6$	$(x \cdot x)(x \cdot x)(x \cdot x)(x \cdot x)(x \cdot x)(x \cdot x)$	
4.	$(2x)^2$	$(2x \cdot 2x)$	
5.	$(-2x^4n^6)^2$	$(-2x \cdot -2x \cdot 2x \cdot -2x)(n \cdot n \cdot n \cdot n \cdot n \cdot n)$	
6.	$[(-5xy)^2]^5$	$[(-5xy)][(-5xy)][(-5xy)][(-5xy)]$ $(-5xy)(-5xy)[(-5xy)][(-5xy)]$ $[(-5xy)][(-5xy)]$	

7. a. Complete the table of values.

x	0	1	2	3	4
2x					
2^x					

b. Sketch the graphs of y=2x and y=2^x in the same coordinate plane.

c. Compare the graphs.
   How are they the same?
   How are they different?

Exponents-E

8.1: Investigating Powers and Products

After this lesson you will be able to: use properties of exponents involving products to simplify expressions.

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 \bullet 7^5$	$(7 \bullet 7 \bullet 7 \bullet 7) \bullet (7 \bullet 7 \bullet 7 \bullet 7 \bullet 7)$	9	7^9
$(-4)^2 \bullet (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	4^5
$x^1 \bullet x^5$	$[(x)] \bullet [(x)(x)(x)(x)(x)]$	6	x^6
$(2x)^3 \bullet (2x)^4$	$[(2x) \bullet (2x) \bullet (2x)] \bullet [(2x)(2x)(2x)(2x)]$	7	$2x^7$

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column.

both E in the first coloum are add to each other to
= the E in the last coloum

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \bullet (5^3)$	$(5 \bullet 5 \bullet 5) \bullet (5 \bullet 5 \bullet 5)$	6	5^6
$[(-6)^2]^4$	$[(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2]$	$(-6 \bullet -6) \bullet (-6 \bullet -6) \bullet (-6 \bullet -6) \bullet (-6 \bullet -6)$	8	-6^8
$(x^3)^3$	$[(x)(x)(x)] \bullet [(x)(x)(x)] \bullet [(x)(x)(x)]$	$(x^3) \bullet (x^3) \bullet (x^3)$	9	x^9

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column.

The E in the first coloum are multiplied by each other to =
the E in the last column

Exploration 3: Finding Powers of a Product

10/10

Name:_____

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy) \cdot (5xy) \cdot (5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	$2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(2^7)(x^7)$	$128(x^7)$
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(4^6)(x^6)$	$4,096(x^6)$
$(-10x^6)^2$	$[(-10x^6)] \cdot [(-10x^6)]$	$-10 \cdot -10 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$(-10^2)(x^{12})$	$100x^{12}$

6. Find a pattern that relates the original expressions in the first column to the simplified expressions in the last column. *Each variable has the same E as the others*

Practice Problems:

For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.
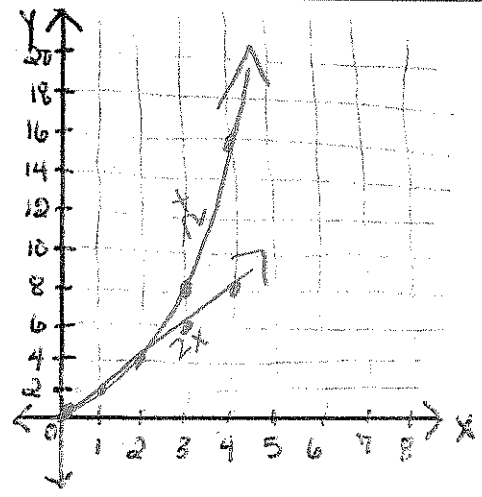
#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	$3^4 \bullet 3^6$	$(3 \cdot 3 \cdot 3 \cdot 3) \cdot (3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3)$	3^9
2.	$(2^3)^2$	$(2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2)$	2^6
3.	$x \bullet x^6$	$(x) \cdot (x \cdot x \cdot x \cdot x \cdot x \cdot x)$	x^7
4.	$(2x)^2$	$(2 \cdot 2) \cdot (x \cdot x)$	$2^2 x^2$
5.	$(-2x^4 n^6)^2$	$[(-2(x \cdot x \cdot x \cdot x)(n \cdot n \cdot n \cdot n \cdot n \cdot n)] \cdot [(-2(x \cdot x \cdot x \cdot x) \cdot (n \cdot n \cdot n \cdot n \cdot n \cdot n)]$	$(2^2)(x^8)(n^{12})$
6.	$[(-5xy)^2]^5$	$[(-5 \cdot -5(x \cdot x (y \cdot y))]$	$(5^{10})(x^{10})(y^{10})$

7. a. Complete the table of values.

x	0	1	2	3	4
2x	0	2	4	6	8
2^x	0	2	4	8	16

b. Sketch the graphs of y=2x and y=2^x in the same coordinate plane.

c. Compare the graphs.
   How are they the same? *They start on 0,1,2*
   How are they different? *They seperate at 3*

8.3: Investigating Division Properties of Exponents

After this lesson you will be able to: use properties of exponents involving quotients to simplify expressions.

Exploration A: Finding quotients of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Remaining After Canceling	Simplified expression
$\dfrac{6^{10}}{6^7}$	$\dfrac{6\cdot6\cdot6\cdot6\cdot6\cdot6\cdot6\cdot6\cdot6\cdot6}{6\cdot6\cdot6\cdot6\cdot6\cdot6\cdot6}$	$6\cdot6\cdot6$	6^3
$\dfrac{(-4)^6}{(-4)^2}$	$\dfrac{(-4)(-4)(-4)(-4)(-4)(-4)}{(-4)(-4)}$	$(-4)(-4)(-4)(-4)$	-4^4
$\dfrac{x^4\cdot x^3}{x^2}$	$\dfrac{x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x}{x\cdot x}$	$x\cdot x\cdot x\cdot x\cdot x$	x^5
$\dfrac{1}{y^5}\cdot y^8$	$\dfrac{1}{x\cdot x\cdot x\cdot x\cdot x}\cdot y\cdot y\cdot y\cdot y\cdot y\cdot y$	$y\cdot y\cdot y$	y^3

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column.

The bigger exponent is subtracted by the smaller one to equal the exponent in the last column

Exploration B: Finding powers of quotients.

3. Complete the table.

Expression	Expanded Expression	Expression as repeated multiplication	Simplified expression
$\left(\dfrac{3}{2}\right)^7$	$\left(\dfrac{3}{2}\right)\left(\dfrac{3}{2}\right)\left(\dfrac{3}{2}\right)\left(\dfrac{3}{2}\right)\left(\dfrac{3}{2}\right)\left(\dfrac{3}{2}\right)\left(\dfrac{3}{2}\right)$	$\dfrac{3\cdot3\cdot3\cdot3\cdot3\cdot3\cdot3}{2\cdot2\cdot2\cdot2\cdot2\cdot2\cdot2}$	$\dfrac{3^7}{2^7}$
$\left(\dfrac{a}{b}\right)^2$	$\left(\dfrac{a}{b}\right)\left(\dfrac{a}{b}\right)$	$\dfrac{a\cdot a}{b\cdot b}$	$\dfrac{a^2}{b^2}$
$\left(\dfrac{x^3}{x}\right)^3$	$\left(\dfrac{x\cdot x\cdot x}{x}\right)\left(\dfrac{x\cdot x\cdot x}{x}\right)\left(\dfrac{x\cdot x\cdot x}{x}\right)$	$\dfrac{x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x}{x\cdot x\cdot x}$	$\dfrac{x^3}{x^6}$
$\left(\dfrac{x}{2y^4}\right)^2$	$\left(\dfrac{x}{2\cdot y\cdot y\cdot y\cdot y}\right)\left(\dfrac{x}{2\cdot y\cdot y\cdot y\cdot y}\right)$	$\dfrac{x\cdot x}{2\cdot2\cdot y\cdot y\cdot y\cdot y\cdot y\cdot y\cdot y\cdot y}$	$\dfrac{x^2}{4y^8}$

4. Find a pattern that relates the exponents of the expression in the first column and the exponent of the expression in the last column.

Exploration 3: Using both Powers of Products and Quotients

5. Complete the table.

Expression	Expression as Repeated Multiplication	Rewritten as a Fraction	Remaining After Canceling	Simplified expression
$\left(\dfrac{1}{3}\right)^4 \cdot 3^7$	$\left(\dfrac{1}{3}\right)\left(\dfrac{1}{3}\right)\left(\dfrac{1}{3}\right)\left(\dfrac{1}{3}\right) 3\cdot3\cdot3\cdot3\cdot3\cdot3\cdot3$	$\dfrac{3\cdot3\cdot3\cdot3\cdot3\cdot3\cdot3}{3\cdot3\cdot3\cdot3}$	$3\cdot3\cdot3$	3^3
$4^9 \cdot \left(\dfrac{1}{4}\right)^5$				
$\dfrac{1}{y^8} \cdot y^{10}$	$\dfrac{y^{10}}{y^8}$			y^2
$\left(\dfrac{x^2}{3y^3}\right)^2$				

incomplete 0/10

Homework:

For each problem, write the expression as repeated multiplication and simplify like you did in the above tables.

		Expression as Repeated Multiplication	Simplified Expression
1.	$\dfrac{2^{11}}{2^6}$		
2.	$\dfrac{(-12)^9}{(-12)^3}$		
3.	$\dfrac{6^7 \cdot 6^4}{6^6}$		
4.	$\dfrac{x^5 \cdot x^{10}}{x^3}$		
5.	$\dfrac{1}{y^8} \cdot y^{15}$		
6.	$\left(\dfrac{c^5}{d^2}\right)^3$		
7.	$\left(\dfrac{4c}{2d^2}\right)^3$		
8.	$\left(\dfrac{2x^3}{y}\right)^3 \cdot \dfrac{1}{6x^3}$		
9.	$\dfrac{3}{8m^5} \cdot \left(\dfrac{m^4}{n^2}\right)^3$		