0/1/12

8.3: Investigating Division Properties of Exponents

J-11:1

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
$\frac{6^{10}}{6^7}$	6.6.6.6.6.6.6.6	6.6.6	63
$\frac{(-4)^6}{(-4)^2}$	(-4)(-4)(-4)(-4) $(-4)(-4)(-4)$	WHIH	(-L)4
$\frac{x^4 \cdot x^3}{x^2}$	1 XXXX O XXXX	XXOXX	Xs
$\frac{1}{y^5} \bullet y^8$	A: A	to to y	y3

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

Exploration B: Finding powers of quotients.

3. Complete the table.

Expression	Expanded Expression	Expression as repeated multiplication	Simplified expression
$\left(\frac{3}{2}\right)^7$	$\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)$	$\frac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}$	$\frac{3^7}{2^7}$
$\left(\frac{a}{b}\right)^2$	$\left(\frac{a}{b}\right)\left(\frac{a}{b}\right)$	$\frac{a \cdot a}{b \cdot b}$	$\frac{\Omega^2}{h^2}$
$\left(\frac{x^3}{x}\right)^3$	$\left(\frac{\chi_3}{\chi}\right)\left(\frac{\chi_3}{\chi}\right)\left(\frac{\chi_3}{\chi}\right)$	X3 × X3 × X3 X3 X3 X3	X3 = X (
$\left(\frac{x}{2y^4}\right)^2$	(zy") (zy")	240744 240744	2/42

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.

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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
$\left(\frac{1}{3}\right)^4 \bullet 3^7$	$\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$	3 · 3 · 3 · 3 · 3 · 8 · 8 · 3 3 · 8 · 8 · 8	3 · 3 · 3	33
$4^9 \bullet \left(\frac{1}{4}\right)^5$	44444444 (14/4/14/14/14)	1 hotel file	· Uill	Li
$\frac{1}{y^8} \bullet y^{10}$	$\frac{y^{10}}{y^8}$		1.7	12
$\left(\frac{x^2}{3y^3}\right)^2$	$\left(\begin{array}{c} \chi^2 \\ \overline{3}, \overline{3} \end{array}\right) \left(\begin{array}{c} \chi^2 \\ \overline{3} \end{array}\right)$	313.312		X
Homework:		, ,		77

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.	$\frac{2^{11}}{2^6}$	5-4-4-4-8-5-5-5-S	53
2.	$\frac{(-12)^9}{(-12)^3}$		66
3.	6 ⁷ • 6 ⁴ ‡	6.6.6.6.6.6.6.6.6.6.6.6.6.6.6.6.6.6.6.	5
4.	$\frac{x^5 \cdot x^{10}}{x^3}$	X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-	1212
5.	$\frac{1}{y_8^8} \bullet y^{15}$		47
6.	$\left(\frac{c^5}{d^2}\right)^3$	$\left(\frac{C5}{d^2}\right)\left(\frac{C5}{d^2}\right)\left(\frac{C5}{d^2}\right)\frac{C5\cdot C5\cdot C5}{d^2\cdot d^2\cdot d^2\cdot d^2\cdot d^2\cdot d^2\cdot d^2\cdot d^2\cdot $	<u>C15</u> d0
7.	$\left(\frac{4c}{2d^2}\right)^3$	2d2 (4C)(4C) 125 2d2 (2d2) 10d2	12c vd2
8.	$\left(\frac{2x^3}{y}\right)^3 \cdot \frac{1}{6x^3} \left($	2 x3 (2x3) (2x3) · (x3) · (x3) · (x3)	V
9.	$\frac{3}{8m^5} \bullet \left(\frac{m^4}{n^2}\right)^3$	$\frac{3}{8m^5}$ $\left(\frac{m^4}{n^2}\right)\left(\frac{m^4}{n^2}\right)\left(\frac{m^4}{n^2}\right)$	3 34 8m 32

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 • 7 ⁵	(7 • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 7)	9	79
$(-4)^2 \cdot (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	+45
$x^1 \cdot x^5$	ו ו ו × · × · ×	6	×6
$(2x)^3 \bullet (2x)^4$	(2x.2x.2x). (2x.2x.2x.2x.2x)	17	7×

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

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 • 5 • 5) • (5 • 5 • 5)	6	56
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	2	-Q8
$(x^3)^3$	$\times^3 \cdot \times^3 \times \times^3$	(x.x.x). (x.xx). (x.x.+	Q	79

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.

is the same as the simplified



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5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	2.2.2.2.2.2.2.	2 × × 1	178) >
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	4 · 4 · 4 · 4 · 4 · 4 · x · x · x · x ·	4 × ×	4096)(8
$(-10x^6)^2$	(x) (x01.x0) (x0)	X. X.X.X.X.	[00] Xe	00,000000

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.

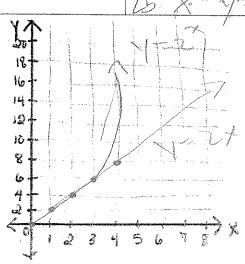
#	22-32 even	Expression as Repeated Multiplication	Simplified
			Expression
1.	3 ⁴ • 3 ⁶	3-3-3-3-3-3-3-3	3. 59049
2.	$(2^3)^2$	(2-2-282-22)	26,64
3.	<i>x</i> • <i>x</i> ⁶	×· ×· × · × · ×	×7
4.	$(2x)^2$	2×2×	И×
5.	$(-2x^4n^6)^2$		NX.8ND
6.	$[(-5xy)^2]^5$	-5xy 5-5xy 5	25.5 × 10 ×/10

7. a. Complete the table of values.

) x	(0	1	2	3	4
2	Х	\bigcirc	2	И	6	8
2	»X	\Diamond	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?



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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 • 7 ⁵	(7 • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 7)	9	79
$(-4)^2 \bullet (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	
$x^1 \cdot x^5$	$[X] \cdot [X \cdot X \cdot X \cdot X \cdot X]$	6	Xb
$(2x)^3 \bullet (2x)^4$	2x.2x.2x].[2x.2x.2x]	7	2x1

2.	Find a pattern th	at relates t	he exponents	of the factors	in the first	column	and the	exponent	of the exp	ression in
	the last column.	$\mathbb{T}_{\mathcal{N}}$	OVIV	70104-8	Ma			<i>e</i> d -		V

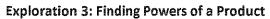
Exploration B: Finding powers of powers.

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 • 5 • 5) • (5 • 5 • 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	-68
$(x^3)^3$	(χ^3) - (χ^3) - (χ^3)	$(x-x-x)\cdot(x-x-x)(x-x-x)$	9	χ9

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



5. Complete the table.

Carried States	Name:	

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	2.2.2.2.2.2 X.X.X.X.X.X	(z ⁿ)(x ⁿ)	178 X1.
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot $	$(4^6)(\chi^6)$	4096x4
$(-10x^6)^2$	[-10x	-101010101010.	(-1012)(X12)	

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.

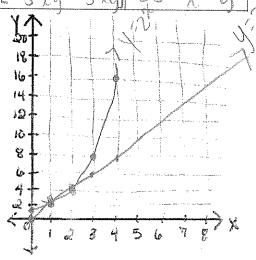
#	22-32 even	Expression as Repeated Multiplication	Simplified
		· ·	Expression
I.	3 ⁴ • 3 ⁶	(3.3.3.3)(3.3.3.3.3.3)	(30)
2.	$(2^3)^2$	(2.2-2) (2.2-2)	(26)
3.	x • x ⁶	$(\chi)(\chi \cdot \chi \cdot \chi \cdot \chi \cdot \chi \cdot \chi \cdot \chi)$	(χ^{7})
4.	$(2x)^2$	2.2. X-X	2x2
5.	$(-2x^4n^6)^2$	L-5x . 5x . 5x 5x . v. v. v. v. v. v. v.	(428 (nº2)
6.	$[(-5xy)^2]^5$	[-5xy2xy][-5xy-2xy][-5xy-5xy]	755 X 0 40

7. a. Complete the table of values.

X	0	1	2	3	4
2х	0	2	1	6	B
2 ^x		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 the same? How are they different?



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 • 7 ⁵	(7 • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 7)	9	79
$(-4)^2 \bullet (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	(-4)5
$x^1 \cdot x^5$	[(1)]-[(6)-(1)(1)(1)(1)	Co	X
$(2x)^3 \bullet (2x)^4$	[24)-(24)-(24)-(24)]	7	4x7

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.

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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 • 5 • 5) • (5 • 5 • 5)	6	56
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	\$	(-C)&
$(x^3)^3$	$(x_3)\cdot(X_3)\cdot(X_3)$	[[1x]-(1x)-[1x][[1x)(1x)-(1x)][[0x00]	9	開放

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 samasthe Simplified Expression



5. Complete the table.

	P / Lamasa Inggano pasa (p. paga)	forms.	Name: Tellay	Erickson
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Expression	Expanded expression	Rearranging and Combining Like	Simplified	Simplified
		Terms	with	expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	Exponents $(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	2-22-2-2-2-8-8-8-8-8-8-8-8-8-8-8-8-8-8-	(2).(X)°	10 y 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 $	(45-Cx)6	(1.12
$(-10x^6)^2$	(-10/26-10/2-10/2-10/2-10/2)	-10-10:40:40:40-10-x.x	(-10)B(D)	-10x6

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
t.	3 ⁴ ≈ 3 ⁶	[3.3.3.3.3.3.3]	230,59049
2.	$(2^3)^2$	(2.2.2) (2.2.2)	26,64
3.	$x \bullet x^6$	[(x)] · [(x) X · X · X · X · X]	X
4.	$(2x)^2$	(2.2) - Cx-x)	232.462
5.	$(-2x^4n^6)^2$	(-2-2-2;2) (n·n·n·n·n·n)	-2×8 n/2
6.	$[(-5xy)^2]^5$	[(-5).(5).(x)(x)(X)(7)] x5	# (-5 k) 10

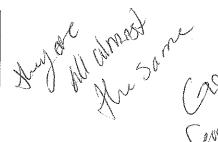
7. a. Complete the table of values.

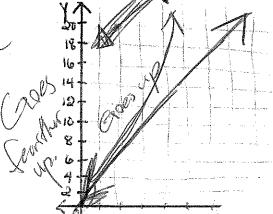
X	0	1	2	3	4
2x	20	21	22	20	24
2*	9°	9"	2	25	24

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?





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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.

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Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
7 ⁴ • 7 ⁵	(7. • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 7)	9	79
$(-4)^2 \cdot (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$. 5	(-u)s
$x^1 \cdot x^5$	[X:X:X:X:X:X]	6	X6
$(2x)^3 \bullet (2x)^4$	2x.2x.2x 12x.2x.2x		24

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.





Exploration B: Finding powers of powers.

3. Complete the table.

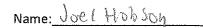
Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \bullet (5^3)$	(5 • 5 • 5) • (5 • 5 • 5)	6	56
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	- (DE
$(x^3)^3$	K5) ((3) ((3))	$(x \cdot x \cdot x)(x \cdot x \cdot x)(x \cdot x \cdot x)$	9	Xa
	~			

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.



is the same as the Simplified expression exponet





5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	2-2-2-2-2-2-2-8-8-8-8-8-8-8-8	(a) (x)	lag 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 $	(H1)(x5)	uge**
$(-10x^6)^2$	(-10x).(-10x).(-10x).(-10x).(-10x).(10x).(-10x).(10x).(-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 • 3 ⁶	3.3.3.3 • 3.3.3.3.3.3	310, 59,0 461
2.	$(2^3)^2$	$(2^3)(2^3) = (2\cdot 2\cdot 2)(3\cdot 2\cdot 2)$	26.
3.	x • x ⁶	X * X · X · X · X · X · X	x 7
4.	$(2x)^2$	Øx1	22 x 2 4 x 3
5.	$(-2x^4n^6)^2$	UBIR?	Lixenta
6.	$[(-5xy)^2]^5$	Work)	250x10y6

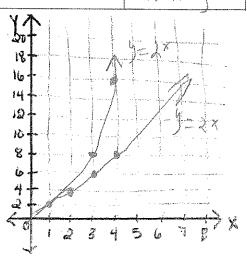
7. a. Complete the table of values.

×	0	1	2	3	4
2x	0	2	Ч	6	8
2×	مُ الاستخداد الدين	2	Н	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?



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 • 7 ⁵	(7 • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 7)	9	7 ⁹
$(-4)^2 \cdot (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	(-4)5
$x^1 \cdot x^5$	$(x) (x \cdot x \cdot x \cdot x \cdot x)$	6	χω
$(2x)^3 \bullet (2x)^4$	(2x.5x.3x)(2x.5x.5x)	Many Land	27

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
$(5^3)^2$	$(5^3) \bullet (5^3)$	(5 • 5 • 5) • (5 • 5 • 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	X9

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 muttiplied



5. Complete the table.

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U	

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	2.2.2.3.3.2.2.2.X.X.X.X.X.X.X.X.	x(27)(X7)	128 X7.
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot $	(46) (X6)	4096 X
$(-10x^6)^2$				

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
<u>1</u> .	3 ⁴ • 3 ⁶	(3.3.3.3)(3.3.3.3.3.3)	310 :
2.	$(2^3)^2$	(2.2.2) (2.2.2)	96,
3.	x • x ⁶	$(X) (X \cdot X \cdot X \cdot X \cdot X)$	χ7
4.	$(2x)^2$	(2x) o(2x)	22x2;4x
5.	$(-2x^4n^6)^2$	WDAK ?	4x8n12
6.	$[(-5xy)^2]^5$	work?	255x10410

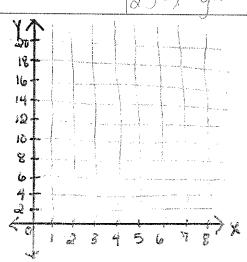
7. a. Complete the table of values.

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 Irlmina Mauri

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 • 7 ⁵	(7 • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 7)	9	79
$(-4)^2 \bullet (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	1-45
$x^1 * x^5$	bcoxoxoxoxox	6	· X ^C
$(2x)^3 \bullet (2x)^4$	(2x.2x.2x).(2x.2x.2x.2x)	7	(20)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 cuded.

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 • 5 • 5) • (5 • 5 • 5)	6	56
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	(-6 ⁸
$(x^3)^3$	$(x^3) < x^3) < x^3) < x^3)$	(x.x.x) (x.x.x)(x.x.x)	9	29

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





Name:_____

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \circ (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	2.2.2.2.2.2.2.2.x.x.x.x.x.	(27)(x7)	128x7
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot $	(46) (x6)	4196 x6
$(-10x^6)^2$	(-10 x G)(-10 x G).	-190-10 0 X 0 X 0 X 0 X 0 X 0 X 0 X 0 X 0 X 0	f10f00c12.	100.00

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.

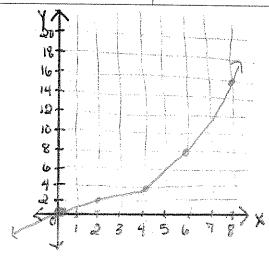
#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	3 ⁴ • 3 ⁶	(3.3.3,3) .(3.3.3.3.3)	59049
2.	$(2^3)^2$	(2-2-2) -(2-22)	. 64
3.	<i>x</i> • <i>x</i> ⁶	36 - X - X - 36 - 36 - 36 - 36	x7
4.	$(2x)^2$	200 - 200	452
5.	$(-2x^4n^6)^2$	(-20x-x-5C&n-n-n-n-n-n-n-n-n-n-n-n-n-n-n-n-n-n-n-	4x8n12
6.	$[(-5xy)^2]^5$	[6-8x43]-[6-8x43]-[6-8x43][6-8x43][6-8x43]	2

7. a. Complete the table of values.

	Х	0	1	2	3	4
,	Žχ	Q	2	d)	63	8
	2*	Q	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)



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 ≠ 7 ⁵	(7 • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 7)	. 9	79
$(-4)^2 \bullet (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	-45
$x^1 \bullet x^5$	(X)· (X·X·X·X)	6	x 6
$(2x)^3 \bullet (2x)^4$	(2x·2x·2x)·(2x·2x·2x·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 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 • 5 • 5) • (5 • 5 • 5)	6	5 ⁶
$[(-6)^2]^4$	$[(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	8	-6 ⁸
$(x^3)^3$	(x3)·(x3)·(x5)	(x·x·x)·(x·x·x)·(x·x·x)	Cus	X

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:			

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	22.2.2.2.2X(X)X(X)X(X)X(X)	(2)(x ²)	128 X7
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot $	(40)(x0)	9096 X
$(-10x^6)^2$	-10x1-10x -10x -10x -10x -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.

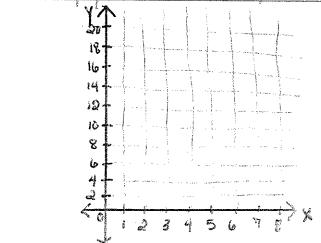
#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
T.	3 ⁴ • 3 ⁶	(3.3.3.3) (3.3.3.3 3.3)	3,10
2.	$(2^3)^2$	(2.2.2) (2.2.2)	2
3.	<i>x</i> • <i>x</i> ⁶	$(x)\cdot(x\cdot x\cdot x\cdot x\cdot x\cdot x)$	× *
4.	$(2x)^2$	2.2.x.x	Samuel A
5.	$(-2x^4n^6)^2$	2.2.2.2.X.X.X.X.0.0.0.0.0.0.0	152 X J W 15
6.	$[(-5xy)^2]^5$	(5.5.x.x.y.y).(55.x.x.y.y).(5.5.x.xy.y) (5.5.x.x.y.y). (5.5.x.x.y.y)	x 15625

7. a. Complete the table of values.

x	0	1	2	3	4
2х					
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: (VUU GUNG

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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.

+ 1

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
$7^4 * 7^5$	(7 • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 7)	9	. 79 /
$(-4)^2 \bullet (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	1-46
$x^1 \bullet x^5$	$(x) \circ (x)(x)(x)(x)$	10	XV
$(2x)^3 \bullet (2x)^4$	(2X)°(2X)°(2X)	7	FX

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.

expoents adds up

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \bullet (5^3)$	(5 • 5 • 5) • (5 • 5 • 5)	6	5 ⁶
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	g	(-W) &
$(x^3)^3$	(x)(x)(x)	[X·X·X] [X·X·X] [X·X·X]	9	Xq

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.

exponents mup-



5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like	Simplified	Simplified
		Terms	with	expression
			Exponents	
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
			7	-
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	(2.2.2.	(ながくどう)	
		2.2.2.2.2.2.2.x.x.x.x	XXXX	ICHYT
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot $	12101/20	8 14
[()]	[(my/my/my/)]		(47/X4)	1624476
(40.6\2			1 /	4 - 4 1 10
$(-10x^6)^2$	Translate North	0-10-10-10-10-10-10-10-10-10-10-10-10-10	16112/1/41	-175000UU
	1 (-10x)(-10x)(-10)(-10)	Part Dans Valver Wall V	LW1/X/	WIL

Name:

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 • 3 ⁶	(3.3.3). (3.3.3.3.3.6)	360
2.	$(2^3)^2$	Delle (23) (23) (2.2.2). (2.4)	26
3.	x • x ⁶	(X) · $(X \cdot X \cdot X \cdot X \cdot X \cdot X)$	XZ
4.	$(2x)^2$	(2x.2+) 2.2.x.x	2'X'
5.	$(-2x^4n^6)^2$	(-2x°2x°2x)°(n°n°n°n°n	7
6.	$[(-5xy)^2]^5$	WOR	2

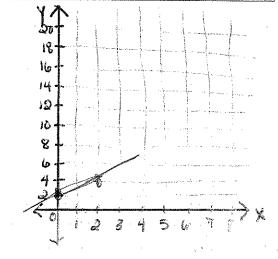
7. a. Complete the table of values.

х	0	1	2	3	4
2x	DX	11	71	丛	41
2 ^x	1)X	J'Y	24	3	4
	V	l	1		-

- 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?



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 • 7 ⁵	(7 • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 7)	9	. 79
$(-4)^2 \cdot (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	(-4)5
$x^1 \cdot x^5$	X - X - X - X - X	- 5	X5
$(2x)^3 \bullet (2x)^4$	(5 x . 5 x . 5 x) . (5 x . 5 x . 5 x . 5)) And the second	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.

into povers from lover equations

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \cdot (5^3)$	$(5 \bullet 5 \bullet 5) \bullet (5 \bullet 5 \bullet 5)$	6	5 ⁶
$[(-6)^2]^4$	$[(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	Color	(d 8
$(x^3)^3$	(X3).(X3).(X3)	(X·X·X)·(8·X·X)·(X·X·X)	7	X9

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 examplified expands



Name:	•		

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	Z. Z. Z. Z. Z. Z. Z. X.	(27)(x2)	128x7
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot $	(49) (x9)	407515
$(-10x^6)^2$	(MOXXXOX-10X-10X-10X)C10XXC0XX	-10-10-10-10-10-10-10-10-10-10-10-10-10-	(1034))	199,900 0 %

6.	Find a pattern that rela	ates the o	original expr	essions in th	ne first c	olumn to t	he simplified e	xpressions, in the last
	column.	500	C. Carp.	disti		77C	x xaca	xpressions in the last
		8 8	a ditt	14 cm	so de de se	Service of		u runnal

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 • 3 ⁶	(3.3.3.3) * (3.3.3.3.3.3.3.3)	315
2.	$(2^3)^2$	(2.2.2)-(2.2.2)	Laure Com
3.	x • x ⁶	×·×·×·×·×	X
4.	$(2x)^2$	(54) (34) = (37) (x3)	412
5.	$(-2x^4n^6)^2$	(1.0) ((2.2.2.2.2.2.x.x.x.x.x)) ((0.0)	(28) (x8)(n13)
6.	$[(-5xy)^2]^5$	[(-Sxy-5xy)] o [(-3xy-5xy)] o [(-5xy-5xy)]	9765626X10

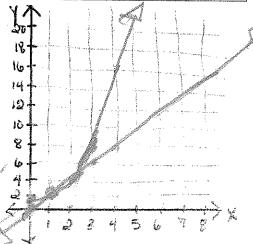
7. a. Complete the table of values.

X	0	1	2	3	4
2x	703	74)	743	20)	200)
2 ^x	2000	2(1)	S. S		(1)
		7	4/	2	16

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

How are they different?





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 • 7 ⁵	(7 • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 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,x) " (x5, x5, x5, x6, x6)	6	X6
$(2x)^3 \bullet (2x)^4$	(2,2,2). (2,2,2,2x).	are for	2x6

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 do exponents added

Exploration B: Finding powers of powers.

3. Complete the table.

Expression	Expanded expression	Expression as repeated multiplication	Number of factors	Simplified expression
$(5^3)^2$	$(5^3) \bullet (5^3)$	(5 • 5 • 5) • (5 • 5 • 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°
$(x^3)^3$	$(x/3) \cdot (x/3) \cdot (x/3)$	(x . x . x) . (x . x . x) . (x . x .)	9	C×3
		·		

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.

Mimpol Factors)

The same as simplified.

Chileskon Multiplied.



5. Complete the table.

1			
	X	Name:	

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	Q2.3-2-2-2-8-8-8-8-8-8	(26)(46)	64x6
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot $	(46)(x5)	4096×5
$(-10x^6)^2$	[(4x) 44x) (10x) 0(-12x) (10x) (10x) (10x)	-1001-01-01-01-01-01-01-01-01-01-01-01	(10) (x)	1×1010

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.

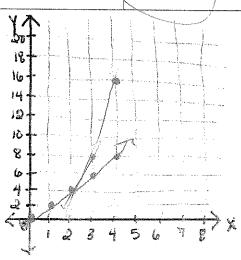
#	22-32 even	Expression as Repeated Multiplication	Simplified
			Expression
1.	3 ⁴ * 3 ⁶	(5-3-3-3)-(3-3-3-3-3-3)	310
2.	$(2^3)^2$	(2.2.2) - (2.2.2)	26
3.	x • x ⁶	(X) ·(x · x · x · x · x · x)	X
4.	$(2x)^2$	[2,2) (x,x)]	\$ x A
5.	$(-2x^4n^6)^2$	(-22) · (x·x·x·x·x·x·x·x) · (n·n·n·n·n·n·n·n·n·n·n·n·n·n·n·n·n·n·	4×50/2
6.	$[(-5xy)^2]^5$	$(-5\times-5)\cdot(\times\cdot\times)\cdot(\times\cdot\times)^{5}$	-3125 a x 1) 1

7. a. Complete the table of values.

х	0	1	2	3	4
2х	0	2	Ų	(a	7
2 ^x	0	٥	4	8)6

- 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 o, 2H, r. How are they different? Expenses block aff of (3,1).



ame: 🚫

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 • 7 ⁵	$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7 \cdot 7 \cdot 7 \cdot 7)$	9	79
$(-4)^2 \cdot (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	-45
$x^1 \bullet x^5$	[X.X.X.X.X]	6	X
$(2x)^3 \bullet (2x)^4$	EX 2x 2x 3x 3x 2x	un Process	

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.

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 • 5 • 5) • (5 • 5 • 5)	6	5 ⁶
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \bullet -6) \bullet (-6 \bullet -6) \bullet (-6 \bullet -6) \bullet (-6 \bullet -6)$	8	-68
$(x^3)^3$	[X·X·XX ·X·X) · (X·X·)	(CX) 1 [X 3] (X)3)	Ć.	X

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:	

5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	2.2.2.2.2.2.xxxxxx	** 127 X x8)	9
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot $	(46) (X6)	43
$(-10x^6)^2$	(-10x)(-10x)(-10x)(-10x)(-10x)	-10:40:-10:-10:-10:-10-10		2

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

Practice Problems:

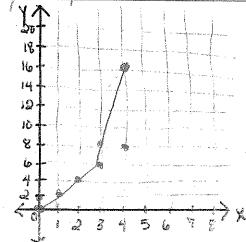
For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	3 ⁴ • 3 ⁶	[B·3·3·3·3·3·3·3·3·3]	->
2.	$(2^3)^2$	Qz.2.2))·[(2.2.2)]	7
3.	$x \cdot x^6$	ロメフ・ビス・メ・メ・メンジ・ビメロ	Xe
4.	$(2x)^2$	$(2x \cdot 2x)$	Й×
5.	$(-2x^4n^6)^2$	17-7x-2x-2x-2x-2x-370000	
6.	$[(-5xy)^2]^5$	[(-5xy).(-5xy)].[-5xy/=5xy]	

7. a. Complete the table of values.

	х	0	1	2	3	4
	2x	4	7	Ц	6	8
į	2 ^x		7	- Same	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?



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 • 7 ⁵	(7 • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 7)	9	79
$(-4)^2 \bullet (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	(-4)5
$x^1 \cdot x^5$	(X) · (X·X·X·X)	6	X &
$(2x)^3 \bullet (2x)^4$	(8x · 8x · 9x) · (8x · 8x · 9x · 5x)	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 • 5 • 5) • (5 • 5 • 5)	6	5 ⁶
$[(-6)^2]^4$	$[(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2] \cdot [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	в	-6 ⁸
$(x^3)^3$	(X3) · (X3) · (X3)	(x · x · x) · (x · x · x) · (x · x · x)	O.	X

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 195t column.



5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	3.3.3.3.3.3.x.x.x.x.x.x.x	(27) (xi)	16.8 × 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 $, r	HUS CON
$(-10x^6)^2$	(-10x)(10x)(-10x)(-10x)(-10x)(-10x)(-10x)	-10.10.70.7010.10.10.10.10 -10.70.7010. X.	(-10p) (x2)	2,000,000

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.

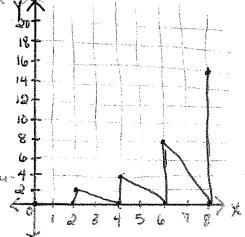
	#	22-32 even	Expression as Repeated Multiplication	Simplified
				Expression
	î.	3 ⁴ • 3 ⁶	3,3,3,3	3 10
			3.3.3.3.3	
	<i>2</i> .	$(2^3)^2$	2.2.3	2 G
-	3.	<i>x</i> • <i>x</i> ⁶	x · X · X · X · X · X	
		-		X G
	4.	$(2x)^2$	(2x.2x)	(Dix) B
K !	5.	$(-2x^4n^6)^2$	-2x2x2x.2x	(48 \
· L			(n.n.n. n. 4 n.)	(-axn")
(6.	$[(-5xy)^2]^5$	(25/x4) (25/x4) 25/x4. 25/x4. 25/x	35 25 100
L		1-5xy5xy	165041 15241 524A 1524A 1524A	-5 2009

7. a. Complete the table of values.

	x	0	1	2	3	4
/	2x	0	3	4	(e	2
74	2 ^x	0	A	4	8	16

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

 How are they the same? Some cordinates are with the same not how are they different? And some aren't



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 • 7 ⁵	(7 • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 7)	9	7 ⁹
$(-4)^2 \bullet (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	45
$x^1 \cdot x^5$	$(x) \cdot (x \cdot x \cdot x \cdot x \cdot x)$	6	Xª
$(2x)^3 \bullet (2x)^4$	(2x.2x.2x).(2x.2x2	(2x) B	AXB

2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in HOURS AN BOOM OF

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 • 5 • 5) • (5 • 5 • 5)	6	5 ⁶
$[(-6)^2]^4$	$[(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2]$	$(-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6) \cdot (-6 \cdot -6)$	9	(G)
$(x^3)^3$	$(x^3)(x^3)(x^3)$	(X.X.X) · (X-X-X) (X-X-X) q	X
		(e	•	

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.

YOU MILL OFF HARMAN MOSINGER OF

and we exponent in the 31/19



5. Complete the table.

Sllo	Name: Sky Johnson

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \cdot (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	8. 9. 9. 9. 9. 9 · X · X · X · X · X · X · X · X · X ·	(2)(1)	
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	4 · 4 · 4 · 4 · 4 · 4 · x · x · x · x ·	(4°)(XÝ)	24x ^{cg}
$(-10x^6)^2$			(m²) (x p)	190x ¹⁹

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

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 • 3 ⁶	(3-3-3-3)-(3-3-3-3-3-3)	310
2.	$(2^3)^2$	(2.3.2).(2.2.2)	24
3.	<i>x</i> • <i>x</i> ⁶	$(x) \cdot (x \cdot x \cdot x \cdot x \cdot x)$	X
4.	$(2x)^2$	(2x)-(2x)	212
5.	$(-2x^4n^6)^2$	(2x-2x-2x2x-n-n-n-n-n-n)	4.8012
6.	$[(-5xy)^2]^5$	(F=5x)(6xy))	50 x10 V10

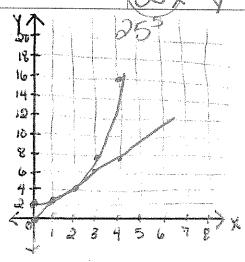
7. a. Complete the table of values.

X	0	1	2	3	4
2х	0	٥	Ą	Ce	8
2 ^x	9000	10 m	A	8	10

- 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?



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

Exploration A: Finding products of powers

1. Complete the table.

Expression	Expression as repeated multiplication	Number of factors	Simplified expression
7 ⁴ • 7 ⁵	(7 • 7 • 7 • 7) • (7 • 7 • 7 • 7 • 7)	9	79
$(-4)^2 \bullet (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	(-4)5
$x^1 \bullet x^5$	X. X. X. X. Y. X.		XO
$(2x)^3 \bullet (2x)^4 \Big($	0. x.0.x.0.x/2.x.2.y	7	λx^{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. + HOH I Simply the number and COUNTED THE AREA TO THE NUMBER AND

and MH in lighter

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 • 5 • 5) • (5 • 5 • 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	16 ³
$(x^3)^3$	LX3 (X3)(X3)	(XXX) (XXXX)	C1	*a
			· ·	-

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

Number factor is the same and the simplified Heresian expense



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
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	JUDA DEKO *X.X.X.X.X.X.X.X.X.	(A)(×7)	
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	4 · 4 · 4 · 4 · 4 · 4 · x · x · x · x ·		
$(-10x^6)^2$	10x)(-10x/ +0x/F10x/ +0x/-10x/-	0x) -10; -10; -10; -10; -10; -10; -10; -10;	(X12)	

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

Practice Problems:

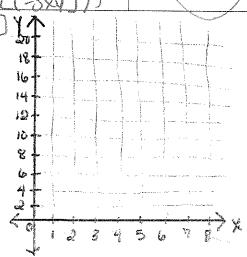
For each problem, write the expression as repeated multiplication and simplified expression like you did in the above tables.

#	22-32 even	Expression as Repeated Multiplication	Simplified Expression
1.	3 ⁴ • 3 ⁶	(3.3,3,3) (3.8.3.3.3)	
2.	$(2^3)^2$	(अविक सिर्विक	
3.	$x \cdot x^6$	(x x) (x x) (x · x) (x · x) (x · x)	
4.	$(2x)^2$	$(a_{*} \circ \chi)$	·
5.	$(-2x^4n^6)^2$	(-2x, -2x, dx, -2x,)(n, n, n	72
6.	$[(-5xy)^2]^5$	(C-5W) [5xy) (C-5xy) (C-5xy))	

7. a. Complete the table of values.

Х	0	1	2	3	4
2х					
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: Maxe Guenk

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 • 7 ⁵	(7•7•7•7) • (7•7•7•7)	9	7 ⁹
$(-4)^2 \bullet (-4)^3$	$[(-4) \bullet (-4)] \bullet [(-4) \bullet (-4) \bullet (-4)]$	5	45
$x^1 \bullet x^5$	[X]·E(X)(X)(X)(X)·K)]	6	χ6
$(2x)^3 \bullet (2x)^4$	E(2x)·(2x)·(2x)7·[(2) 44 (2x) (2x)	y y	2×7

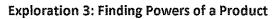
2. Find a pattern that relates the exponents of the factors in the first column and the exponent of the expression in the last column.

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 • 5 • 5) • (5 • 5 • 5)	6	5 ⁶
$[(-6)^2]^4$	$[(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2] \bullet [(-6)^2]$	(-6 • -6) • (-6 • -6) • (-6 • -6) • (-6 • -6)	É	-68
$(x^3)^3$	[6969-69] , [64-60-61] , [64-60-61]			X
	The second secon			

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:		
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5. Complete the table.

Expression	Expanded expression	Rearranging and Combining Like Terms	Simplified with Exponents	Simplified expression
$(5xy)^3$	$(5xy)\cdot(5xy)\cdot(5xy)$	$5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y$	$(5^3)(x^3)(y^3)$	$125x^3y^3$
$(2x)^3 \bullet (2x)^4$	$(2x \cdot 2x \cdot 2x) \cdot (2x \cdot 2x \cdot 2x \cdot 2x)$	J.5.5.5.5.5.5.3.x.x.x.x	(27)67)	12807)
$[(4x)^3]^2$	$[(4x)(4x)(4x)] \cdot [(4x)(4x)(4x)]$	$4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot $	149/4/	4.0% (x4)
$(-10x^6)^2$	[(-10×27. [(10×4)7	-10,-16 ·X·X·X·X·X·X·X·X·X·X·X	(1031x2)	10m/x ¹³)

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 at the others

Practice Problems:

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

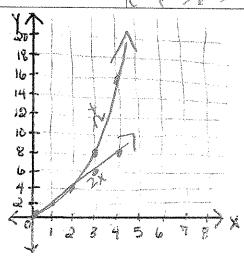
#	22-32 even	Expression as Repeated Multiplication	Simplified
			Expression
1.	3 ⁴ • 3 ⁶	(3.3.3.3).(3.3.3.3.3)	34
2.	$(2^3)^2$	(2-2-2) - (2-2-2)	26
3.	x • x ⁶	(x) · (x · x · x · x · x · x)	and the same of th
4.	$(2x)^2$	(z·z) · (x·x)	22/2
5.	$(-2x^4n^6)^2$	E(-2(x.x.x)(v.x.v.))	122)(x8)/m12)
6.	$[(-5xy)^2]^5$	[(-5,-5(x·x(y·x)))]	65° (2) (19)

7. a. Complete the table of values.

x	0	1	2	3	4
2x	0	Z	tal	6	8
2 ^x	O	erg Li	Loof .	Š	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 of an 0,1,2 How are they different? They scretate at 3



Name: Nate Comers

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 as repeated multiplication	Remaining After	Simplified expression
	Canceling	
6 · 6 · 6 · 6 · 6 · 6 · 6 · 6 · 6	6.6.6	6 ³
6 · 6 · 6 · 6 · 6 · 6		
(-4)(-4)(-4)(-4)(-4)(-4)	441/-111/0/11/U	weekend lef
(-4)(-4)		To you have a second or the second of the se
X 1 X 1 X Marchanthackarthere	X · X · X · X · X	X5
Toy you you	N. X. Y. Y. W.	1
	$\frac{6 \cdot 6 \cdot 6}{6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6}$ $\frac{(-4)(-4)(-4)(-4)(-4)(-4)}{(-4)(-4)}$	$\frac{6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6}{6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6 \cdot 6}$ $\frac{(-4)(-4)(-4)(-4)(-4)}{(-4)(-4)}$ $\frac{(-4)(-4)(-4)}{(-4)(-4)}$ $\frac{(-4)(-4)(-4)(-4)(-4)}{(-4)(-4)(-4)}$

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.

Exploration B: Finding powers of quotients.

3. Complete the table.

Expression	Expanded Expression	Expression as repeated multiplication	Simplified expression
$\left(\frac{3}{2}\right)^7$	$\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)\left(\frac{3}{2}\right)$	$\frac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}$	$\frac{3^7}{2^7}$
$\left(\frac{a}{b}\right)^2$	$\left(\frac{a}{b}\right)\left(\frac{a}{b}\right)$	$\frac{a \cdot a}{b \cdot b}$	a ²
$\left(\frac{x^3}{x}\right)^3$	(x.x.x/x.x.x)x.x.x.x	and the second s	b X
$\left(\frac{x}{2y^4}\right)^2$	(Z.y.y.y.y) (Z.y.y.y.y)	2.2. Vy V V V V V V	1 State of the sta

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
$\left(\frac{1}{3}\right)^4 * 3^7$	$\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$	$\frac{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3}{3 \cdot 3 \cdot 3 \cdot 3}$	3 · 3 · 3	33
$4^9 \cdot \left(\frac{1}{4}\right)^5$				
$\frac{1}{y^8} * y^{10}$	$\frac{y^{10}}{y^8}$			×2
$\left(\frac{x^2}{3y^3}\right)^2$				

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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.	$\frac{(-12)^9}{(-12)^3}$		
3.	6 ⁷ • 6 ⁴ 6 ⁶		
4.	x ⁵ e x ¹⁰		
5.	$\frac{1}{y^8} \cdot y^{15}$		
6.	$\left(\frac{c^5}{d^2}\right)^3$		
7.	$\left(\frac{4c}{2d^2}\right)^3$		
8.	$\left(\frac{2x^3}{y}\right)^3 \bullet \frac{1}{6x^3}$		
9.	$\frac{3}{8m^5} * \left(\frac{m^4}{n^2}\right)^3$		