




Name: KEY

Period: \_\_\_\_\_

Algebra 1

Chapter 7: Exponents and Exponential Functions

Targets	Learning Targets	Got it	Ok	No way
T 7-1	I can multiply monomials using the properties of exponents and simplify expressions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T 7-2	I can divide monomials using the properties of exponents and simplify expressions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T 7-3	I can use all properties of exponents to solve exponents.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
T 7-4	I can evaluate, rewrite and solve expressions involving rational exponents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Target	Lesson/Activity	Homework Assignment o = only do odd problems	Turned In?
T 7-1 3/31	Multiplication Property of Exponents	T 7-1 Multiplication Property Worksheet	
4/2 T 7-2	Division Property of Exponents	T 7-2 Division Property Worksheet	
4/4	<del>ITH MULTIPLICATION PART 2</del>		
4/8 T 7-3	Zero Property of Exponents	T 7-3 Zero and Negative Property Worksheet	} 2 stamps
	Negative Property of Exponents	Extra <u>WST 7-3</u>	
4/10 T 7-4	Rational Exponents	T 7-4 Rational Exponent Worksheet	
4/14	All Exponent Properties Review	Stations – Participation in all stations earns a stamp. ART	
4/16	Chapter 7 <del>Review</del> TEST	<del>Ch 7 ART</del>	
	<del>Chapter 7 Test</del> ★ conferences ★	You must have 4 stamps to be eligible for retakes	

## Retake Problems for Ch. 6

<b>T 6-1</b>	6.1 pg. 339 #25-37all
<b>T 6-2</b>	6.2 pg. 347 #1-13all, 23, 25 T6-2 and T6-3 Retake Worksheet
<b>T 6-3</b>	6.4 pg. 360 #7-20all T6-2 and T6-3 Retake Worksheet

### Exponent Rules:

Rule Name	Definition	Example

## T 7-1 Multiplication Properties of Exponents

(Multiplication Rule and Power to Power Rule)

Simplify the following.

1. $(a^2)^3$ $a^6$	2. $(x^4)^2$ $x^8$
3. $(x^3)^2$ $x^6$	4. $(b^2)^5$ $b^{10}$
5. $(u^7)^{10}$ $u^{70}$	6. $(z^8)^5$ $z^{40}$
7. $(2x^2)^3$ $2^3 x^6 = 8x^6$	8. $(3y^3)^3$ $3^3 y^9$ <span style="border: 1px solid black; padding: 2px;"><math>27y^9</math></span>
9. $(-3x^2)^2$ $(-3)^2 x^4$ <span style="border: 1px solid black; padding: 2px;"><math>9x^4</math></span>	10. $(-5y^3)^3$ $(-5)^3 y^9$ <span style="border: 1px solid black; padding: 2px;"><math>-125y^9</math></span>
11. $(\frac{1}{2}x^4)^2$ $\frac{1}{2} \cdot \frac{1}{2} x^4 x^4 = \frac{1}{4} x^8$	12. $(\frac{1}{3}y^3)^2$ $(\frac{1}{3})^2 y^6$ <span style="border: 1px solid black; padding: 2px;"><math>\frac{1}{9} y^6</math></span>
13. $2(3a^2)^3$ $2 \cdot 3^3 a^6$ <span style="border: 1px solid black; padding: 2px;"><math>54a^6</math></span>	14. $4(-2x^3)^3$ $4 \cdot (-2)^3 x^9 = 4 \cdot (-8) x^9 = -32x^9$
15. $\frac{1}{2}(4x^3)^2$ $\frac{1}{2} \cdot 4^2 x^6 = \frac{16}{2} x^6 = 8x^6$ <span style="border: 1px solid black; padding: 2px;"><math>8x^6</math></span>	16. $\frac{1}{3}(3t^2)^3$ $\frac{1}{3} 3^3 t^6 = \frac{27}{3} t^6 = 9t^6$
17. $(-x^2)^3$ $(-1)^3 x^6$ <span style="border: 1px solid black; padding: 2px;"><math>-x^6</math></span>	18. $(-2y^3)^2$ $(-2)^2 y^6$ <span style="border: 1px solid black; padding: 2px;"><math>4y^6</math></span>
19. $(-3x^3)^2$ $(-3)^2 x^6$ <span style="border: 1px solid black; padding: 2px;"><math>9x^6</math></span>	20. $(-5y^2)^3$ $(-5)^3 y^6$ $-125y^6$
21. $(a^m)^n$ $a^{mn}$	22. $(b^x)^y$ $b^{xy}$
23. $(3b^5)^3$ $3^3 b^{15}$	24. $(5x^p)^2$ $5^2 x^{2p}$
25. $(x^5)^2(2x^3)^2$ $x^{10} 2^2 x^6$ <span style="border: 1px solid black; padding: 2px;"><math>4x^{16}</math></span>	26. $(a^7)^3(a^3)^2$ $a^{21} a^6 = a^{27}$
27. $(x^2)^8(x^3)^4$ $x^{16} x^{12}$ $x^{28}$	28. $(y^3)^1(y^2)^4 = y^3 y^8 = y^{11}$
29. $(2x^m)^3(x^2)^m$ $2^3 x^{3m} x^{2m}$ $8x^{3m+2m} = 8x^{5m}$ <span style="border: 1px solid black; padding: 2px;"><math>8x^{5m}</math></span>	30. $(3y^r)^2(y^3)^r$ $3^2 y^{2r} y^{3r} = 9y^{5r}$

Name: Key

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Simplify the following.

1. $x^5 \cdot x$ $x^6$	2. $y^3 \cdot y^2$ $y^5$
3. $5x^3 \cdot x^4$ $5x^7$	4. $4y^2 \cdot y^5$ $4y^7$
5. $2x^3 \cdot 7x^3$ $14x^6$	6. $9y^2 \cdot 5y^2$ $45y^4$
7. $3x^5(-7x)^2$ $3x^5(-7)^2x^2$ $147x^7$	8. $5y^4(-2y)^5$ $5(-2)^5y^4y^5$ $-160y^9$
9. $(-4x)^2(-7x)^2$ $(-4)^2x^2(-7)^2x^2$ $16(49)x^4$ $784x^4$	10. $(-3y)^3(-7y)^2$ $(-3)^3y^3(-7)^2y^2$ $-27(+49)y^5$
11. $(6a^3b^3)(-4a^4b)$ $-24a^7b^4$	12. $(-9r^3s)(5r^5s)$ $-45r^8s^2$
13. $c^3(c^2)(c^4)$ $c^9$	14. $z^3(z^2)(z^5)$ $z^{10}$
15. $m(-m^2)(-m^3)$ $m^6$	16. $t^4(-t^2)(t^3)$ $-t^9$
17. $17a^3b^2(-2a^4)(-3b)$ $17(-2)(-3)$ $102a^7b^3$	18. $-2s^3t^2(5s^4)(7t)$ $-2(5)7$ $-70s^7t^3$
19. $4xy(-3x^3y)(2xy^4)$ $4(-3)(2)$ $-24x^5y^6$	20. $3m^3(2m^2n^2)(-3n)$ $3(2)(-3)$ $-18m^5n^3$
21. $3r^4(2s)(-5r^2s^2)$ $3(2)(-5)$ $-30r^6s^3$	22. $5c^3(2c^3d^2)(-11d)$ $5(2)(-11)$ $-110c^6d^3$
23. $7^3(7^3)(7^2)$ $7^8 =$	24. $2^4(2^5)(2^2)$ $2^{11}$
25. $c^3(c^r)$ $c^{3+r}$	26. $d^4(d^5)$ $d^{4+5}$
27. $a^1(a^3)(a^x)$ $a^{4+x}$	28. $r^y(r^1)(r^3)$ $r^{y+1+3} = r^{y+4}$
29. $5x^a(-2x^3)(-3x^1)$ $5(-2)(-3)$ $30x^{a+4}$	30. $12d^r(-2d^1)(-7d^2)$ $12(-2)(-7)$ $168d^{r+3}$

## Exponents and Division T7-2

Simplify. Your answer should contain only positive exponents.

$$1) \frac{5^4}{5} = 5^{4-1} = 5^3$$

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$$2) \frac{3}{3^3} = \frac{1}{3^2}$$

$$3) \frac{2^2}{2^3} = \frac{1}{2}$$

$$4) \frac{2^4}{2^2} = 2^2$$

$$5) \frac{3r^3}{2r} = \frac{3r}{2}$$

$$6) \frac{7k^2}{4k^3} = \frac{7}{4k}$$

$$7) \frac{10p^4}{6p} = \frac{5p^3}{3}$$

$$8) \frac{3b}{10b^3} = \frac{3}{10b^2}$$

$$9) \frac{8m^3}{10m^3} = \frac{4}{5}$$

$$10) \frac{7n^3}{2n^5} = \frac{7}{2n^2}$$

$$11) \frac{2n^2}{n} = 2n$$

$$12) \frac{8x^3}{10x^5} = \frac{4}{5x^2}$$

$$13) \frac{12x^3}{9y^8} = \frac{4x^3}{3y^8}$$

$$14) \frac{14x^4y^7}{6x^5y^4} = \frac{7y^3}{3x}$$

$$15) \frac{11u^4}{17u^7v^9} = \frac{11}{17u^3v^9}$$

$$16) \frac{2xy^{4-1}}{7 \cdot 14xx^8} = \frac{2y^3}{7x^8}$$

$$17) \frac{\overset{6}{12}yx^4}{\underset{5}{10}yx^{8-4}} = \frac{6}{5x^4}$$

$$18) \frac{\overset{9}{18}x^{8-3}y^3}{\underset{5}{10}x^2} = \frac{9x^5y^3}{5}$$

$$19) \frac{\overset{1}{5}n^8}{\underset{4}{20}n^8} = \frac{1}{4}$$

$$20) \frac{16yx^4}{9x^8y^{12-1}} = \frac{16}{9x^4y}$$

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### Zero and Negative Exponents Algebra 1 Homework

**Skills**

For problems 1 through 36, rewrite without zero or negative exponents.

1.  $4^{-3} = \frac{1}{4^3}$
2.  $5^{-2} = \frac{1}{5^2}$
3.  $5^0 = 1$
4.  $10^{-2} = \frac{1}{10^2}$
5.  $4^{-3} = \frac{1}{4^3}$
6.  $2^{-4} = \frac{1}{2^4}$
7.  $\frac{1}{2^{-2}} = \frac{2^2}{1}$
8.  $\frac{1}{4^0} = \frac{1}{1} = 1$
9.  $(-3)^{-2} = \frac{1}{(-3)^2}$
10.  $3x^0 = 3 \cdot 1 = 3$
11.  $5x^{-4} = \frac{5}{x^4}$
12.  $\frac{x^5}{y^{-3}} = x^5 y^3$
13.  $\frac{a^{-4}}{b^{-3}} = \frac{b^3}{a^4}$
14.  $2x^0 y^{-2} = \frac{2(1)}{y^2} = \frac{2}{y^2}$
15.  $2^{-3} = \frac{1}{2^3}$
16.  $(16x^2 y^{-5})^0 = 1$

17.  $3^0 = 1$
18.  $8x^0 y^{-3} = \frac{8 \cdot 1}{y^3} = \frac{8}{y^3}$
19.  $(-3)^{-3} = \frac{1}{(-3)^3}$
20.  $(\frac{1}{2})^{-1} = (\frac{2}{1})^1 = 2$
21.  $(\frac{1}{2})^{-2} = (\frac{2}{1})^2$
22.  $(\frac{1}{3})^{-1} = (\frac{3}{1})^1$
23.  $1^{-6} = \frac{1}{1^6} = 1$
24.  $(-5)^0 = 1$
25.  $(-1)^2 = (-1)(-1) = 1$
26.  $2^{-1} = \frac{1}{2^1} = \frac{1}{2}$
27.  $(-2)^1 = -2$
28.  $(-2)^{-2} = \frac{1}{(-2)^2} = \frac{1}{4}$
29.  $(-2^{-2})^{-1} = (-\frac{1}{2^2})^{-1} = (-\frac{2^2}{1})^1 = -4$
30.  $\frac{2x^3 y^2}{4x^{-4} y^{-1}} = \frac{1x^7 y^3}{2}$
31.  $a^3 b^{-4} = \frac{a^3}{b^4}$
32.  $\frac{a^{-2}}{b^4} = \frac{1}{b^4 a^2}$

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**+7-3**

33.  $\frac{x^2}{2y^{-3}} = \frac{x^2 y^3}{2}$
34.  $\frac{3x^3}{y^{-4}} = 3x^3 y^4$
35.  $\frac{x^0 y^{-3}}{z^2} = \frac{1 \cdot y^3 z^2}{y^3 z^2} = 1$
36.  $2x^{-1} y^{-4} = \frac{2}{xy^4}$

Use the STORE feature on your calculator to help evaluate the following.

37.  $y^{-3}$  for  $y=2$   $(2)^{-3} = \frac{1}{2^3} = \frac{1}{8}$
38.  $y^{-3}$  for  $y=\frac{1}{2}$   $(\frac{1}{2})^{-3} = (\frac{2}{1})^3 = 8$
39.  $2x^{-4} y^{-1}$  for  $x=2, y=\frac{1}{3}$   
 $2(2)^{-4} (\frac{1}{3})^{-1} = \frac{2}{16} \cdot 3 = \frac{3}{8}$   
calc = .375
40.  $(x+3)^{-2}$  for  $x=-4$   
 $(-4+3)^{-2} = (-1)^{-2} = \frac{1}{(-1)^2} = 1$
41.  $x^{-y}$  for  $x=-2, y=2$   
 $(-2)^{-2} = .25$
42.  $(x^4 y^2)^0$  for  $x=\frac{4}{3}, y=-\frac{2}{7}$   
 $= 1$
43.  $x^y x^{-y}$  for  $x=\frac{2}{5}, y=-\frac{4}{3}$   
 $(\frac{2}{5})^{-\frac{4}{3}} (\frac{2}{5})^{\frac{4}{3}} = 1$

Student Name: \_\_\_\_\_

Score: \_\_\_\_\_

### Quotient Rule Worksheet

Rewrite the following as single exponent using quotient rule: Work Space

Example:  $\frac{3^5}{3^2} = 3^{5-2} = 3^3$

$$\frac{9^8}{9^4} = \underline{9^{8-4}} = 9^4$$

$$\frac{7^7}{7^6} = \underline{7^{7-6}} = 7^1$$

$$15^8 \times 15^{-3} = \underline{15^{8+(-3)}} = 15^5$$

$$\frac{8^{10}}{8^{15}} = \underline{8^{10-15}} = 8^{-5} = \frac{1}{8^5}$$

$$3^4 \times 3^{-2} = \underline{3^{4+(-2)}} = 3^2$$

$$\frac{12^6}{12^1} = \underline{12^{6-1}} = 12^5$$

$$\frac{4^2}{4^9} = \underline{4^{2-9}} = 4^{-7} = \frac{1}{4^7}$$



## More Properties of Exponents T7-3

Simplify. Your answer should contain only positive exponents.

$$1) (x^{-2}x^{-3})^4$$

$$\left(\frac{1}{x^2x^3}\right)^4$$

$$\left(\frac{1}{x^5}\right)^4$$

$$\boxed{\frac{1}{x^{20}}}$$

$$2) (x^4)^{-3} \cdot 2x^4$$

$$\frac{1}{(x^4)^3} \cdot 2x^4 = \frac{2x^4}{x^{12-4}} = \frac{2}{x^8}$$

$$3) (n^3)^3 \cdot 2n^{-1}$$

$$\frac{2n^9}{n} = 2n^8$$

$$4) (2v)^2 \cdot 2v^2 = 2^2v^2 \cdot 2v^2$$

$$= 2^3v^4$$

$$5) \frac{2x^2y^4 \cdot 4x^2y^4 \cdot 3x^2y^2}{3x^3y^2} = \frac{2 \cdot 4 \cdot 3 x^8 y^{8+2}}{3yz}$$

$$\boxed{8x^8y^6}$$

$$6) \frac{2y^3 \cdot 3xy^3}{3x^2y^4} = \frac{2 \cdot 3 \cdot x y^{6-4}}{3x^2y^4} = \frac{2y^2}{x}$$

$$7) \frac{x^3y^3 \cdot x^3}{4x^2} = \frac{x^6y^3}{4x^2} = \frac{x^4y^3}{4}$$

$$8) \frac{3x^2y^2 \cdot x}{2x^{-1} \cdot 4yx^2} = \frac{3x^3y^2 \cdot x}{2 \cdot 4x^2y} = \frac{3xy}{8}$$

$$9) \frac{x}{(2x^2)^2} = \frac{x}{4}$$

$$10) \frac{2m^{-4}}{(2m^{-4})^3} = \frac{2m^{-4}}{2m^{-4} \cdot 2m^{-4} \cdot 2m^{-4}}$$

$$\frac{2m^4m^4m^4}{2 \cdot 2 \cdot 2m^4} = \frac{m^8}{2^2}$$

$$11) \frac{(2m^2)^{-1}}{m^2} = \frac{1}{2m^2 m^2} = \frac{1}{2m^4}$$

$$12) \frac{2x^3}{(x^{-1})^3} = \frac{2x^3}{x^{-1} x^{-1} x^{-1}}$$

$$\frac{2x^3}{x^{-3}} = 2x^3 x^3 = 2x^6$$

$$13) (a^{-3} b^{-3})^0 = 1$$

$$14) x^4 y^3 \cdot (2y^2)^0 = x^4 y^3$$

$$15) ba^4 \cdot (2ba^4)^{-3} = \frac{ba^4}{(2ba^4)^3} = \frac{ba^4}{2^3 b^3 a^{12-4}} = \frac{1}{8b^2 a^8}$$

$$16) (2x^0 y^2)^{-3} \cdot 2yx^3 = \frac{2yx^3}{(2y^2)^3} = \frac{2yx^3}{2^3 y^{6-1}} = \frac{x^3}{2^2 y^5} = \frac{x^3}{4y^5}$$

$$17) \frac{2k^3 \cdot k^2}{k^{-3}} = 2k^3 k^2 k^3 = 2k^8$$

$$18) \frac{(x^{-3})^4 x^4}{2x^{-3}}$$

$$19) \frac{(2x)^{-4}}{(x^{-1}) \cdot x} = \frac{x}{(2x)^4 x} = \frac{1}{2^4 x^4} = \frac{1}{16x^4}$$

$$20) \frac{(2x^3 z^2)^3}{x^3 y^4 z^2 \cdot x^{-4} z^3} = \frac{2^3 x^9 z^6}{x^3 y^4 z^5} = \frac{8x^{10} z}{y^4}$$

$$21) \frac{(2pm^{-1}q^8)^{-4} \cdot 2m^{-1}p^3}{2pq^2} = \frac{2p^3}{(2pm^{-1})^4 2pq^2} = \frac{2p^3 m^4}{2^5 p^5 q^2} = \frac{m^4}{2^4 p^2 q^2}$$

$$22) \frac{(2hj^2 k^{-2} \cdot h^4 j^{-1} k^4)^0}{2h^{-3} j^{-4} k^{-2}} = \frac{1}{2h^{-3} j^{-4} k^{-2}} = \frac{1h^3 j^4 k^2}{2}$$

# T 7-4 Skills Practice

## ational Exponents

Write each expression in radical form, or write each radical in exponential form.

$$1. (8x)^{\frac{3}{2}} \quad \sqrt[2]{8x}^3$$

$$2. 6z^{\frac{1}{2}} \quad 6\sqrt{z}$$

$$3. (\sqrt[4]{19})^3 \quad 19^{\frac{3}{4}}$$

$$4. \sqrt{11} = 11^{\frac{1}{2}}$$

$$5. 19x^{\frac{1}{2}} = 19\sqrt{x}$$

$$6. \sqrt[5]{34} = 34^{\frac{1}{5}}$$

$$7. \sqrt{27g} \quad (27g)^{\frac{1}{2}}$$

$$8. 33gh^{\frac{1}{2}} \quad 33g\sqrt{h}$$

$$9. \sqrt{13abc} \quad (13abc)^{\frac{1}{2}}$$

Simplify.

$$10. \left(\frac{1}{16}\right)^{\frac{1}{4}} = \frac{1}{2}$$

$$11. \sqrt[5]{3125} = 5$$

$$12. 729^{\frac{1}{3}} \quad \sqrt[3]{729} = 9$$

$$13. \left(\frac{1}{32}\right)^{\frac{1}{5}} = \frac{1}{\sqrt[5]{32}} = \frac{1}{2}$$

$$14. \sqrt[6]{4096} = 4$$

$$15. 1024^{\frac{2}{5}} \quad \begin{array}{l} \swarrow 2 \text{ exponent} \\ \searrow 5 \text{ index} \end{array} \quad \left(\sqrt[5]{1024}\right)^2$$

$$\sqrt[5]{1024} : 4 \quad (4)^2 = 16$$

16.  $\left(\frac{16}{625}\right)^{\frac{3}{4}}$

$$\frac{\sqrt[4]{16^3}}{\sqrt[4]{625^3}} = \frac{2^3}{5^3}$$

$$= \frac{8}{125}$$

$\sqrt[4]{16} = 2$

$\sqrt[4]{625} = 5$

17.  $\sqrt[6]{15,625} = 5$

$$\begin{array}{c} \wedge \\ 5 \quad 3125 \\ \wedge \\ 5 \quad 625 \\ \wedge \\ 5 \quad 125 \\ \wedge \\ 5 \quad 25 \\ \wedge \\ 5 \quad 5 \end{array}$$

18.  $117,649^{\frac{1}{6}} = 7$

$$\sqrt[6]{7^6} = 7$$

Solve each equation.

19.  $2^x = 512$

$2^x = 2^9$

$x = 9$

20.  $3^x = 6561$

$3^x = 3^8$

$x = 8$

21.  $6^x = 46,656$

$6^x = 6^6$

$x = 6$

22.  $5^x = 125$

$5^x = 5^3$

$x = 3$

23.  $3^{x-3} = 243$

$3^{x-3} = 3^5$

$x-3 = 5$

$x = 8$

24.  $4^{x-1} = 1024$

$4^{x-1} = 4^5$

$x-1 = 5$

$x = 6$

25.  $6^{x-1} = 1296$

$6^{x-1} = 6^4$

$x-1 = 4$

$x = 5$

26.  $2^{4x+3} = 2048$

$2^{4x+3} = 2^{11}$

$4x+3 = 11$

$4x = 8$

$x = 2$

27.  $3^{3x+3} = 6561$

$3^{3x+3} = 3^8$

$3x+3 = 8$

$3x = 5$

$x = \frac{5}{3}$