

Algebra 1 – Unit 8 Guide

Exponent Rules (Laws of Exponents)

Properties	General Form	Application	Example
Product Rule <i>Same base add exponents</i>	$a^m a^n$	a^{m+n}	$x^5 x^3 = x^{5+3} = x^8$
Quotient Rule <i>Same base subtract exponents</i>	$\frac{a^m}{a^n}$	a^{m-n}	$\frac{x^9}{x^5} = x^{9-5} = x^4$
Power Rule I <i>Power raised to a power multiply exponents.</i>	$(a^m)^n$	a^{mn}	$(x^3)^4 = x^{3 \cdot 4} = x^{12}$
Power Rule II <i>Product to power distribute to each base</i>	$(ab)^m$	$a^m a^n$	$(4x^3)^2 = 4^2 x^{3 \cdot 2} = 16x^6$
Negative Exponent I <i>Flip and change sign to positive</i>	a^{-m}	$\frac{1}{a^m}$	$x^{-3} = \frac{1}{x^3}$
Negative Exponent II <i>Flip and change sign to positive</i>	$\frac{1}{a^{-m}}$	a^m	$\frac{1}{x^{-5}} = x^5$
Zero Exponent <i>Anything to the zero power (except 0) is one</i>	a^0	$a^0 = 1$	$(-4x)^0 = 1$

- It is important to note that none of these applications can occur if the bases are not the same.

For example, $\frac{x^5}{y^3}$ cannot be simplified.

Combination of Exponent Rules

Example:

- $\frac{(2^3y^2)^5}{2^{10}y^{16}}$ → Power Rule
- $\frac{2^{3 \cdot 5}y^{2 \cdot 5}}{2^{10}y^{16}}$
- $\frac{2^{15}y^{10}}{2^{10}y^{16}}$ → Quotient Rule
- $2^{15-10}y^{10-16}$
- 2^5y^{-6} → Negative Exponent
- $\frac{32}{y^6}$

Example:

- $\left(\frac{p^{-4}q}{r^{-3}}\right)^{-3}$ → Power Rule
- $\frac{p^{-4 \cdot -3}q^{1 \cdot -3}}{r^{-3 \cdot -3}}$ **Note:** When a base does not have an exponent there is really a one as the power. So that, q is understood as q^1
- $\frac{p^{12}q^{-3}}{r^9}$ → Negative Exponents
- $\frac{p^{12}}{q^3r^9}$

Algebra 1 – Unit 8 Study Packet

Exponent Rules (Laws of Exponents)

Skill #1 – Powers of Zero

1. Simplify:

$$(6x)^0 =$$

2. Simplify:

$$6x^0 =$$

3. Simplify:

$$[4(x^2)^4]^0 =$$

4. Simplify:

$$4[(x^2)^4]^0 =$$

Skill #1 I can evaluate expressions involving a power of zero.

Skill #2 – Product Rule (Multiplying with Like Bases)

5. Write the following expression in simplified form:

$$(8x^6)(x^3)$$

6. Write the following expression in simplified form:

$$(-3y^2z^2)(y^4z^5)$$

7. Write the following expression in simplified form:

$$(3x^8y)(-10xy^{10})$$

8. Write the following expression in simplified form:

$$(7a^3b^5)(-9a^6b^3)$$

Skill #2 I can evaluate expressions involving multiplication of exponents with the same base.
 Need more practice (IXL – V.4)

Skill #3 – Quotient Rule (Dividing with Like Bases)

9. Write the following expression in simplified form:

$$\frac{x^3}{x}$$

10. Write the following expression in simplified form:

$$\frac{4g^5h^8}{2g^2h^2}$$

11. Identify each true statement:

$$\frac{12x^5y^8}{4xy^3} = 3x^4y^5$$

$$\frac{14x^4y^{10}}{2x^2y^4} = 12x^2y^6$$

$$\frac{15x^7y}{3x^5y} = 5x^2$$

$$\frac{20x^4y^8}{10x^2y^4} = 2x^2y^2$$

Skill #3 I can evaluate expressions involving division of exponents with the same base.
 Need more practice (IXL – V.5)

Skill #4 – Power Rule 1 (Raising a Power to a Power)

12.

$$(y^3)^9$$

13.

$$(3x^2y^3)^3$$

14. Identify each true statement:

$$(5x^3y^2)^4 = 625x^{12}y^8$$

$$(5xy^2)^2 = 25x^2y^4$$

$$(2x^3y^2)^2 = 4x^5y^4$$

$$(2x^3y^2)^3 = 6x^9y^6$$

Skill #3 I can evaluate expressions involving raising an exponent to another power.
 Need more practice (IXL – V.7)

Skill #5 – Power Rule 2 (Raising a Product/Quotient to a Power)

15. Simplify:

$$(4x^7y^5)^4$$

16. Simplify:

$$\left(\frac{x^4}{y^5}\right)^3$$

17. Simplify:

$$\left(\frac{3ab^2}{c^3}\right)^2$$

18. Simplify:

$$\left(\frac{2x^3}{6y^5}\right)^3$$

Skill #3 I can evaluate expressions involving raising a product/quotient to a power.
 Need more practice (IXL – V.7)

Skill #6 – Negative Exponent Rules

19. Simplify:

$$x^{-4}$$

20. Simplify:

$$\frac{1}{b^{-5}}$$

21. Simplify:

$$\frac{b^{-6}}{a^{-7}}$$

22. Simplify:

$$\frac{9x^{-4}}{3y^2}$$

Skill #3 I can evaluate expressions involving negative exponents.
 Need more practice (IXL – V.3)

Skill #7 – Combination of Exponent Rules

23. What is equivalent to:

$$\frac{ab(15a^3b^2c)}{25b^5c^2}$$

24. What expression is the simplest form of:

$$(4x^3y)(5x^5y^2)^2$$

25. What expression is the simplest form of:

$$(6x^4)^{-1}$$

26. What is a simplified form of the following expression where $a \neq 0$ and $b \neq 0$?

$$\frac{(4ab^3)^2}{32a^7b}$$

27. Which is a simplified form of the following expression using only positive exponents?

$$\left(\frac{x^3}{y^4}\right)^{-3}$$

28. Which is a simplified form of the following expression using only positive exponents?

$$(5x)^{-3}(25x^{-8})$$

29. Simplify:

$$\frac{6(x^4)^2}{x^5}$$

30. Simplify:

$$\frac{(8x^3)^3}{20x^{10}}$$

Skill #3

- I can evaluate an expression involving a combination of exponent rules.
- Need more practice (IXL – V.6)