

Algebra

Properties of Exponents

Name: KEY

Period: _____ Date: _____

Simplify each of the following completely.

1. $(10ab)^0$

1

2. $10ab^0$

10a

3. $5x^{-3}$

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

4. $(5x)^{-3}$

 $\frac{1}{5x^3}$

5. $a^6 \cdot a^{10}$

 a^{16}

6. $y^{-5} \cdot y^3 \cdot y$

 $y^{-2} = \left(\frac{1}{y^2}\right)$

7. $(x^5)^8$

 x^{40}

8. $(2^3)^{-2}$

 $2^{-6} = \left(\frac{1}{2^6}\right)$

9. $(5x^2y^3)^3$

 $5^3 x^6 y^9$

10. $(2a^{-4}b^3c^2)^{-3}$

 $2^{-12} a^{12} b^{-6} c^{-4}$
 $\frac{a^{12}}{2^{12} b^6 c^4}$

11. $\frac{x^4}{x^2} \cdot x^2$

12. $\frac{a^5 b^8 c^4}{a^2 b^7 c^3} \cdot a^3 b c^2$

13. $\left(\frac{x^4}{y^2}\right)^5 \cdot \frac{x^{20}}{y^{10}}$

14. $\left(\frac{5a^2b^3}{c^2}\right)^3 \cdot \frac{5^3 a^6 b^9}{c^6}$

15. $\frac{2w^2x^{-3}y^{-8}z^0}{5a^{-4}b^{-2}c^5d^2}$

 $\frac{2w^2a^4b^2}{5x^3y^8c^5d^2}$

16. $\frac{a^4b^2c^{10}}{a^6b^4c^{12}}$

 $\frac{1}{a^2b^2c^2}$

$$17. (-5ab)(2a^2b^2)(10a^{-1}b)$$

$$-100 a^2 b^4$$

$$18. (3a^2b)^{-2}(2a^4b^2)^2$$

$$(3^{-2} a^{-4} b^{-2})(2^2 a^8 b^4)$$

$$\frac{4 a^4 b^2}{9}$$

$$19. \left(\frac{2x^4y^4}{3x^2y^2} \right)^{-2}$$

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

$$\frac{9x^4y^4}{4x^8y^8}$$

$$= \frac{9}{4x^4y^4}$$

$$20. \left(\frac{a^4b^5c^{10}}{10} \right)^{-1}$$

$$\frac{10}{a^4b^5c^{10}}$$

$$21. (-3a^2b^5)^0(-7a^{10}b^{10})^0(2ab)^0$$

$$1$$

$$22. \left(\frac{(10xy^2)(2x^2y^4)}{1} \right)^0$$

$$1$$

1. Zero Exponents

$$a^0 = 1$$

$$\text{examples: } x^0 = 1 \quad 100^0 = 1 \quad 5xyz^0 = 5xy \quad (5xyz)^0 = 1$$

2. Negative Exponents

$$x^{-n} = \frac{1}{x^n}$$

$$\text{examples: } 10^{-2} = \frac{1}{10^2} = \frac{1}{100} \quad \frac{5x^{-1}y^4z^{-5}}{2a^{10}b^{-2}c^2} = \frac{5y^4b^4}{2a^{10}c^2xz^5}$$

3. Multiplying Powers with the Same Base

$$a^m \cdot a^n = a^{m+n}$$

$$\text{examples: } 2^2 \cdot 2^3 = 2^{2+3} = 2^5 = 32 \quad x^{10} \cdot x^5 = x^{10+5} = x^{15}$$

4. Raising a Power to a Power

$$(a^m)^n = a^{mn}$$

$$\text{examples: } (a^5)^2 = a^{5(2)} = a^{10} \quad (2^3)^{-3} = 2^{3(-3)} = 2^{-9} = \frac{1}{2^9} = \frac{1}{512}$$

5. Raising a Product to a Power

$$(ab)^n = a^n \cdot b^n$$

$$\text{examples: } (2x^3)^2 = 2^2x^6 = 4x^6 \quad (2x^3)^{-3} = 2^{-3}x^{-9} = \frac{1}{2^3x^9} = \frac{1}{8x^9}$$

6. Dividing Powers with the Same Base

$$\frac{a^m}{a^n} = a^{m-n}$$

$$\text{example: } \frac{5^3}{5^5} = 5^{3-5} = 5^{-2} = \frac{1}{5^2} = \frac{1}{25}$$

7. Raising a Quotient to a Power

$$\left(\frac{a}{b} \right)^n = \frac{a^n}{b^n}$$

$$\text{examples: } \left(\frac{x^3}{y^2} \right)^3 = \frac{x^9}{y^6} \quad \left(\frac{2^3}{4} \right)^2 = \frac{2^6}{4^2} = \frac{64}{16} = 4$$