

1.5 part 1

Algebra 2

Exponent Properties

Review: $x^2 = x \cdot x$

$$(-4x)^3 = (-4x)(-4x)(-4x)$$

Product of Powers Property

Words To multiply powers having the same base, add the exponents.

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

Example $5^6 \cdot 5^3 = 5^{6+3} = 5^9$
 $555555 \cdot 555 = 5^9$

EXAMPLE 1 Use the product of powers property

a. $7^3 \cdot 7^5 = 7^8$

b. $9^1 \cdot 9^8 \cdot 9^2 = 9^{11}$

c. $(-5)^1(-5)^6 = (-5)^7$

d. $x^4 \cdot x^3 = x^7$

Quotient of Powers Property

Words To divide powers having the same base, subtract exponents.

Example $\frac{4^7}{4^2} = 4^{7-2} = 4^5$ $\frac{\cancel{4444444}}{\cancel{44}} = 4^5$

EXAMPLE 1 Use the quotient of powers property

a. $\frac{8^{10}}{8^4} = 8^6$

b. $\frac{(-3)^9}{(-3)^3} = (-3)^6$

c. $\frac{5^4 \cdot 5^8}{5^7} = \frac{5^{12}}{5^7} = \boxed{5^5}$

d. $\frac{1}{x^4} \cdot \frac{x^6}{1} = \frac{x^6}{x^4} = \boxed{x^2}$

Power of a Power Property

Words To find a power of a power, multiply exponents.

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

$$(3^4)^2 = 3^4 \cdot 3^4 = 3^8$$

Example $(3^4)^2 = 3^{4 \cdot 2} = 3^8$

EXAMPLE 2 Use the power of a power property

a. $(2^5)^3 = 2^{15}$

b. $[(-6)^2]^5 = (-6)^{10}$

c. $(x^2)^4 = x^8$

d. $[(y+2)^6]^2 = (y+2)^{12}$

Power of a Product Property

Words To find a power of a product, find the power of each factor and multiply.

Algebra $(ab)^m = a^m b^m$

Example $(23 \cdot 17)^5 = 23^5 \cdot 17^5$

EXAMPLE 3 Use the power of a product property

a. $(24 \cdot 13)^8 = 24^8 \cdot 13^8$

b. $(9xy)^2 = 9^2 x^2 y^2 = \boxed{81x^2y^2}$

c. $(-4z)^2 = (-4)^2 z^2 = \boxed{16z^2}$

d. $-1(4z)^2 = -1 \cdot 4^2 z^2 = \boxed{-16z^2}$

Power of a Quotient Property

Example $\left(\frac{3}{2}\right)^7 = \frac{3^7}{2^7}$

EXAMPLE 2 Use the power of a quotient property

a. $\left(\frac{x}{y}\right)^3$ $\frac{x^3}{y^3}$

b. $\left(-\frac{7}{x}\right)^2 = \frac{(-7)^2}{x^2} = \frac{49}{x^2}$

EXAMPLE 4 Use all three properties

Simplify $(2x^3)^2 \cdot x^4$

$$2^2 (x^3)^2 \cdot x^4 = 4x^6 \cdot x^4 = 4x^{10}$$

a. $\left(\frac{4x^2}{5y}\right)^3 = \frac{4^3 (x^2)^3}{5^3 y^3} = \frac{64x^6}{125y^3}$

$$\frac{a^2}{a^{10}} = \frac{1}{a^8}$$

b. $\left(\frac{a^2}{b}\right)^5 \cdot \frac{1}{2a^2}$

$$\frac{(a^2)^5}{b^5} \cdot \frac{1}{2a^2} = \frac{a^{10}}{b^5} \cdot \frac{1}{2a^2} = \frac{a^8}{2b^5}$$

GUIDED PRACTICE

9. $(42 \cdot 12)^2$

$$42^2 \cdot 12^2$$

10. $(-3n)^2$

$$(-3)^2 n^2$$
$$9n^2$$

11. $(9m^3n)^4$

$$9^4 (m^3)^4 n^4$$
$$6561 m^{12} n^4$$

12. $5 \cdot (5x^2)^4$

$$5 \cdot 5^4 (x^2)^4$$
$$5^5 x^8$$
$$3125x^8$$

GUIDED PRACTICE for Examples 2 and 3

Simplify the expression.

5. $\left(\frac{a}{b}\right)^2$

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

6. $\left(-\frac{5}{y}\right)^3$

$$\frac{(-5)^3}{y^3}$$
$$\frac{-125}{y^3}$$

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

$$\frac{(x^2)^2}{4^2 y^2}$$
$$\frac{x^4}{16y^2}$$

8. $\left(\frac{2s}{3t}\right)^3 \cdot \left(\frac{t^5}{16}\right)$

$$\frac{2^3 s^3}{3^3 t^3} \cdot \frac{t^5}{16}$$
$$\frac{8s^3 t^5}{27 t^3 \cdot 16}$$
$$\frac{8s^3 t^5}{432 t^3}$$
$$\frac{3t^2}{54}$$

Homework

Worksheet