


Determine whether each pair of monomials is equivalent. If not, then why?

1. $5m^2$ and $(5m)^2$ $(5m)(5m) 25m^2$ No 

2. $(yz)^4$ and y^4z^4 *yes* $(yz)(yz)(yz)(yz) y^4z^4$

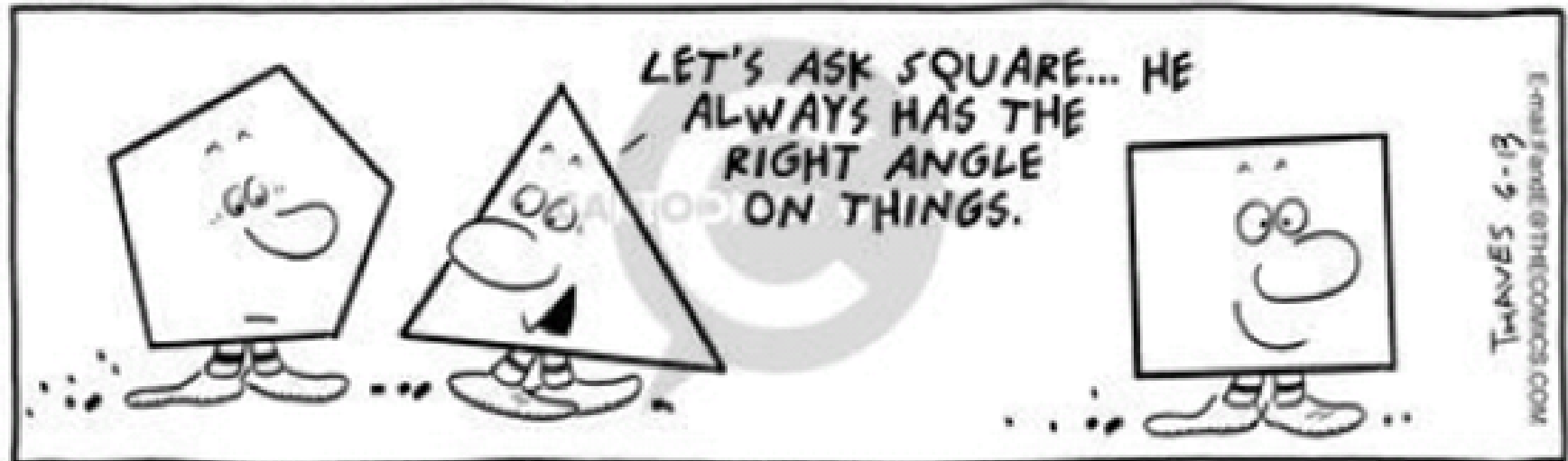
3. $-3a^2$ and $(-3a)^2$ $(-3a)(-3a) 9a^2$ No

4. $2(c^7)^3$ and $8c^{21}$ $2(c^7)(c^7)(c^7) 2c^{21}$ No

Warm Up

More Polynomials....

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Goals aligned to the Common Core Standards:

- You will use operations of addition, subtraction, and multiplication on polynomials.
- You will use division to simplify monomials.

Power of a Power

When a power is taken to another power,
MULTIPLY the exponents.

$$(2^3)^4 = 2^{12}$$

$$(8^5)^7 = 8^{35}$$

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

Examples

Simplify expressions.

1. $[(2^2)^2]^4$

$$2^{16}$$

2. $[(3^2)^3]^2$

$$3^{12}$$

Power of a Product

When a product is taken to a power, **DISTRIBUTE** the power to everything inside the parentheses.

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

$$(-2x^2y)^3 = -8x^6y^3$$

$$\begin{matrix} (-2)^3 & (x^2)^3 & (y)^3 \end{matrix}$$

$$\left[\left(\frac{1}{2} a^3 b^5\right)^2\right]^4 = \left(\frac{1}{2} a^3 b^5\right)^4 = \frac{1}{16} a^{12} b^{20}$$

$$\begin{matrix} \left(\frac{1}{2}\right)^4 & (a^3)^4 & (b^5)^4 \end{matrix}$$

Examples

Simplify expressions.

1. $(j^5 k^7)^4$

2. $(n^3 p)^4$

3. $[(4r^2 t)^3]^2$

4. $[(-2xy^2)^3]^2$

To simplify a monomial expression:

1. Make sure that each variable base appears exactly once
2. There are no powers of powers (no exponents outside of parentheses)
3. All fractions are in simplest form

Things to Remember

When multiplying two powers that have the same base,
_____ exponents.

When a power is taken to another power, _____ the
exponents.

When a product is taken to a power, _____
the power to everything inside the parentheses.

A negative number to an even exponent becomes _____.

A negative number to an odd exponent becomes _____.

Examples

Simplify expressions.

1. $(-2a^6)(6a^6)$

$$-12a^{12}$$

2. $(9w^2x^8)(w^6x^4)$

$$9w^8x^{12}$$

3. $(2a^4)^3(a^3)^4$

$$(2^3)(a^4)^3 \cdot a^{12}$$
$$8a^{12} \cdot a^{12}$$

$$8a^{24}$$

Examples

Simplify expressions.

4. $(5a^2b^3c^4)(2a^3b^4c^2)^2$

$$(2)^2(a^3)^2(b^4)^2(c^2)^2$$

$$5a^2b^3c^4 \cdot 4a^6b^8c^4 \rightarrow 20a^8b^{11}c^8$$

5. $(-3x^2y^5)^3(2x^4y^2)(3xy)$

$$(-27x^6y^{15})(2x^4y^2)(3xy)$$

$$-162x^{11}y^8$$

Division Property of Exponents

When you divide two things with the same base, you subtract your exponents.

$$\frac{a^7}{a^5} = a^2$$

(Handwritten diagram showing 7 'a's in the numerator and 5 'a's in the denominator, with 5 'a's crossed out, leaving 2 'a's.)

$$\frac{a^5 b^3}{a^2 b^9} = \frac{a^3}{b^6}$$

(Handwritten diagram showing the result as a^3 b^-6 with an arrow pointing to the negative exponent.)

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

(Handwritten diagram showing 10 'b's in the denominator and 8 'b's in the numerator, with 8 'b's crossed out, leaving 2 'b's in the denominator.)

$$b^{-2} = \frac{1}{b^2}$$

$$7^{-2} = \frac{1}{7^2} = \frac{1}{49}$$

Examples:

$$\frac{7^{10}}{7^8}$$

$$7^2$$

$$\frac{x^5 y^9}{x^7 y^5}$$

$$x^{-2} y^4$$

y^4
x^2

$$\left(\frac{3bc^3}{4b} \right)^2$$

$$\frac{(3)^2 (b)^2 (c^3)^2}{(4)^2 (b)^2}$$

$$\frac{9b^2 c^6}{16 \cancel{b^2}}$$

$9c^6$
16

Negative Property of Exponents

When you have a negative exponent in the numerator, move it to the _____ to make it positive and vice versa.

$$4^{-2} = \frac{1}{4^2} = \frac{1}{16}$$

$$\frac{1}{3^{-3}} = 3^3 = 27$$

Examples:

$$x^{-6} z^8$$

$$\frac{27b^2}{14b^{-4}}$$

$$\frac{a^3 b}{a^{-2} b^9 c^{-7}}$$

Zero Property of Exponents

Anything to the zero power always equals

_____.

$$\frac{5^2}{5^2}$$

$$(6a)^0$$

$$(2000a^3 b^5 c^{-7} d)^0$$

Examples

$$\frac{(3a^3bc^2)^2}{18a^2b^3c^4}$$

$$\frac{-16a^3b^2x^4y}{-48a^4bxy^3}$$

$$\frac{2a^2b^{-7}c^{10}}{6a^{-3}b^2c^{-3}}$$

$$\frac{1a^5b^{-9}c^{13}}{3}$$

$$\frac{1a^5c^{13}}{3b^9}$$