

7.1 MULTIPLYING MONOMIALS

A monomial is a number, a variable, or a product of a number and one or more variables.

Monomials that are real numbers are called constants.

These are monomials...

$$\frac{3}{2} \quad 4 \quad k \quad 4k \quad a^2b^5c$$

These are not...

$$4+k \quad \frac{4}{k} \\ 4-k$$

MULTIPLICATION PROPERTIES OF EXPONENTS

PRODUCT OF POWERS

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

Same base (under $(a)^m$ and $(a)^n$)
 Keep base (under a)
 Add exponents (under $m+n$)

EXAMPLES

Simplify the expression. Write your answer using exponents.

$$1. \quad \underline{5^3} \cdot \underline{5^6} = 5^{3+6} = \boxed{5^9}$$

$$2. \quad \underline{(-2)^1} \cdot \underline{(-2)^4} = (-2)^{1+4} = \boxed{(-2)^5}$$

$$3. \quad \underline{x^4} \cdot \underline{x^3} \cdot \underline{x^2} = x^{4+3+2} = \boxed{x^9}$$

$$4. \quad \underline{(-3)^1} \cdot \underline{(-3)^5} \cdot \underline{(-3)^2} = (-3)^{1+5+2} = \boxed{(-3)^8}$$

YOU TRY...

Simplify the expression. Write your answer using exponents.

$$a) \quad 7^8 \cdot 7^1 = 7^{8+1} = \boxed{7^9}$$

$$b) \quad g^2 \cdot g^5 \cdot g^9 = g^{2+5+9} = \boxed{g^{16}}$$

$$c) \quad (-9)^4 \cdot (-9)^4 = \boxed{(-9)^8}$$

POWER OF A POWER

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

← multiply exponents

↑
base stays the same

EXAMPLES

Simplify the expression. Write your answer using exponents.

$$5. \quad (4^3)^6 = 4^{3 \cdot 6} = \boxed{4^{18}} \quad 6. \quad (p^8)^4 = p^{8 \cdot 4} = \boxed{p^{32}}$$

$$7. \quad [(-6)^4]^2 = (-6)^{4 \cdot 2} = \boxed{(-6)^8} \quad 8. \quad (k^5)^5 = k^{5 \cdot 5} = \boxed{k^{25}}$$

YOU TRY...

Simplify the expression. Write your answer using exponents.

$$a) \quad (5^2)^3 = \boxed{5^6}$$

$$b) \quad (h^7)^4 = \boxed{h^{28}}$$

$$c) \quad [(-2)^3]^4 = \boxed{(-2)^{12}}$$

POWER OF A PRODUCT

$$\underbrace{(a \cdot b)^n}_{\substack{\text{multiplied} \\ \text{together}}} = a^n b^n$$

EXAMPLES Simplify the expression.

9. $(-6 \cdot 5)^2$

$$\begin{aligned} &(-6)^2 (5)^2 \\ &36 \cdot 25 = \boxed{900} \end{aligned}$$

10. $(2xy)^4$

$$\begin{aligned} &(2)^4 (x)^4 (y)^4 \\ &\boxed{16x^4y^4} \end{aligned}$$

11. $-(2w)^2$

$$\begin{aligned} &-(2)^2 (w)^2 \\ &\boxed{-4w^2} \end{aligned}$$

12. $(7gh)^3$

$$\begin{aligned} &(7)^3 (g)^3 (h)^3 \\ &\boxed{343g^3h^3} \end{aligned}$$

YOU TRY...

Simplify the expression.

a) $(3 \cdot 4)^2 = (3)^2 (4)^2 = 9 \cdot 16 = \boxed{144}$

b) $(4ef)^6 = (4)^6 (e)^6 (f)^6 = \boxed{4096e^6f^6}$

c) $(-7k)^5 = (-7)^5 (k)^5 = \boxed{-16807k^5}$

USING ALL THREE PROPERTIES

EXAMPLES Simplify the expression.

$$13. (4x^2y)^3 \cdot x^5$$

$$\begin{aligned} & (4)^3 (x^2)^3 (y)^3 \cdot x^5 \\ & 64 x^6 y^3 \cdot x^5 \\ & \boxed{64x^{11}y^3} \end{aligned}$$

$$14. (-3a^4)^2 \cdot a^7$$

$$\begin{aligned} & (-3)^2 (a^4)^2 \cdot a^7 \\ & 9 a^8 \cdot a^7 \\ & \boxed{9a^{15}} \end{aligned}$$

$$15. 9 \cdot (9z^5)^2$$

$$\begin{aligned} & 9 \cdot (9)^2 (z^5)^2 \\ & 9 \cdot 81 z^{10} \\ & \boxed{729z^{10}} \end{aligned}$$

$$16. (2mn^6)^3 \cdot 3m^7$$

$$\begin{aligned} & (2)^3 (m)^3 (n^6)^3 \cdot 3m^7 \\ & 8m^3 n^{18} \cdot 3m^7 \\ & \boxed{24m^{10}n^{18}} \end{aligned}$$

YOU TRY...

Simplify the expression.

$$a) (3mn^2)^4 \cdot 2m^2$$

$$\begin{aligned} & (3)^4 (m)^4 (n^2)^4 \cdot 2m^2 \\ & 81 m^4 n^8 \cdot 2m^2 \\ & \boxed{162m^6n^8} \end{aligned}$$

$$b) (-2c^3d^2)^3 \cdot 5cd^6$$

$$\begin{aligned} & (-2)^3 (c^3)^3 (d^2)^3 \cdot 5cd^6 \\ & -8 c^9 d^6 \cdot 5cd^6 \\ & \boxed{-40c^{10}d^{12}} \end{aligned}$$