

Name Key

Mrs. Roubos

Date _____

8R Period _____

Properties of ExponentsI. Multiplying Powers with the same base

ex ① $7^4 \cdot 7^2 = 7^6$

$(7 \cdot 7 \cdot 7 \cdot 7) \cdot (7 \cdot 7)$

$7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$

7^6

② $3^3 \cdot 3^2 = 3^5$

$(3 \cdot 3 \cdot 3) \cdot (3 \cdot 3)$

$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$

3^5

A) When you multiply powers with the same base, you keep the base and ADD the exponents.

ex ① $4^2 \cdot 4^8 = 4^{2+8} = 4^{10}$

② $x^a \cdot x^b = x^{a+b}$

B) Examples: Simplify

1) $6^6 \cdot 6^3 = 6^{6+3} = 6^9$

2) $n^5 \cdot n^7 = n^{5+7} = n^{12}$

3) $2^5 \cdot 2^1 = 2^{5+1} = 2^6$

4) $3^4 \cdot 3^{-4} = 3^{4+(-4)} = 3^0 = 1$

5) $x^5 \cdot y^2 = x^5 y^2$

Can't add exponents b/c the bases are not the same

6) $4^2 \cdot 4^{-5} = 4^{2+(-5)} = 4^{-3} = \frac{1}{4^3} = \frac{1}{64}$

II. Dividing Powers with the same base

a ① $\frac{5^5}{5^3} = \frac{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5 \cdot 5} = 5 \cdot 5 = 5^2$

② $\frac{2^6}{2^5} = \frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2} = 2 = 2^1$

A) When you divide powers with the same base, you keep the base and Subtract the exponents.

ex ① $\frac{7^9}{7^4} = 7^{9-4} = 7^5$

② $\frac{x^a}{x^b} = x^{a-b}$

B) Examples: Simplify

$$1) \frac{7^5}{7^3} = 7^{5-3} = \boxed{7^2}$$

$$2) \frac{x^{10}}{x^9} = x^{10-9} = x^1 = \boxed{x}$$

$$3) \frac{5^8}{5^2} = 5^{8-2} = \boxed{5^6}$$

$$4) \frac{4^4}{4^4} = 4^{4-4} = 4^0 = \boxed{1}$$

$$5) \frac{2^3}{2^5} = 2^{3-5} = 2^{-2} = \frac{1}{2^2} = \boxed{\frac{1}{4}}$$

$$6) \frac{8^8}{8^{11}} = 8^{8-11} = 8^{-3} = \frac{1}{8^3} = \boxed{\frac{1}{512}}$$

III. Raising a Power to a Power

ex 1) $(3^3)^2 = (3^3)(3^3) = (3 \cdot 3 \cdot 3)(3 \cdot 3 \cdot 3) = 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 = \boxed{3^6}$

A) To raise a power to a power, keep the base and multiply the exponents.

ex 2) $(9^4)^5 = 9^{4 \cdot 5} = 9^{20}$

2) $(x^a)^b = x^{a \cdot b}$

B) Examples: Simplify

$$1) (5^4)^2 = 5^{4 \cdot 2} = \boxed{5^8}$$

$$2) (6^7)^9 = 6^{7 \cdot 9} = \boxed{6^{63}}$$

$$3) (2^2)^3 = 2^{2 \cdot 3} = 2^6 = \boxed{64}$$

$$4) (3^{-3})^0 = 3^{-3 \cdot 0} = 3^0 = \boxed{1}$$

IV. Mixed Examples: Simplify

$$1) 5^6 \cdot 5^9 = 5^{6+9} = \boxed{5^{15}}$$

$$2) 12^3 \cdot 12^{-2} = 12^{3+(-2)} = \boxed{12^1}$$

$$3) m \cdot m^3 \cdot m^4 = m^{1+3+4} = \boxed{m^8}$$

$$4) \frac{6^5}{6^3} = 6^{5-3} = \boxed{6^2}$$

$$5) \frac{a^8}{a^{-1}} = a^{8-(-1)} = a^{8+1} = \boxed{a^9}$$

$$6) \frac{12^5}{12^5} = 12^{5-5} = 12^0 = \boxed{1}$$

$$7) (3^4)^5 = 3^{4 \cdot 5} = \boxed{3^{20}}$$

$$8) (2^2)^0 = 2^{2 \cdot 0} = 2^0 = \boxed{1}$$

$$9) (4^{-2})^3 = 4^{-2 \cdot 3} = 4^{-6} = \frac{1}{4^6} = \boxed{\frac{1}{4096}}$$

$$10) \frac{7^6}{7^8} = 7^{6-8} = 7^{-2} = \frac{1}{7^2} = \boxed{\frac{1}{49}}$$

$$11) 3^2 \cdot 3^3 \cdot 3^5 = 3^{2+3+5} = \boxed{3^{10}}$$

$$12) (4^0)^3 = 4^{0 \cdot 3} = 4^0 = \boxed{1}$$

$$\boxed{\frac{1}{49}}$$

ex 13) $(-4x^3)^2 = (-4x^3)(-4x^3) = \boxed{16x^6}$