

Exponential - Exponent Rules & Equivalent Equations Classwork

Product Rule: ① Multiply the coefficients $X^a \cdot X^b = X^{a+b}$ ② Keep the base, add the exponents	Power of Power Rule: ① Raise coefficient to the power $(X^a)^b = X^{ab}$ ② Keep the base, multiply the exponents
$x^2 \cdot x^5 = x^7$	$(x^2)^3 = x^6$
$(1.05)^x \cdot (1.05)^{12} = 1.05^{x+12}$	$(2^3)^x = 2^{3x}$
$(2)^t (2)^5 = 2^{t+5}$	$(1.08^{1/2})^{12} = 1.08^{6}$

Mixed Exponent Practice:

$(2x^3y^2)^3$ $(2)^3(x^3)^3(y^2)^3$ $8x^9y^6$	$2m^3 \cdot 4m^7$ $2 \cdot 4 \cdot m^3 \cdot m^7$ $8m^{10}$	$(4x^6y^3z)^2$ $(4)^2 \cdot (x^6)^2 \cdot (y^3)^2 \cdot (z)^2$ $16x^{12}y^6z^2$
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Regents Example:

1. Which expression is equivalent to $(-4x^2)^3$?

(1) $-12x^6$

(3) $-64x^6$

(2) $-12x^5$

(4) $-64x^5$

$(-4)^3(x^2)^3$
 $-64x^6$

Can check these all in the calc by putting original answers into y and comparing tabs

Exponential Problems- Equivalent Expressions -

Example 1- Which of the following is equivalent to $(1.02)^{t+6}$?
 ← Do you see adding exponents that means you were originally multiplying the same bases

- (1) $(1.02)^t + (1.02)^6$
- (2) $((1.02)^t)^6$
- (3) $(1.02)^t \cdot (1.02)^6$
- (4) $(1.02)^{\frac{t}{6}}$

$$x^a \cdot x^b = x^{a+b}$$

Look for 2 of that same base being multiplied

Example 2- Ava inherited a savings account that was started by her great-grandma 10 years ago. This scenario is modeled by the function $A(t) = 4000(1.02)^{t+10}$, where $A(t)$ represents the value of the account, in dollars, t years after the inheritance. Which function below is equivalent to $A(t)$?

- (1) $A(t) = (4000)^t(1.02)^{10}$
- (2) $A(t) = 4000(1.02)^t(1.02)^{10}$
- (3) $A(t) = 4000[(1.02)^t]^{10}$
- (4) $A(t) = 4000[(1.02)^t + (1.02)^{10}]$

Do you see adding exponents, that means you were originally multiplying the same base

$$x^a \cdot x^b = x^{a+b}$$

Look for 2 of that same base being multiplied

Example 3- A sequence can be modeled by $g(n) = 150 \cdot 8^n$. Which function below will generate the same note sequence as $g(n)$? Justify your answer with work.

A	B	C
$300 \cdot 2^{4n}$	$150^n \cdot 2^3$	$150 \cdot 2^{3n}$
$300 \cdot 16^n$	$150^n \cdot 8$	$150 \cdot 8^n$

Function C

You Try:

1. Which of the following is equivalent to 3^{2n} ?
 ← If you see multiplied exponents means originally there was a base with 2 exponents. The () was in between the two exponents.

- (1) 6^{2n}
- (2) 9^n
- (3) 3^{2+n}
- (4) 6^n

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

2. In an organism, the number of cells, $C(d)$, after d days can be represented by the function $C(d) = 120 \cdot 2^{3d}$. This function can also be expressed as:

- (1) $C(d) = 240^{3d}$
- (2) $C(d) = 960 \cdot 2^d$

$$(3) C(d) = 120 \cdot 6^d$$

$$(4) C(d) = 120 \cdot 8^d$$

↑
 If you see multiplied exponents that means originally there was 1 base with 2 exponents. The () was in between the two

$$(2^3)^d = 8^d$$

3. Which expression is not equivalent to $(5^{2x})^3$? *multiply exponent 5^{6x}*
- (1) $(5^x)^6 = 5^{6x}$
 (2) $(5^{3x})^2 = 5^{6x}$
 (3) $(5^5)^x = 5^{5x}$
 (4) $(5^2)^{3x} = 5^{6x}$

4. Which of the following is equivalent to $(.75)^{t+10}$? *When you see exponents added that means it was originally the same bases.*
- (1) $(.75)^{\frac{t}{10}}$
 (2) $(.75)^t \cdot (.75)^{10}$
 (3) $((.75)^t)^{10}$
 (4) $(.75)^t + (.75)^{10}$
- $x^a \cdot x^b = x^{a+b}$
 look for 2 of that same base being multiplied*

5. Michelle inherited a savings account that was started by her grandparent 15 years ago. This scenario is modeled by the function $A(t) = 2000(1.03)^{t+15}$, where $A(t)$ represents the value of the account, in dollars, t years after the inheritance. Which function below is equivalent to $A(t)$?
- (1) $A(t) = (2000)^t(1.03)^{15}$
 (2) $A(t) = 2000(1.03)^t(1.03)^{15}$
 (3) $A(t) = 2000[(1.03)^t]^{15}$
 (4) $A(t) = 2000[(1.03)^t + (1.03)^{15}]$
- look for 2 of that same base being multiplied*

Mixed Problems:

6. If a population of 20 rabbits triples every month, which function represents $p(t)$, the population after t months? *a starting population*
- (1) $p(t) = 20t + 3$
 (2) $p(t) = 3t + 20$
 (3) $p(t) = 20(3)^t$
 (4) $p(t) = 3(20)^t$
- ratio/b*
 $y = a \cdot b^x$
 $y = 20 \cdot 3^t$
key x=t

7. The number of bacteria grown in a lab can be modeled by $P(t) = 300 \cdot 16^t$, where t is the number of hours. Which expression is equivalent to $P(t)$? *300 · 16^t simplify*

A	B	C
$300^t \cdot 2^t$ <i>300^t · 16</i>	$300 \cdot 8^t$ <i>300 · 8^t</i>	$300 \cdot 16^t$ <i>300 · 16^t</i>

Function C

8. A laboratory technician used the function $t(m) = 2(3)^{2m+1}$ to model her research. Consider the following expressions: *original has base when exponents inside + outside*
- I. $6(3)^{2m}$
 II. $6(6)^{2m}$
 III. $6(9)^m$
- $6 \cdot (3^2)^m$
 $6 \cdot 9^m$
 $6 \cdot (6^2)^m$
 $6 \cdot 36^m$*
- The function $t(m)$ is equivalent to
- (1) I, only
 (2) II, only
 (3) I and III
 (4) II and III
- When you see exponents added that means it was originally the same bases
 look for 2 of that same base being multiplied
 $2 \cdot 3^{2m+1}$
 $2 \cdot 9^m \cdot 3$
 $6 \cdot 9^m$*