3.5 Equation Solving & Modeling

Target 3B: Know and understand the inverse relationships of exponential and logarithmic equations

SAT Connection

Problem Solving and Data Analysis

4. Create an equivalent form of an algebraic expression

Example:

$$9a^4 + 12a^2b^2 + 4b^4$$

Which of the following is equivalent to the expression shown above?

A) $(3a^2 + 2b^2)^2$

B) $(3a + 2b)^4$

C) $(9a^2 + 4b^2)^2$

D) $(9a + 4b)^4$

Solution

Orders of Magnitude and Logarithmic Models

Explain in your own words what **Order of Magnitude** means and give an example.

Read through *Example 5*, then find the answer to the following problem:

In January of 2010, the country of Haiti was hit by a disastrous 7.0 magnitude earthquake. In February of 2010, a 3.8 magnitude earthquake was recorded 45 miles northwest of Chicago. How many times stronger was the Haiti earthquake than the Illinois earthquake?

Properties of Logarithms Extra Practice

1. Expand using properties of logarithms:

a) $\log_3 rt$

b) $\log_f k^3$

c) $\log_5 2f^3h^4$

d) $\ln \frac{u}{7}$

e) $\log_4 \frac{3y}{gh}$

f) $\log_9 \frac{2d}{5w^3}$

2. Write as a single logarithm (condense) using properties of logarithms:

a) $\log_2 t + \log_2 6 + \log_2 k$

b) $2\log_4 m + 5\log_4 n + \log_4 k$

c) $\frac{1}{2}\log_8 a + \frac{1}{3}\log_8 b$

d) $\log_3 y - \log_3 6 - 2\log_3 t$

e) $2\log_6 t + 3\log_6 t + 5\log_6 t$

f) $\ln x - 3\ln x + 2\ln x$

More Practice

Orders of Magnitude
https://www.khanacademy.org/math/pre-algebra/pre-algebra-exponents-radicals/pre-algebra-orders-of-magnitude/v/orders-of-magnitude-exercise-example-1

Properties of Logarithms
https://www.khanacademy.org/math/algebra2/exponential-and-logarithmic-functions/properties-of-logarithms/v/introduction-to-logarithm-properties
http://www.algebralab.org/lessons/lesson.aspx?file=algebra_logarithmproperties.xml
http://www.regentsprep.org/regents/math/algtrig/ate9/LogPrac.htm
http://www.mathguide.com/lessons2/Logs.html
https://www.youtube.com/watch?v=SxF44olWTyk
https://www.youtube.com/watch?v=eLapHtvQbFo

Homework Assignment

p.301 #29,37,39,41,45,47

SAT Connection

Solution

Choice A is correct. If a polynomial expression is in the form $(x)^2 + 2(x)(y) + (y)^2$, then it is equivalent to $(x + y)^2$. Because $9a^4 + 12a^2b^2 + 4b^4 = (3a^2)^2 + 2(3a^2)(2b^2) + (2b^2)^2$, it can be rewritten as $(3a^2 + 2b^2)^2$.

Choice B is incorrect. The expression $(3a + 2b)^4$ is equivalent to the product $(3a + 2b)(3a + 2b)(3a + 2b)(3a + 2b)$. This product will contain the term $4(3a)^3 (2b) = 216a^3b$. However, the given polynomial, $9a^4 + 12a^2b^2 + 4b^4$, does not contain the term $216a^3b$. Therefore, $9a^4 + 12a^2b^2 + 4b^4 \neq (3a + 2b)^4$. Choice C is incorrect. The expression $(9a^2 + 4b^2)^2$ is equivalent to the product $(9a^2 + 4b^2)(9a^2 + 4b^2)$. This product will contain the term $(9a^2)(9a^2) = 81a^4$. However, the given polynomial, $9a^4 + 12a^2b^2 + 4b^4$, does not contain the term $81a^4$. Therefore, $9a^4 + 12a^2b^2 + 4b^4 \neq (9a^2 + 4b^2)^2$. Choice D is incorrect. The expression $(9a + 4b)^4$ is equivalent to the product $(9a + 4b)(9a + 4b)(9a + 4b)(9a + 4b)$. This product will contain the term $(9a)(9a)(9a)(9a) = 6{,}561a^4$. However, the given polynomial, $9a^4 + 12a^2b^2 + 4b^4$, does not contain the term $6{,}561a^4$. Therefore, $9a^4 + 12a^2b^2 + 4b^4 \neq (9a + 4b)^4$.