

The Ninth Grade Math Competition Class

Exponents

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1. Find $5^{-3}5^55^1$.

$$5^{-3+5+1} = 5^3$$

2. Find $\frac{3^4 3^{-2}}{3^5 3^{-1}}$. $= \frac{3^2}{3^4} = 3^{2-4} = 3^{-2} = \frac{1}{9}$

$$3^4 3^{-2} = 3^{4-2} = 3^2$$

$$3^5 3^{-1} = 3^{5-1} = 3^4$$

3. Find 4^{x+1} if 2^x is 9.

4. If $8^x = 27$, what is 4^{2x-3} .

5. Find all values of x such that $25^{-2} = \frac{5^{\frac{48}{x}}}{5^{\frac{26}{x}} 25^{\frac{17}{x}}}.$

6. Simplify the expression $81^{-2^{-2}}$.

7. Find x if $2^{16^x} = 16^{2^x}$.

8. Solve for n : $\sqrt{1 + \sqrt{2 + \sqrt{n}}} = 2$.

9. Find, with a rational common denominator, the sum

$$\left(\frac{1}{2}\right)^{-\frac{1}{2}} + \left(\frac{3}{2}\right)^{-\frac{3}{2}} + \left(\frac{5}{2}\right)^{-\frac{5}{2}}$$

10. What is the difference between $x^2 = 9$ and $x = \sqrt{9}$?

11. Suppose that $y = \frac{3}{4}x$ and $x^y = y^x$, the quantity $x + y$ can be expressed as a rational number $\frac{r}{s}$, where r and s are relatively prime positive integers. Find $r + s$.

12. The formula $N = 8 * 10^8 * x^{-\frac{3}{2}}$ gives, for a certain group, the number of individuals whose income exceeds x dollars. What is the smallest possible value of the lowest income of the wealthiest 800 individuals?

13. Solve for x in the equation $2^{333x-2} + 2^{111x+2} = 2^{222x+1}$.