Solving Exponential and Logarithmic Equations

Directions: Solve each exponential equation.

1. $2^{x+2} = 16^{5x}$

$2^{x+2} = (2^4)^{5x}$

$2^{x+2} = 2^{20x}$

$x + 2 = 20x$

$-x \quad -x$

$\frac{2}{19} = \frac{19x}{19}$

$x = \frac{2}{19}$

2. $27^{x+1} = 81^{x+5}$

$(3^3)^{x+1} = (3^4)^{x+5}$

$3^{3(x+1)} = 3^{4(x+5)}$

$3(x+1) = 4(x+5)$

$3x + 3 = 4x + 20$

$-3x \quad -3x$

$3 = x + 20$

$-20 \quad -20$

$x = -17$

3. $\left(\frac{1}{5}\right)^x = 125^{x^2}$

$(5^{-1})^x = (5^3)^{x^2}$

$5^{-x} = 5^{3x^2}$

$-x = 3x^2$

$+x \quad +x$

$0 = 3x^2 + x$

$x(3x+1) = 0$

$x = 0$ $\quad 3x + 1 = 0$

$-1 \quad -1$

$3x = -1$

$x = -1/3$

4. $7^{4-x} = 1$

$7^{4-x} = 7^0$

$4 - x = 0$

$x = 4$

Directions: Solve each exponential equation. Round your answer to the nearest thousandth.

5. $2^{5x} = 3000$

$\log 2^{5x} = \log 3000$

$5x \log 2 = \log 3000$

$\frac{5x \log 2}{5 \log 2} = \frac{\log 3000}{5 \log 2}$

$x = \frac{\log 3000}{5 \log 2} = 2.310$

$\log 3000 \div (5 \times \log 2) =$

6. $8^{x-2} = 250$

6. $8^{x-2} = 250$

$\log 8^{x-2} = \log 250$

$(x-2)\log 8 = \log 250$

$\frac{(x-2)\log 8}{\log 8} = \frac{\log 250}{\log 8}$

$x - 2 = \frac{\log 250}{\log 8} + 2$

$+2 \quad +2$

$x = \frac{\log 250}{\log 8} + 2 = \boxed{4.655}$

$\log 250 = \div \log 8 = + 2$

7. $14^{3x-4} = 10^{x-1}$

$\log 14^{3x-4} = \log 10^{x-1}$

$(3x-4)\log 14 = (x-1)\log 10 = 1$

$3x\log 14 - 4\log 14 = x - 1$

$+4\log 14 \quad +4\log 14$

$-x \quad -x$

$3x\log 14 - x = -1 + 4\log 14$

$x(3\log 14 - 1) = -1 + 4\log 14$

$\frac{x(3\log 14 - 1)}{3\log 14 - 1} = \frac{-1 + 4\log 14}{3\log 14 - 1}$

$x = \frac{-1 + 4\log 14}{3\log 14 - 1} = \boxed{1.470}$

$-1 + 4 \times \log 14 = \div (3 \times \log 14 - 1) =$

Directions: Solve each logarithmic equation. Round your answer to the nearest thousandth.

8. $\log(x-2) = 3$

$10^{\log(x-2)} = 10^3$

$x - 2 = 10^3$

$x - 2 = 1000$

$+2 \quad +2$

$\boxed{x = 1002}$

9. $\log_4 x - \log_4(x-2) = \frac{2}{3}$

$\log_4 \frac{x}{x-2} = \frac{2}{3}$

$x = 4^{2/3}(x-2)$

$x = 4^{2/3}x - 2\cdot 4^{2/3}$

$-4^{2/3}x \quad -4^{2/3}x$

$x - 4^{2/3}x = 2\cdot 4^{2/3}$

$x(1-4^{2/3}) = 2\cdot 4^{2/3}$

$1 \quad 1-4^{2/3}$

$x = \frac{2\cdot 4^{2/3}}{1-4^{2/3}} = -3.316$

^ y^x

4 ^ (2 ÷ 3) = × 2 = ÷ (1 − 4 ^ (2 ÷ 3)) =

10. $\log_6 x + \log_6(x-8) = \log_6 20$

$\log_6 x(x-8) = \log_6 20$

$x(x-8) = 20$

$x^2 - 8x = 20$

$-20 \quad -20$

$x^2 - 8x - 20 = 0$

$(x-10)(x+2) = 0$

$x-10=0 \quad x+2=0$

$x = 10 \quad x = -2$