Name __Key__

Solving Logarithms & Exponential Equations

Solve each equation. Exact answers only.

1. $\left(\frac{1}{6}\right)^{-3v} = 216^{3v}$

$3v = 9v$

$\boxed{v = 0}$

$\left(6^{-1}\right)^{-3v} = \left(6^3\right)^{3v}$

2. $\left(\frac{1}{4}\right)^{2b} = 64$

$-2b = 3$

$\boxed{b = -\frac{3}{2}}$

$\left(4^{-1}\right)^{2b} = 4^3$

3. $125^{1-p} = 625$

$3 - 3p = 4$

$-3p = 1$

$\boxed{p = -\frac{1}{3}}$

$\left(5^3\right)^{1-p} = 5^4$

4. $\left(\frac{1}{9}\right)^{2-2x} = 27$

$-4 + 4x = 3$

$4x = 7$

$\boxed{x = 7/4}$

$\left(3^{-2}\right)^{2-2x} = 3^3$

5. $\frac{625^{-3x}}{\left(\frac{1}{5}\right)^{2x+1}} = 5^3$

$-12x - (-2x-1) = 3$

$\frac{\left(5^4\right)^{-3x}}{5^{-2x-1}} = 5^3$

$-12x + 2x + 1 = 3$

$-10x = 2$

$\boxed{x = -\frac{1}{5}}$

6. $25^{2-n} \cdot 125^{-3n+2} = 125$

$\left(5^2\right)^{2-n} \cdot \left(5^3\right)^{-3n+2} = 5^3$

$5^{4-2n+-9n+6} = 5^3$

$-11n + 10 = 3$

$-11n = -7$

$\boxed{n = 7/11}$

Solve each equation. Round to three decimal places.

7. $-4.5 \cdot 11^{-10n} = -94$

$11^{-10n} = \frac{-94}{-4.5}$

$11^{-10n} = \frac{188}{9}$

$-10\ln 11 = \ln(188/9)$

$n = \frac{\ln(188/9)}{-10\ln 11}$

$\boxed{x \approx -.127}$

8. $6^{k-2} = 11^{-2k+1}$

$(k-2)\ln 6 = (-2k+1)\ln 11$

$k\ln 6 - 2\ln 6 = -2k\ln 11 + \ln 11$

$k\ln 6 + 2k\ln 11 = 2\ln 6 + \ln 11$

$k(\ln 6 + 2\ln 11) = 2\ln 6 + \ln 11$

$k = \frac{2\ln 6 + \ln 11}{\ln 6 + 2\ln 11}$

$\boxed{k \approx .908}$

9. $-2 \cdot 6^{2n+5} = -99$

$\frac{-2}{-2} \qquad \frac{}{-2}$

$6^{2n+5} = 49.5$

$(2n+5)\ln 6 = \ln(49.5)$

$n = \left(\frac{\ln(49.5)}{\ln 6} - 5\right)/2$

$\boxed{n \approx -1.411}$

10. $14^{9m-2} + 4 = 39$

$14^{9m-2} = 35$

$(9m-2)\ln 14 = \ln 35$

$m = \left(\frac{\ln 35}{\ln 14} + 2\right)/9$

$\boxed{m \approx .372}$

11. $-8 \cdot 11^{-2b} + 7 = -80$

$\frac{-7 \qquad -7}{}$

$-8 \cdot 11^{-2b} = -87$

$11^{-2b} = 87/8$

$-2b\ln(11) = \ln(87/8)$

$b = \frac{\ln(87/8)}{-2\ln(11)}$

$\boxed{b \approx -.498}$

12. $6 \cdot 9^{-3k} + 10 = 75.5$

$6 \cdot 9^{-3k} = 65.5$

$\frac{6 \cdot 9^{-3k}}{6} = \frac{65.5}{6}$

$9^{-3k} = \frac{65.5}{6}$

$-3k\ln 9 = \ln(65.5/6)$

$\frac{}{-3\ln 9}$

$\boxed{k = -.363}$

13. $\log_8(-3x + 10) = \log_8(5x - 9)$

$-3x+10 = 5x-9$
$-3x-5x = -10-9$
$-8x = -19$
$\boxed{x = 19/8}$

14. $\log_{17}(-4x - 1) = \log_{17}(-3x + 4)$

$-4x-1 = -3x+4$
$-4x+3x = 1+4$
$-x = 5$
$x = -5$ ← extraneous
so, $\boxed{\text{no solution}}$

15. $\log_{14}(n^2 + 7n) = \log_{14}(7 + n)$

$n^2+7n = 7+n$
$n^2+6n-7 = 0$
$(n+7)(n-1) = 0$
$n = -7 \quad \boxed{n=1}$

16. $\log_8(12p - 2) = \log_8(p^2 + 18)$

$12p-2 = p^2+18$
$0 = p^2-12p+20$
$0 = (p-10)(p-2)$
$\boxed{p=10 \quad p=2}$

17. $\log x - \log(x - 2) = 1$

$\log \frac{x}{x-2} = 1$

$10X-20 = X$
$9x = 20$
$\boxed{x = \frac{20}{9}}$

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

18. $\log_3(x - 6) - \log_3 x = \log_3 12$

$\log_3 \frac{x-6}{x} = \log_3 12$

$\frac{x-6}{x} = 12$
$x-6 = 12x$

$-6 = 11x$
$\boxed{\frac{-6}{11} = x}$

19. $\log_9 10 - \log_9 5x = 2$

$\log_9 \frac{10}{5x} = 2$

$9^2 = \frac{10}{5x}$

$405x = 10$
$x = 10/405 = \boxed{2/81}$

20. $\log_9 x + \log_9(x + 11) = \log_9 42$

$\log_9 (x^2+11x) = \log_9 42$

$x^2+11x = 42$
$x^2+11x-42 = 0$
$(x+14)(x-3) = 0$
$x = -14 \quad \boxed{x=3}$

21. $\log_5 x + \log_5(x + 4) = 1$

$\log_5 (x^2+4x) = 1$

$5^1 = x^2+4x$
$0 = x^2+4x-5$
$0 = (x+5)(x-1)$
$x = -5 \quad \boxed{x=1}$

22. $\log_9 2 + \log_9(x^2 + 6) = \log_9 61$

$\log_9 (2x^2+12) = \log_9 61$

$2x^2+12 = 61$
$2x^2 = 49$
$\sqrt{x^2} = \sqrt{\frac{49}{2}}$

$x = \pm \frac{7}{\sqrt{2}} =$

$\boxed{x = \pm \frac{7\sqrt{2}}{2}}$