

Solve each equation. Check for extraneous solutions when necessary.

### LOGARITHMIC EQUATIONS

<p>1. <math>\log_7(9x - 4) = \log_7(x + 20)</math></p> $9x - 4 = x + 20$ $8x = 24$ $x = 3$	<p>2. <math>\log_5(m^2 - 12) = \log_5 m</math></p> $m^2 - 12 = m$ $m^2 - m - 12 = 0$ $(m - 4)(m + 3) = 0$ $m = 4 \quad m = -3$
<p>3. <math>\log_3 4 + \log_3(a + 5) = \log_3 56</math></p> $\log_3 4(a + 5) = \log_3 56$ $4a + 20 = 56$ $4a = 36$ $a = 9$	<p>4. <math>\log(2y - 10) = 7 \cdot \log 2 - \log 8</math></p> $\log 2y - 10 = \log\left(\frac{128}{8}\right)$ $2y - 10 = 16$ $2y = 26$ $y = 13$
<p>5. <math>\log_4(5m + 9) = 3</math></p> $4^3 = 5m + 9$ $64 = 5m + 9$ $55 = 5m$ $m = 11$	<p>6. <math>\log_{36}(20 - 4p) = \frac{1}{2}</math></p> $\sqrt{36} = 20 - 4p$ $6 = 20 - 4p$ $-14 = -4p$ $\frac{14}{4} = p$ $\frac{7}{2} = p$
<p>7. <math>\log_6(7k - 1) = 3</math></p> $6^3 = 7k - 1$ $216 = 7k - 1$ $217 = 7k$ $k = 31$	<p>8. <math>\log(n + 8) + \log 4 = 2</math></p> $\log 4(n + 8) = 2$ $10^2 = 4n + 32$ $68 = 4n$ $n = 17$

## EXPONENTIAL EQUATIONS

9.  $25^{v-2} = 625$

$$25^{v-2} = 25^2$$

$$v-2=2$$

$$v=4$$

10.  $\frac{1}{16} = 8^{4x-2}$

$$16^{-1} = 8^{4x-2}$$

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

$$-4 = 12x - 6$$

$$2 = 12x$$

$$x = \frac{1}{6}$$

11.  $8^k = 78$

$$\log_8 78 = k$$

$$k \approx 2.0951$$

12.  $9^{m-6} = 78$

$$\log_9 78 = m-6$$

$$1.9828 = m-6$$

$$m \approx 7.9828$$

13.  $15^{3a} + 7 = 67$

$$15^{3a} = 60$$

$$\log_{15} 60 = 3a$$

$$1.5119 = 3a$$

$$a \approx .504$$

14.  $14^{3-8x} + 9 = 77$

$$14^{3-8x} = 68$$

$$\log_{14} 68 = 3-8x$$

$$1.5989 = 3-8x$$

$$-1.4011 = -8x$$

$$x \approx .1751$$

15.  $8 \cdot 3^{n-1} - 21 = 51$

$$8 \cdot 3^{n-1} = 72$$

$$3^{n-1} = 9$$

$$3^{n-1} = 3^2$$

$$n-1=2$$

$$n=3$$

16.  $2 \cdot 18^{10r-3} - 1 = 73$

$$2 \cdot 18^{10r-3} = 74$$

$$18^{10r-3} = 37$$

$$\log_{18} 37 = 10r-3$$

$$1.2493 = 10r-3$$

$$r \approx 0.4249$$

