

Algebra 2 // Topic 6 // Solving Logs C

D: Solve the following equations for x:

1) $4^x = 13$
 \downarrow Si
 $\log_4 13 = x$

2) $7^x = 31$ \downarrow Si
 $\log_7 31 = x$

3) $\log_4 x = -3$ \downarrow Si
 $4^{-3} = x$
 $x = \frac{1}{64}$

4) $\log_6 x = 2$ \downarrow Si
 $6^2 = x$
 $x = 36$

5) $\log_7 3x = 2$ \downarrow Si
 $7^2 = 3x$
 $\frac{49}{3} = \frac{3x}{3}$
 $x = \frac{49}{3}$

6) $\log_x 10 = 3$ \downarrow Si
 $10^3 = x$
 $x = 1000$

7) $2^x - 5 = 13$
 $+5 \quad +5$
 $2^x = 18$
 \downarrow Si
 $\log_2 18 = x$

8) $10^x + 2 = 31$
 $-2 \quad -2$
 $10^x = 29$
 \downarrow Si
 $\log_{10} 29 = x$
 or
 $\log 29 = x$

9) $4(2^x) + 8 = 40$
 $-8 \quad -8$
 $4(2^x) = 32$
 $\frac{4(2^x)}{4} = \frac{32}{4}$
 $2^x = 8$
 $\rightarrow x = 3$

10) $\log_4 16 + \log_4 x = 3$
 \downarrow Si
 $\log_4 16x = 3$
 $4^3 = 16x$
 $\frac{64}{16} = \frac{16x}{16}$
 $x = 4$

11) $\log_3 6 + \log_3 x = 4$
 \downarrow Si
 $\log_3 6x = 4$
 $3^4 = 6x$
 $\frac{81}{6} = \frac{6x}{6}$
 $x = \frac{27}{2}$

12) $\log 8 + \log x = 3$
 \downarrow Si
 $\log_{10} 8x = 3$
 $10^3 = 8x$
 $\frac{1000}{8} = \frac{8x}{8}$
 $x = 125$

13) $\log_{10}(5x + 35) = 2$ \downarrow Si
 $10^2 = 5x + 35$
 $100 = 5x + 35$
 $-35 \quad -35$
 $\frac{65}{5} = \frac{5x}{5}$
 $x = 13$

14) $8^{3x} \cdot 8^{2x} = 5$
 \downarrow Si
 $8^{5x} = 5$
 $\frac{\log_8 5}{5} = \frac{5x}{5}$
 $x = \frac{\log_8 5}{5}$
 or
 $x = \frac{1}{5} \log_8 5$

15) $6(2^{4x}) + 7 = 25$
 $-7 \quad -7$
 $6(2^{4x}) = 18$
 $\frac{6(2^{4x})}{6} = \frac{18}{6}$
 $2^{4x} = 3$
 \downarrow Si
 $\frac{\log_2 3}{4} = \frac{4x}{4}$
 $x = \frac{\log_2 3}{4}$ or $x = \frac{1}{4} \log_2 3$

$$16) 2^x \cdot 2^{3x} = 8$$

$$\begin{aligned} \left(\begin{array}{l} 2^{4x} = 8 \\ \log_2 8 = 4x \\ \frac{3}{4} = \frac{4x}{4} \\ x = 3/4 \end{array} \right. & \left. \begin{array}{l} 2^{4x} = 2^3 \\ 4x = 3 \\ \frac{4x}{4} = \frac{3}{4} \\ x = 3/4 \end{array} \right. \end{aligned}$$

$$19) 2(3^x) + 2 = 12$$

$$\begin{aligned} & \begin{array}{r} -2 \quad -2 \\ \hline 2(3^x) = 10 \\ \frac{2(3^x)}{2} = \frac{10}{2} \end{array} \\ \text{Si } \downarrow & \begin{array}{l} 3^x = 5 \\ \log_3 5 = x \end{array} \end{aligned}$$

$$17) 2\log_3(3x-5) + 16 = 22$$

$$\begin{aligned} & \begin{array}{r} -16 \quad -16 \\ \hline 2\log_3(3x-5) = 8 \\ \frac{2\log_3(3x-5)}{2} = \frac{8}{2} \end{array} \\ \text{Si } \downarrow & \begin{array}{l} \log_3(3x-5) = 4 \\ 3^4 = 3x-5 \\ 81 = 3x-5 \\ \frac{81}{+5} = \frac{3x-5}{+5} \\ x = \frac{86}{3} \end{array} \end{aligned}$$

$$18) 8\log x = -24$$

$$\begin{aligned} & \begin{array}{r} \frac{8}{8} \quad \frac{-24}{8} \\ \hline \log_{10} x = -3 \\ 10^{-3} = x \\ \boxed{x = \frac{1}{1000}} \end{array} \end{aligned}$$

$$20) \log_2 6 + \log_2 x = 5$$

$$\begin{aligned} \text{Si } \downarrow & \begin{array}{l} \log_2 6x = 5 \\ 2^5 = 6x \\ 16 \cdot \frac{3x}{3} = \frac{6x}{3} \\ \frac{48}{3} = \frac{6x}{3} \\ x = \frac{16}{3} \end{array} \end{aligned}$$

$$21) \log_x 49 = 2$$

$$\begin{aligned} \downarrow \text{Si} & \begin{array}{l} \sqrt{x^2} = \sqrt{49} \\ x = \pm 7 \end{array} \end{aligned}$$

$$22) \log 5 - \log x = 3$$

$$\begin{aligned} \text{Si } \downarrow & \begin{array}{l} \log_{10} \frac{5}{x} = 3 \\ 10^3 = \frac{5}{x} \\ \frac{1000}{1000} = \frac{5}{1000} \\ \frac{1000}{1000} x = \frac{5}{1000} \end{array} \end{aligned}$$

$$x = \frac{1}{200}$$

$$23) 2(3^x) - 7 = 11$$

$$\begin{aligned} & \begin{array}{r} +7 \quad +7 \\ \hline 2(3^x) = 18 \\ \frac{2(3^x)}{2} = \frac{18}{2} \\ 3^x = 9 \rightarrow x = 2 \\ 3^x = 3^2 \end{array} \end{aligned}$$

$$24) \log(2x+4) = 2$$

$$\begin{aligned} \downarrow \text{Si} & \begin{array}{l} 10^2 = 2x+4 \\ 100 = 2x+4 \\ \frac{-4}{-4} \quad \frac{-4}{-4} \\ \frac{96}{2} = \frac{2x}{2} \\ x = 48 \end{array} \end{aligned}$$

$$25) \log_3 x + \log_3(x-6) = 3$$

$$\begin{aligned} \text{Si } \downarrow & \begin{array}{l} \log_3 x(x-6) = 3 \\ 3^3 = x(x-6) \\ x^2 - 6x = 27 \\ \frac{-27}{-27} \quad \frac{-27}{-27} \\ x^2 - 6x - 27 = 0 \\ \begin{array}{r} 1 \quad \quad -9 \\ 1 \quad \quad +3 \\ \hline \end{array} \\ (x-9)(x+3) = 0 \\ \begin{array}{l} x-9=0 \quad x+3=0 \\ \frac{+9}{+9} \quad \frac{-3}{-3} \\ \hline x=9 \quad x=-3 \end{array} \end{array} \end{aligned}$$

$$26) \log_2 x + \log_2(x+2) = 3$$

$$\begin{aligned} \text{Si } \downarrow & \begin{array}{l} \log_2 x(x+2) = 3 \\ 2^3 = x(x+2) \\ 8 = x^2 + 2x \\ \frac{-8}{-8} \quad \frac{-8}{-8} \\ x^2 - 2x - 8 = 0 \\ \begin{array}{r} 1 \quad \quad -4 \\ 1 \quad \quad +2 \\ \hline \end{array} \\ (x-4)(x+2) = 0 \\ \begin{array}{l} x-4=0 \quad x+2=0 \\ \frac{+4}{+4} \quad \frac{-2}{-2} \\ \hline x=4 \quad x=-2 \end{array} \end{array} \end{aligned}$$