Math 121 – Section 5.6 Solutions

9. Solve $\log_4(x+2) = \log_4 8$.

$$\begin{aligned} \log_4(x+2) &= \log_4 8 \\ x+2 &= 8 \\ \boxed{x = 6} \end{aligned}$$

15. Solve $3\log_2(x-1) + \log_2 4 = 5$.

$$\begin{aligned} 3\log_2(x-1) + \log_2 4 &= 5 \\ \log_2[4(x-1)^3] &= 5 \\ 4(x-1)^3 &= 2^5 \\ 4(x-1)^3 &= 32 \\ (x-1)^3 &= 8 \\ x-1 &= 2 \\ \boxed{x = 3} \end{aligned}$$

19. Solve $\log(2x+1) = 1 + \log(x-2)$.

$$\begin{aligned} \log(2x+1) &= 1 + \log(x-2) \\ \log(2x+1) - \log(x-2) &= 1 \\ \log\left(\frac{2x+1}{x-2}\right) &= 1 \\ \frac{2x+1}{x-2} &= 10^1 \\ 2x+1 &= 10(x-2) \\ 2x+1 &= 10x-20 \\ -8x &= -21 \\ \boxed{x = \frac{21}{8}} \end{aligned}$$

24. Solve $\log_5(x+3) = 1 - \log_5(x-1)$.

$$\begin{aligned} \log_5(x+3) &= 1 - \log_5(x-1) \\ \log_5(x+3) + \log_5(x-1) &= 1 \\ \log_5[(x+3)(x-1)] &= 1 \\ (x+3)(x-1) &= 5^1 \\ x^2+2x-3 &= 5 \\ x^2+2x-8 &= 0 \\ (x+4)(x-2) &= 0 \\ x = -4,\ x &= 2 \end{aligned}$$

Note, however, that $x = -4$ is not a solution since we cannot take the logarithm of a negative number. Therefore, $\boxed{x = 2}$.

41. Solve $3^{1-2x} = 4^x$.

$$\begin{aligned} 3^{1-2x} &= 4^x \\ \ln 3^{1-2x} &= \ln 4^x \\ (1-2x)\ln 3 &= x \ln 4 \\ \ln 3 - (2\ln 3)x &= (\ln 4)x \\ (\ln 4)x + (2\ln 3)x &= \ln 3 \\ (\ln 4 + 2\ln 3)x &= \ln 3 \\ & \boxed{x = \frac{\ln 3}{\ln 4 + 2\ln 3}} \end{aligned}$$

47. Solve $\pi^{1-x} = e^x$.

$$\begin{aligned} \pi^{1-x} &= e^x \\ \ln \pi^{1-x} &= \ln e^x \\ (1-x)\ln \pi &= x \ln e \\ \ln \pi - (\ln \pi)x &= x \\ (\ln \pi)x + x &= \ln \pi \\ (\ln \pi + 1)x &= \ln \pi \\ & \boxed{x = \frac{\ln \pi}{\ln \pi + 1}} \end{aligned}$$

53. Solve $16^x + 4^{x+1} - 3 = 0$.

$$\begin{aligned} 16^x + 4^{x+1} - 3 &= 0 \\ (4^x)^2 + 4 \cdot 4^x - 3 &= 0 \end{aligned}$$

Use the quadratic equation with $a = 1$, $b = 4$, and $c = -3$:

$$\begin{aligned} 4^x &= \frac{-4 \pm \sqrt{4^2 - 4(-3)(1)}}{2(1)} \\ 4^x &= \frac{-4 \pm \sqrt{16 + 12}}{2} \\ 4^x &= -2 \pm \sqrt{7} \end{aligned}$$

We must take the + since 4^x can't be negative. Therefore,

$$\begin{aligned} 4^x &= -2 + \sqrt{7} \\ & \boxed{x = \log_4(-2 + \sqrt{7})} \end{aligned}$$