Math 124 - Section 012
Quiz on 1.4 (with solutions)

*Write clearly and **show all of your work.** Good luck.*

1. Solve for x in the equation $10 = 30(2^x)$.

   Solution:

$$\frac{1}{3} = 2^x$$
$$\log \frac{1}{3} = x(\log 2)$$
$$x = \frac{\log \frac{1}{3}}{\log 2} \approx -1.58$$

2. Find the half-life of a radioactive substance that is reduced by 20% in 40 hours.

Solution:

Let $P(t) = P_0 e^{kt}$ represent the amount of the substance that remains after t hours. Set $0.8(P_0) = P_0 e^{40k}$ and solve for k:

$$\begin{aligned} 0.8 &= e^{40k} \\ \ln 0.8 &= 40k \\ k &= \tfrac{\ln 0.8}{40} \end{aligned}$$

Now set $0.5(P_0) = P_0 e^{kt}$ and solve for t:

$$\begin{aligned} 0.5 &= e^{kt} \\ \ln 0.5 &= kt \\ t = \tfrac{\ln 0.5}{k} &= \tfrac{\ln 0.5}{\left(\frac{\ln 0.8}{40}\right)} \approx 124.25 \text{ hours.} \end{aligned}$$

Note: It would also work to use the form $P(t) = P_0 a^t$.