

SCENARIO CARDS (SAMPLE RESPONSES)

| Scenario 1 | Scenario 2 |
|--|--|
| $y = (2)^{0.04t}, t = ? \text{ when } y = 30$ $30 = (2)^{0.04t}$ $\log_2(30) = \log_2\left((2)^{0.04t}\right)$ $\log_2(30) = 0.04t$ $\frac{\log_2(30)}{0.04} = \frac{0.04t}{0.04}$ $\frac{\log_2(30)}{0.04} = t$ $t \approx 122.67$ <p>The raw chicken wing will reach an unsafe level of bacteria after 2 hours and 2 minutes.</p> | $y = 30,000(0.9)^t, t = ? \text{ when } y = 15,000$ $15,000 = 30,000(0.9)^t$ $\frac{15,000}{30,000} = \frac{30,000(0.9)^t}{30,000}$ $0.5 = (0.9)^t$ $\log_{0.9}(0.5) = \log_{0.9}\left((0.9)^t\right)$ $\log_{0.9}(0.5) = t$ $t \approx 6.58$ <p>In 7 years, I can resell the truck for half of what I paid for it.</p> |

Scenario 3

$$y = 27e^{-0.02t}, t = ? \text{ when } y = 0.1(27) = 2.7$$

$$2.7 = 27e^{-0.02t}$$

$$\frac{2.7}{27} = \frac{27e^{-0.02t}}{27}$$

$$0.1 = e^{-0.02t}$$

$$\ln(0.1) = \ln(e^{-0.02t})$$

$$\ln(0.1) = -0.02t$$

$$\frac{\ln(0.1)}{-0.02} = \frac{-0.02t}{-0.02}$$

$$\frac{\ln(0.1)}{-0.02} = t$$

$$t \approx 115.13$$

$$1986 + 115.13 = 2101.13$$

It will be **2102** when the amount of Cesium-137 in the atmosphere reaches 10% of the initial amount released.

Scenario 4

$$y = 650\left(\frac{1}{2}\right)^{1.1t}$$

$$t = ? \text{ when } y = 0.01(2 \cdot 325) = 6.5$$

$$6.5 = 650\left(\frac{1}{2}\right)^{1.1t}$$

$$\frac{6.5}{650} = \frac{650\left(\frac{1}{2}\right)^{1.1t}}{650}$$

$$0.01 = \left(\frac{1}{2}\right)^{1.1t}$$

$$\log_{\frac{1}{2}}(0.01) = \log_{\frac{1}{2}}\left(\left(\frac{1}{2}\right)^{1.1t}\right)$$

$$\log_{\frac{1}{2}}(0.01) = 1.1t$$

$$\frac{\log_{\frac{1}{2}}(0.01)}{1.1} = \frac{1.1t}{1.1}$$

$$\frac{\log_{\frac{1}{2}}(0.01)}{1.1} = t$$

$$t \approx 6.04$$

In **6 hours**, there will be less than 1% of the medicine left in someone's system, and they can safely take the next dosage.

Scenario 5

$$y = 270e^{0.01t}, t = ? \text{ when } y = 350 \text{ million}$$

$$350 = 270e^{0.01t}$$

$$\frac{350}{270} = \frac{270e^{0.01t}}{270}$$

$$\frac{35}{27} = e^{0.01t}$$

$$\ln\left(\frac{35}{27}\right) = \ln(e^{0.01t})$$

$$\ln\left(\frac{35}{27}\right) = 0.01t$$

$$\frac{\ln\left(\frac{35}{27}\right)}{0.01} = \frac{0.01t}{0.01}$$

$$\frac{\ln\left(\frac{35}{27}\right)}{0.01} = t$$

$$t \approx 25.95$$

$$2000 + 25.95 = 2025.95$$

The U.S. population will be over 350 million people in **2026**.

Scenario 6

$$y = 700e^{-0.26t} + 90, t = ? \text{ when } y = 140$$

$$140 = 700e^{-0.26t} + 90$$

$$\frac{-90}{-90} = \frac{-90}{-90}$$

$$50 = 700e^{-0.26t}$$

$$\frac{50}{700} = \frac{700e^{-0.26t}}{700}$$

$$\frac{1}{14} = e^{-0.26t}$$

$$\ln\left(\frac{1}{14}\right) = \ln(e^{-0.26t})$$

$$\ln\left(\frac{1}{14}\right) = -0.26t$$

$$\frac{\ln\left(\frac{1}{14}\right)}{-0.26} = \frac{-0.26t}{-0.26}$$

$$\frac{\ln\left(\frac{1}{14}\right)}{-0.26} = t$$

$$t \approx 10.15$$

It takes approximately **10 minutes** for the pizza to reach the ideal temperature.

Scenario 7

$$y = 2400e^{-0.25t} + 75, t = ? \text{ when } y = 100$$

$$100 = 2400e^{-0.25t} + 75$$

$$\frac{-75}{2400} = \frac{-75}{2400}$$

$$25 = 2400e^{-0.25t}$$

$$\frac{25}{2400} = \frac{2400e^{-0.25t}}{2400}$$

$$\frac{1}{96} = e^{-0.25t}$$

$$\ln\left(\frac{1}{96}\right) = \ln(e^{-0.25t})$$

$$\ln\left(\frac{1}{96}\right) = -0.25t$$

$$\frac{\ln\left(\frac{1}{96}\right)}{-0.25} = \frac{-0.25t}{-0.25}$$

$$\frac{\ln\left(\frac{1}{96}\right)}{-0.25} = t$$

$$t \approx 18.26$$

It will be approximately **18 hours** before the tiles are safe to touch.

Scenario 8

$$y = A_0e^{r \cdot t}, t = ? \text{ when } y = 0.98(A_0)$$

$$0.98A_0 = A_0e^{-0.0001t}$$

$$\frac{0.98A_0}{A_0} = \frac{A_0e^{-0.0001t}}{A_0}$$

$$0.98 = e^{-0.0001t}$$

$$\ln(0.98) = \ln(e^{-0.0001t})$$

$$\ln(0.98) = -0.0001t$$

$$\frac{\ln(0.98)}{0.0001} = \frac{-0.0001t}{0.0001}$$

$$\frac{\ln(0.98)}{-0.0001} = t$$

$$t \approx 202.02$$

$$(\text{Current Year}) - 202.595 = \underline{\hspace{2cm}}$$

Sadly, your friend is mistaken, as this tree was cut down after the War of 1812.