

You may use a calculator and your homework, but not your books or notes. There are three problems worth 10 points each. Show all of your work to receive full/partial credit.

- 1) (#26 from 9.1) The *Better Baby Buggy Co.* has just come out with a new model, the Turbo. The market research department predicts that the demand equation for Turbos is given by $q = -2p + 320$, where q is the number of buggies it can sell in a month if the price is $\$p$ per buggy. At what price should it sell the buggies to get the largest revenue? What is the largest monthly revenue?

$$R = pq = p(-2p + 320) = -2p^2 + 320p$$

$$p_{\max} = \frac{-320}{2(-2)} = \$80$$

$$R_{\max} = -2(80)^2 + 320(80) = \$12,800$$

- 2) (#62 from 9.2) Find the equation of the exponential function that passes through the points $(-1, 2)$ and $(3, 1)$.

$$y = Ab^x \quad 2 = Ab^{-1} \quad 1 = Ab^3$$

$$\frac{1}{2} = \frac{Ab^3}{Ab^{-1}} \rightarrow \frac{1}{2} = b^4 \quad b = \left(\frac{1}{2}\right)^{1/4} \approx 0.8409$$

$$1 = A(0.8409)^3 \rightarrow A = \frac{1}{0.8409^3} = 1.6818$$

$$y = 1.6818(0.8409)^x$$

3) (#53 from 9.3) The half-life of cobalt 60 is 5 years.

- a) Obtain an exponential model for cobalt 60 in the form $Q(t) = Q_0 e^{-kt}$. (Round coefficients to three significant digits.)

$$k = \frac{\ln\left(\frac{1}{2}\right)}{5} = -0.139$$

$$Q(t) = Q_0 e^{-0.139t}$$

- b) Use your model to predict, to the nearest year, the time it takes for one third of the sample of cobalt 60 to decay.

If $\frac{1}{3}$ decays, $\frac{2}{3}$ remain, so

$$\frac{2}{3} Q_0 = Q_0 e^{-0.139t}$$

$$\ln\left(\frac{2}{3}\right) = -0.139t$$

$$t = \frac{\ln\left(\frac{2}{3}\right)}{-0.139} = 2.9$$

About 3 years