Polynomial Models

1. The cost (in dollars) of manufacturing $x$ items is given by: $C(x) = x^3 - 8x^2 + 16x$. What is the cost of manufacturing 18 items?

2. Suppose that the population of a certain city during a certain time period can be approximated by: $P(x) = -0.1x^5 + 2.5x^4 + 6000$, where $x$ is time in years since 1960. Find the population of the city in 1982.

3. Scientists notice that a population of wild birds follows the formula $P(x) = 0.002x^3 + 0.024x^2 - 5.3x + 9.2$ where “$x$” represents days after the study and $45 < x < 365$. Find the population of wild birds after 65 days.

4. The concentration of a drug in the bloodstream in mg/dl “$x$” hours after consumption is given by the function $C(x) = 0.003x^3 - 0.093x^2 + 0.504x$. What is the blood concentration level of the drug after 4 hours?

5. A rectangular box has a length that is two inches less than its width and a height that is three inches less than the width. Find the dimensions of the box if the volume of the box is 30 in$^3$.

6. A rectangular box has a length that is four inches less than its width and a height that is six inches more than the width. Find the approximate dimensions of the box if the volume of the box is 48 in$^3$. Round your answer to the nearest hundredth of an inch.

7. The rate of lung cancer cases per 100,000 females in the year $t$ (where $t = 0$ corresponds to 1930) can be modeled by $C(t) = 0.00028t^3 - 0.011t^2 + 0.23t + 0.93$. Find the expected number of lung cancer cases in 1980 and in 2006.

8. Find the formula for the volume of a cylinder that has a height that is 4 cm longer than the radius. ($V = \pi r^2 h$)

9. The polynomial $f(x) = \frac{\pi}{3}x^3 - 5\pi r^2 + \frac{500\pi d}{3}$ can be used to find the depth that a ball having a diameter of 10 cm sinks in water. The constant $d$ represents the density of the ball, where we assume the density of water is 1. The smallest positive zero of $f(x)$ is the depth that the ball sinks. Using MathGV, approximate the depth a solid aluminum ball having $d = 2.7$ will sink.

10. A survey team measures the concentration (in parts per million) of a particular toxin in a local river. On a normal day, the concentration of the toxin at time $x$ hours after the factory upstream dumps its waste is given by the function $T(x) = -0.006x^4 + 0.23x^3 - 0.07x^2 + 0.03x$, where $0 \leq x \leq 24$. Use MathGV to determine the time at which the concentration is the greatest.

11. The polynomial function $L(p) = p^3 - 5p^2 + 20$ gives the rate of gas leakage from a tank as pressure increases in $p$ units from its initial setting. ($p = 0$ represents the “initial setting”.) What value of $p$ will result in the lowest rate of gas leakage? (Use MathGV)

12. The polynomial $G(x) = -0.006x^4 + 0.140x^3 - 0.53x^2 + 1.79x$ measures the concentration of a dye in the bloodstream $x$ seconds after it is injected. Use MathGV to answer the following questions.
   a) After how many seconds does the concentration reach its peak?
   b) How long does it take for the dye to completely leave the bloodstream?