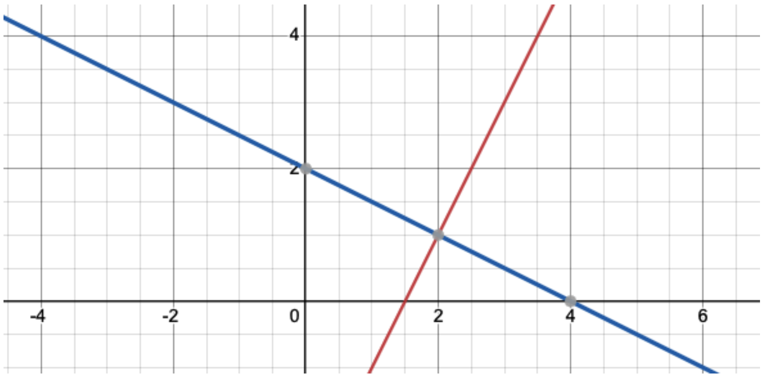
1. The points $(0,2)$ and $(-1,-1)$ are easiest to identify as lying on the line. Then

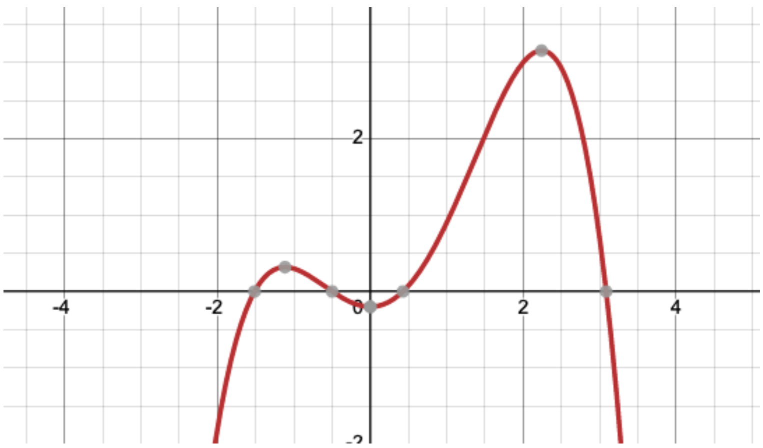
$$\begin{aligned} y - y_1 &= \frac{y_2 - y_2}{x_2 - x_1}(x - x_1) \\ y - 2 &= \frac{-1-2}{-1-0}(x-0) \\ y &= 3x + 2 \end{aligned}$$

2. The slope of the given line is 2, so the slope of the perpendicular line is $-\frac{1}{2}$. We have the slope and a point, so use the slope-point form:

$$\begin{aligned} y - y_1 &= m(x - x_1) \\ y - 0 &= -\frac{1}{2}(x-4) \\ y &= -\frac{1}{2}x + 2 \end{aligned}$$



3. Choose any 4 roots you like and note that the leading coefficient being negative means that the graph is increasing at first.



4. (a)

$$\begin{array}{r l} & \quad -2x^2 \;\; +9x \;\; -4 \\ x+3 \big) & -2x^3 + 3x^2 + 23x - 12 \\ & \;\; 2x^3 + 6x^2 \\ \hline & \qquad\quad 9x^2 + 23x \\ & \qquad\; -9x^2 - 27x \\ \hline & \qquad\qquad\quad -4x - 12 \\ & \qquad\qquad\qquad 4x + 12 \\ \hline & \qquad\qquad\qquad\qquad 0 \end{array}$$

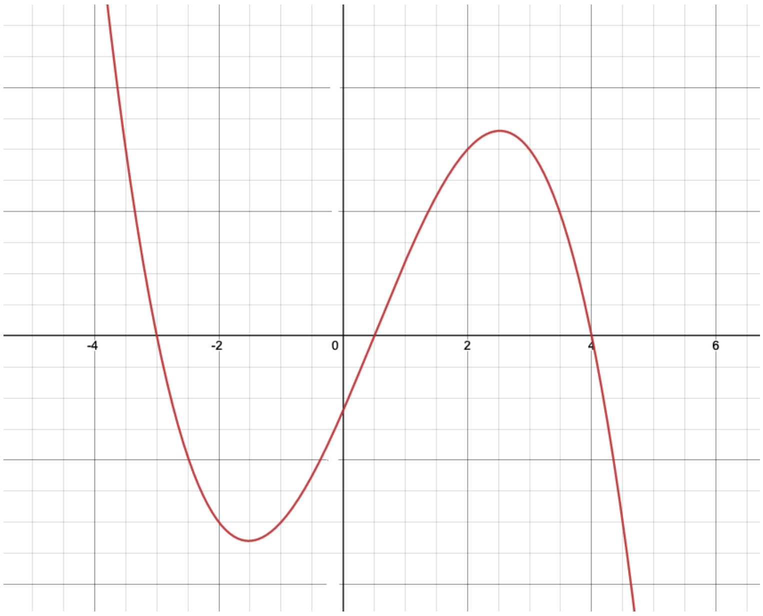
$$\therefore \; -2x^3 + 3x^2 + 23x - 12 = (x+3)(-2x^2 + 9x - 4)$$

(b)

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-9 \pm \sqrt{81 - 32}}{-4} = \frac{-9 \pm 7}{-4} = \frac{1}{2}, 4$$

$$\therefore \; -2x^3 + 3x^2 + 23x - 12 = (x+3)\left(x - \frac{1}{2}\right)(x-4)$$

(c) Roots are $-3, \frac{1}{2}, 4$. Leading coefficient is negative, so the graph decreases at first.



5. One more day, of course! If the population doubles every day and half the pond is covered on Day 35, the whole pond is covered on Day 36.

6. We have $n = 1$ and $r = 0.15$, with initial investment 1000.

   (a)

$$P_f = P_0\left(1 + \frac{r}{n}\right)^{nt} = 1000(1 + 0.15)^5 \approx 2011.36$$

   (b)

$$P_f = P_0\left(1 + \frac{r}{n}\right)^{nt} = 1000(1 + 0.15)^{10} \approx 4045.56$$

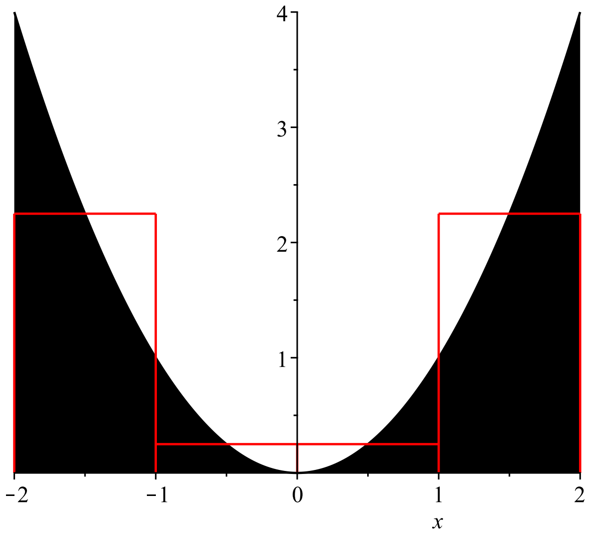
7. (a) We calculate k, then find A_f.

$$\begin{aligned} k &= \frac{\ln 2}{8} \approx 0.0866 \\ A_f &= 200e^{-0.0866 \cdot 32} \approx 12.52 \text{ grams} \end{aligned}$$

   (b) We need to find k, which involves a method not seen in class. To isolate an exponent, first isolate the exponential and then take the logarithm of both sides.

$$\begin{aligned} 4 = 512e^{-35k} &\to \frac{4}{512} = e^{-35k} \to \ln\frac{4}{512} = \ln e^{-35k} = -35k \\ k = -\frac{1}{35}\ln\frac{4}{512} &\approx 0.1386 \to T_{1/2} = \frac{\ln 2}{0.1386} \approx 5 \text{ days} \end{aligned}$$

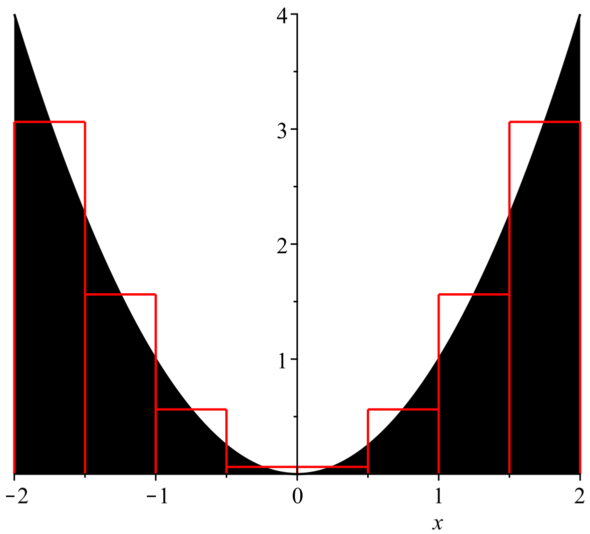
8. (a)



The area of a rectangle is width times height; the width of each of these rectangles is 1 and the height is each (midpoint)^2.

$$A \approx 1(-1.5)^2 + 1(-0.5)^2 + 1 \cdot 0.5^2 + 1 \cdot 1.5^2 = 5$$

(b)



This time, the widths are 0.5.

$$A \approx 0.5[(-1.75)^2 + (-1.25)^2 + (-0.75)^2 + (-0.25)^2 + 0.25^2 + 0.75^2 + 1.25^2 + 1.75^2] = 5.25$$

(c)

$$A = \int_{-2}^{2} x^2 dx = \frac{x^3}{3}\Big|_{-2}^{2} = \frac{2^3}{3} - \frac{(-2)^3}{3} = \frac{16}{3}$$

(d)

$$E_4 = \frac{\left|5 - \frac{16}{3}\right|}{\frac{16}{3}} = 0.0625 \rightarrow 6.25\% \text{ error}$$
$$E_8 = \frac{\left|5.25 - \frac{16}{3}\right|}{\frac{16}{3}} = 0.015625 \rightarrow 1.5625\% \text{ error}$$