Section 1.2 #72: Write the equation of the line satisfying the given conditions in slope-intercept form: passing through $(-3,7)$ and $(1,2)$.
Solution: The slope-intercept form of the equation of a line looks like $y = mx+b$ where m is the slope and b is the y-intercept. However, we are not told the y-intercept here, so we must use the point-slope form of the equation of a line $y - y_1 = m(x - x_1)$, where m is the slope and (x_1, y_1) is a point on the line. To find the slope, compute

$$\text{slope} = \frac{\Delta y}{\Delta x} = \frac{2-7}{1-(-3)} = \frac{-5}{4}.$$

Therefore, using the point $(1,2)$, the equation of the line is

$$y - 2 = -\frac{5}{4}(x-1).$$

This equation is not in point-slope form. To get it there, solve for y by adding 2 to both sides and distribute the $-\frac{5}{4}$ into the $(x-1)$ to get

$$y = -\frac{5}{4}x + \frac{5}{4} + \underbrace{2}_{=\frac{8}{4}},$$

thus

$$y = -\frac{5}{4}x + \frac{13}{4}.$$

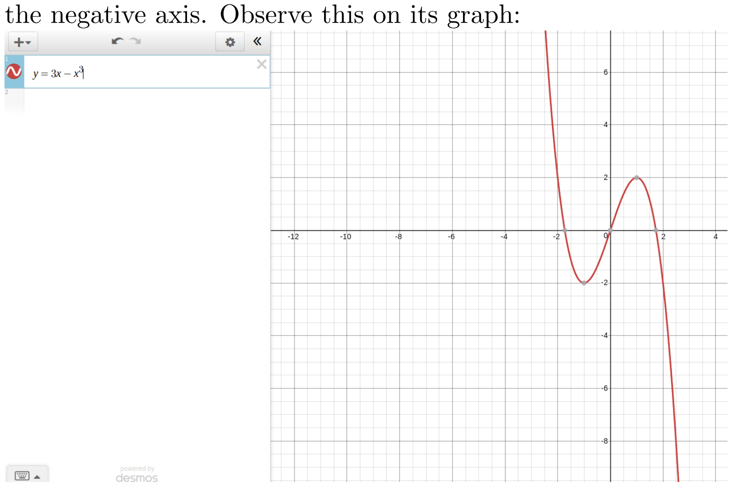
Section 1.2 #87: For the polynomial function $f(x) = 3x - x^3$ do the following:

a. Find the degree of f.
   Solution: The degree is the highest exponent of a term. In this function, that is 3.

b. Find the zeros of f.
   Solution: The zeros are the solutions of the equation $f(x) = 0$. This means we need to solve $3x - x^3 = 0$. To solve it, factor an x on the left to get $x(3-x^2) = 0$. At this point, the zero-product rule for the real numbers tells us we need to solve $x = 0$ (already solved) and $3-x^2 = 0$. To solve the remaining equation, add x^2 to both sides to get $3 = x^2$ and now take square roots of both sides (always include $\pm$ when taking square roots of an equation): $\pm\sqrt{3} = x$. Therefore the zeros of f are the numbers $x = 0, \sqrt{3}, -\sqrt{3}$.

c. Find the y-intercept(s) of f.
   Solution: A y-intercept is where the function crosses the y-axis. Since the y-axis consists of points of the form $(0, y)$, we see that to find the y-intercept we just need to plug $x = 0$ into the function to get $f(0) = 3(0) - 0^3 = 0$. Therefore the y-intercept is the point $(0,0)$ (note: y-intercept is a POINT, not a number!)

d. Use the leading coefficient to determine the graph's end behavior.
Solution: Since this is a cubic function, the end behavior will be ∞ on one side and $-\infty$ on the other side. Since the coefficient of x^3 is -1, we get end behavior that diverges to $-\infty$ on the positive real axis and towards ∞ on the negative axis. Observe this on its graph:



Section 1.2 #103: A company purchases some computer equipment for \$20, 500. At the end of a 3-year period, the value of the equipment has decreased linearly by \$12, 300.

a. Find a function $y = V(t)$ that determines the value V of the equipment at the end of t years.
Solution: We are given two pieces of information: at the starting time ($t = 0$) the equipment is valued at \$20, 500 and so we imagine this as the point $(t, V(t)) = (0, 20500)$. The other piece of information is that after 3 years the equipment is valued at \$12, 300 and so we imagine this as the point $(3, 12300)$. All that is left to do is find an equation for this linear function (it's linear because they told us it is!!). To do that, find the slope:

$$\text{slope} = \frac{12300 - 20500}{3 - 0} = \frac{-8200}{3}.$$

Using the point $(0, 20500)$ we can find the equation of the line as

$$V(t) - 20500 = -\frac{8200}{3}(t - 0).$$

Therefore solve for $V(t)$ to get

$$V(t) = -\frac{8200}{3}t + 20500.$$

(*note: we are using $V(t)$ instead of y here – this is ok! The context of this question makes the* ***dependent variable*** *V instead of "traditional" y*)

b. Find and interpret the meaning of the x- and y-intercepts for this situation.
Solution: The y-intercept is given by

$$V(0) = -\frac{8200}{3}(0) + 20500 = 20500$$

and the x-intercept is just another way to ask us to find the root, i.e. the solution of $V(t) = 0$. This equation is $-\frac{8200}{3}t + 20500 = 0$. To solve it, first subtract 20500 to get $-\frac{8200}{3}t = -20500$. Now multiply by 3 to get $-8200t = 3(20500) = 61500$. Finally, divide by -8200 to get $t = -\frac{61500}{8200} =$ 7.5 years. This means that after 7.5 years, the equipment becomes worthless, i.e. valued at \$0 (according to the model!).

c. What is the value of the equipment at the end of 5 years?
Solution: The value of the equipment after 5 years is given by $V(5)$, so compute

$$V(5) = -\frac{8200}{3}(5) + 20500 \approx \$34,166.66$$

d. When will the value of the equipment be \$3000?
Solution: Here we are asked to find the time t when $V(t) = 3000$. This means we need to solve the equation $-\frac{8200}{3}t + 20500 = 3000$. To solve it, first subtract 20500 to get $-\frac{8200}{3}t = -17500$. Finally find t by multiplying by $-\frac{3}{8200}$ (note: you could multiply one number at a time like we did in part b!) to get $t = -17500\left(-\frac{3}{8200}\right) \approx 6.40$ years.