Revenue and Cost *The total monthly revenue function for camcorders is given by* $R = 6600x$ *dollars, and the total monthly cost function for the camcorders is* $C = 2000 + 4800x + 2x^2$ *dollars, where x is the number of camcorders that are produced and sold.* [1]

a. *Find the profit function.*

Profit is the difference between revenue and cost. Algebraically this looks like, $P(x) = R(x) - C(x)$ and we can simply substitute the given functions for revenue and cost. Because you're subtracting, be careful to use parentheses around the cost function.

$$\begin{aligned} P(x) &= R(x) - C(x) \\ P(x) &= 6600x - (2000 + 4800x + 2x^2) \\ &= 6600x - 2000 - 4800x - 2x^2 \\ &= -2x^2 + 1800x - 2000 \end{aligned}$$

The monthly profit function for producing and selling x number of camcorders is $P(x) = -2x^2 + 1800x - 2000$.

b. *Find the number of camcorders that gives maximum profit.*

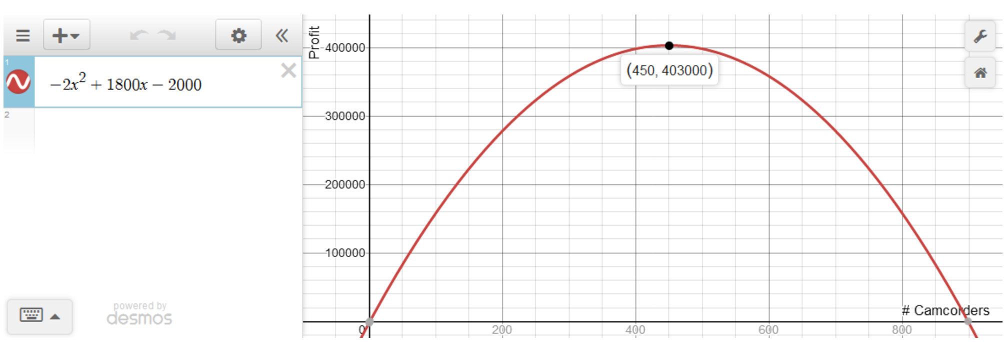
Because $P(x)$ is quadratic with a negative leading coefficient, we know that the graph of $P(x)$ is a parabola that opens down. We also know that this graph has a maximum point, $\big(x, P(x)\big)$ at the value given by $\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right)$.

The value of x that produces the maximum profit is:

$$\begin{aligned} x &= \frac{-b}{2a} \\ x &= \frac{-1800}{2(-2)} \\ &= \frac{-1800}{-4} \\ &= 450 \end{aligned}$$

The maximum profit occurs when 450 camcorders are produced and sold.

If you verify this using your graphing utility, look for the x-coordinate of the parabola's maximum point:



Again, the maximum profit occurs when 450 camcorders are produced and sold.

[1] Harshbarger/Yocco, *College Algebra In Context*, 5e, p. 272, #30.

c. *Find the maximum possible profit.*

From part b, we know that the number of camcorders that will produce the maximum profit is 450. Substituting this value into the profit function, $P(x) = -2x^2 + 1800x - 2000$, will give us the maximum profit.

$$\begin{aligned} P(x) &= -2x^2 + 1800x - 2000 \\ P(450) &= -2(450)^2 + 1800(450) - 2000 \\ &= -2 \cdot 202{,}500 + 810{,}000 - 2000 \\ &= -405{,}000 + 810{,}000 - 2000 \\ &= 403{,}000 \end{aligned}$$

The maximum possible profit is \$403,000.

Graphically, this value appears as the y-coordinate of the parabola's maximum point: