

Manufacturing antibiotics

The cost in dollars of producing x units of liquid antibiotic that sells for \$200/unit is,

$$C(x) = 500,000 + 80x + 0.003x^2$$

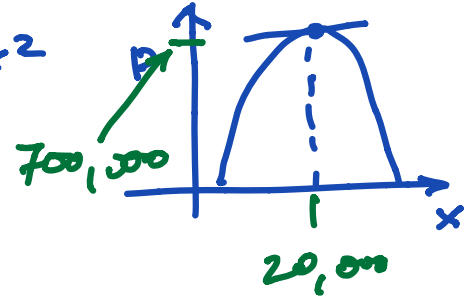
What production level will maximize profit?

$$P = R - C = 200x - (500,000 + 80x + 0.003x^2)$$

$$\Rightarrow P(x) = 120x - 500,000 - 0.003x^2$$

Horizontal tangent line

$$\Rightarrow m_{\text{tan}} = 0 = P'(x)$$



$$P'(x) = 120 \cdot 1 - 0 - 0.003 \cdot 2x'$$

$$= 120 - 0.006x \stackrel{!}{=} 0$$

$$+x = \frac{+120}{0.006} = 20,000$$

$$\text{Max } P(20,000) = 120(20,000) - 500,000 - 0.003(20,000)^2$$

$$= 700,000$$

$$x = -\frac{b}{2a} = \frac{-120}{2(-0.003)}$$

$$P = -0.003x^2 + 120x - 500,000$$

$$y = ax^2 + bx + c \quad \text{graph of parabola} \quad m_{\text{tan}} = 0 = y'$$

$$y' = a \cdot 2x + b \cdot 1 + 0 = 2ax + b \stackrel{!}{=} 0$$

$$2ax = -b \Rightarrow x = -b/2a$$