A standard business problem.

Demand is the relationship between the price of an item and the number of units that will sell at the price.

\[ P : \text{ price of unit.} \]
\[ q : \text{ quantity demanded.} \]

Problem:

Price of OPad $200.

Weekly demand 5000 units.

For every $1 increase in the price, the weekly demand decreased by 50 units.

Fixed costs on weekly is $100,000, variable cost $75 per unit.
(a) Find the linear demand equation for the optical, $P$ price, $Q$ for demand.

Equation the line.

$y = mx + b$

$m$ slope

$m = \frac{\text{rise}}{\text{run}} = \frac{200 - 201}{5000 - 4950} = -\frac{1}{50}$

$P \propto Q, \quad P \sim y$

$P = m(Q - Q_1) + P_1$

$P_1 = 200 \quad Q_1 = 5000$

$P = -\frac{1}{50}(Q - 5000) + 200$

$P(9) = -\frac{1}{50}9 + 300 \quad P(9)$
(b) weekly cost function \( C(q) \)

\[
\text{Cost} = \frac{\text{Fixed cost} + \text{Variable cost}}{100,000} \uparrow 75/\text{units}
\]

\[
C(q) = 100,000 + 75q
\]

(c) Find the weekly revenue

\[
R = R(q)
\]

\[
\text{Revenue} = \text{price} \times \text{demand}
\]

\[
R(q) = p \cdot q = \left( -\frac{1}{50}q + 300 \right)q
\]

\[
V. = \frac{1}{50}q^2 + 300q
\]

\[
P(q) = q \left( -\frac{1}{50}q + 300 \right)
\]

\[
q = 0 \quad q = 15000
\]
(d) break-even points are where cost equals revenue, i.e., $C(q) = R(q)$

$$100,000 + 75q = -\frac{1}{50}q^2 + 300q$$

$$-\frac{1}{50}q^2 + 225q - 100,000 = 0$$

$$q_1 = -125 \left( \sqrt{1725} - 45 \right)$$

$$q_2 = 125 \left( \sqrt{1725} + 45 \right)$$

(e) on the same set of axes, sketch $C(q)$ and $R(q)$.
9. Graph $P(q)$ on the same axes as you sketched $C(q)$ and $R(q)$

\[ P(q) = R(q) - C(q) \]

\[ P(q) \geq 0, \quad 0 \leq q \leq 9, \text{ and } 9 \leq q \leq 9_2 \]

\[ P(q) = \frac{-\frac{1}{50} q^2 + 300q - 100,000 - 75q}{R(q)} \]

h). How should Apple Inc. operates in order to maximize weekly profit. $P(q)$

sol: vertex of $P(q)$