(2.5)

$$q = 200 - \pi$$

Find price (π) and price elasticity of demand (E_d) = 0, 50, 100, 150, 200

$$\mathcal{E} = \frac{dq}{q} \cdot \frac{\pi}{d\pi} = \frac{\pi}{q} \cdot \frac{dq}{d\pi}$$

→ express price in terms of quantity: $q = 200 - \pi \rightarrow \pi = 200 - q$

$$\frac{dq}{d\pi} = -1 \quad , \quad \mathcal{E}_d = (-1)\frac{\pi}{q} = \frac{-\pi}{q}$$

1. $q = 0$

$\pi = 200 - 0 = 200$

$Ed = \frac{-200}{0} \rightarrow$ ~~undefined~~ $-\infty$, perfectly elastic

2. $q = 50$

$\pi = 200 - 50 = 150$

$Ed = \frac{-150}{50} = -3$

3. $q = 100$

$\pi = 200 - 100 = 100$

$Ed = \frac{-100}{100} = -1$

4. $q = 150$

$\pi = 200 - 150 = 50$

$Ed = \frac{-50}{150} = -1/3$

5. $q = 200$

$\pi = 200 - 200 = 0$

$Ed = \frac{-0}{200} = 0$ (perfectly inelastic)

$$q = \frac{10,000}{\pi}$$

$$\cancel{q}\ \pi = \frac{10,000}{q}$$

$$\frac{dq}{d\pi} = \frac{1}{\pi}\, 10,000$$

$$\frac{dq}{d\pi} = -10000\,\pi^{-2} = \frac{-10000}{\pi^2}$$

$$E_d = \frac{dq}{d\pi} \cdot \frac{\pi}{q} = \left(-\frac{10000}{\pi^2}\right) \cdot \frac{\pi}{q} = \frac{-10,000}{\pi \cdot q}$$

$$\pi \cdot q = 10,000 \rightarrow E_d = \frac{-10,000}{10,000} = -1$$

1. $q = 0$

   $\pi = \frac{10,000}{0}$ (undefined, $q \to 0, \pi \to \infty$)

   $E_d = -1$

2. $q = 50$

   $\pi = \frac{10,000}{50} = 200$

   $E_d = -1$

3. $q = 100$

   $\pi = \frac{10000}{100} = 100$

   $E_d = -1$

4. $q = 150$

   $\pi = \frac{10000}{150} \approx 66.67$

   $E_d = -1$

5. $q = 200$

   $\pi = \frac{10,000}{200} = 50$

   $E_d = -1$

(2.8) $C(y) = 10y^2 + 200y + 100{,}000$ — price per Gizmo: \$2400

a)

profit : total revenue − total cost

$: 2400y - (10y^2 + 200y + 100{,}000)$

$: 2400y - 10y^2 - 200y - 100{,}000$

$= -10y^2 + 2200y - 100{,}000$

Break-even points → (profit = 0)

$\pi(y) = 0, \quad -10y^2 + 2200y - 100{,}000 = 0$

$10y^2 - 2200y + 100{,}000$

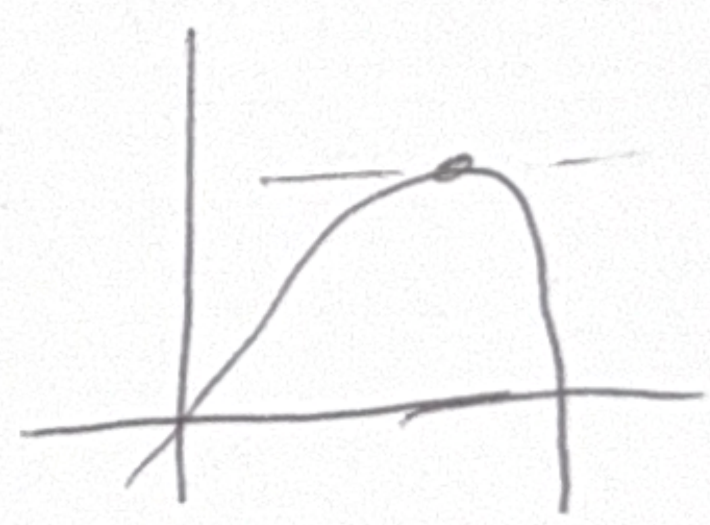
$y^2 - 220y + 10{,}000 = 0$

Solve quadratic eq; $y_q = \dfrac{220 \pm \sqrt{8400}}{2} \approx \dfrac{220 \pm 91.65}{2}$

$y_1 = 64.175$

$y_2 = 155.825$

profit is positive when output is b/w $64.18 < y < 155.83$



∴ Output that maximizes profit

$-10y^2 + 2200y - 100{,}000$

$\dfrac{d\pi}{dy} = -20y + 2200$

$-20y + 2200 = 0, \rightarrow 20y = 2200 \rightarrow y = 110$

$\dfrac{d^2\pi}{dy^2} = -20 < 0$ (so it has a maximum)

profit-maximizing output would be $y = 110$

b)

2.8

b) Total Revenue: $2400y - (10y^2 - 200y + 200{,}000)$

$= -10y^2 + 2200y - 200{,}000$

$-10y^2 + 2200y - 200{,}000 = 0$

$y^2 - 220y + 20{,}000 = 0$

solve quadratic eq: $\dfrac{220 \pm \sqrt{-31{,}600}}{2}$

$\Delta = -31600 < 0$, $\rightarrow$ NO REAL ROOTS

$\therefore$ FUNCTION NEVER EQUALS 0

$\therefore$ PROFIT ALWAYS NEGATIVE

$\dfrac{d\pi}{dy} = -20y + 2200 = 0$, $20y = 2200$, $y = 110$

$\dfrac{d^2\pi}{dy^2} = -20 < 0$ (maximum)

Compute profit at $y = 110$;

$\pi(110) = -10(110)^2 + 2200(110) - 200{,}000$

$= -10(12{,}100) + 242{,}000 - 200{,}000$

$= -121{,}000 + 242{,}000 - 200{,}000 = -79{,}000$

max profit is $-79{,}000$ (loss of \$79,000)

$\therefore$ Fixed cost went from $100{,}000 \rightarrow 200{,}000$

Fixed cost is too high, there is no range of production at which the firm would make a profit.