$30 = P + t$

$\Delta P = MC_{world} = $25

$\Delta Q_d$

Artificially generated domestic profits due to market price of $30 after tax is imposed.
20.6.

If \( P \), \( MP > W \) \( \Rightarrow \)

MR > MC : added benefit of producing is greater than the costs \( \Rightarrow \) Increase production

23.1: \( C(y) = 10y^2 + 1000 \)

\[ MC = \frac{dC}{dy} = 20y = MR = P \]

\[ \therefore \quad y = \frac{P}{20} = Supply \]

23.2. \( AC = \frac{C(y)}{y} = 10y + \frac{1000}{y} \)

\[ \frac{dAC}{dy} = 10 - \frac{1000}{y^2} = 0 \Rightarrow y^* = 10 \]

\( AC = MC = 10 - \frac{1000}{y^2} = 20y \Rightarrow y^* = 10 \)
23.7. Individual firms are so small relative to the market that they have no market power \( \Rightarrow \) They are thus "price-takers."

\[ P \neq P(q) \quad q = \text{firm output} \]

25.1. A tricky question \( \Rightarrow \) a monopolist won't be maximizing profits unless it either reduces quantity or raises prices sufficiently to approach an elastic point on the market demand curve. So:

\( \frac{dN}{d_\pi} \)

25.4. \( q_d = \frac{100}{p} \quad C(q) = q^2 \)

\[ E_q = \frac{\partial q_d}{\partial p} p = -100 \cdot \frac{p}{p^2} \cdot \frac{100}{p} = -1 \]

\( \Rightarrow \) \( MR = 0 \); there is no quantity that will generate non-negative profits.
\[ \text{mc}(q) = \text{mr}(q) \]

\[ = \text{p}(q) + q \cdot \frac{\partial \text{p}(q)}{\partial q} \]

So: \( \text{mc}(q) - q \cdot \frac{\partial \text{p}(q)}{\partial q} \) is greater than \( \text{mc}(q) \) alone \( \Rightarrow \)

\[ \text{p}(q) > \text{mc}(q) \]
Non-book:

Note: \( r = v = \) the rental rate

1. \( f(k, l) = k^2 l^{1/2} = q \)

\[ a.) \min_{k,l} Z = wL + rk + \lambda \left[ q - k^2 l^{1/2} \right] \]

**f.o.c.**

1. \( \frac{\partial Z}{\partial k} = r - 2\lambda kl^{1/2} = 0 \)

2. \( \frac{\partial Z}{\partial L} = w - \frac{\lambda k^2}{2L^{1/2}} = 0 \)

3. \( \frac{\partial Z}{\partial \lambda} = q - k^2 l^{1/2} = 0 \)

\( \frac{1}{2} \implies \frac{r}{w} = \frac{4L}{K} \implies rk = 4wL \)

\( \therefore K = \frac{4wL}{r} \)

4. \( \rightarrow 3 \implies q = \left[ \frac{4Lw}{r} \right]^2 L^{1/2} = \left( \frac{4w}{r} \right)^2 L^{5/2} \)

\( \therefore L^* = q^{2/5} r^{4/5} \frac{16^{2/5}}{w^{4/5}} \)

\( \therefore L^* = \left( \frac{r}{4w} \right)^{4/5} , q^{2/5} \)
\[ a) \text{ continued...} \]

\[ \text{5) } K^* = \frac{4w}{r} \]
\[ = \frac{4w}{r} \left[ \frac{q^{2/5} r^{4/5}}{16^{2/5} w^{4/5}} \right] \]
\[ K^* = \left( \frac{4w}{r} \right)^{1/5} q^{2/5} \]

\[ b) \quad c = W \cdot L^* + r K^* \]
\[ = W^{1/5} \left( \frac{r}{H} \right)^{4/5} q^{2/5} + r^{4/5} \left( 4w \right)^{1/5} q^{2/5} \]
\[ = W^{1/5} r^{4/5} q^{2/5} \left( \frac{1}{4^{4/5}} + 4^{1/5} \right) \]
\[ \approx 1.65 \left( W^{1/5} r^{4/5} q^{2/5} \right) \]

\[ c) \quad \frac{c(q)}{q=100, \; w=r=1} = 1.65 \left( 100^{2/5} \right) \]
\[ \approx 10.41 \]

\[ \text{7) } \rightarrow \text{5)} \quad L^* \approx 2.08 \quad K^* \approx 8.33 \]

\[ d) \quad \text{Repeat process:} \]
\[ L^* \approx 0.143 \left( \frac{w}{r} \right)^{-4/5} q^{2/5} \]
\[ K^* \approx 0.574 \left( \frac{w}{r} \right)^{1/5} q^{2/5} \]
1. d.) continued...

\[ C(q) = \frac{0.717}{q^{1/5}} \cdot r^{4/5} \cdot q^{2/5} \]

Costs have gone down!

\[ e.) \quad C(q) \bigg|_{q=100} = (0.717)(100)^{2/5} \]

\[ \frac{2}{4.52} \]

\[ L^* = 0.9 \]

\[ K^* = 3.62 \]

\[ \text{due to } q \text{ technology improvement.} \]

2. \[ C(q) = q^2 + 3q \]

a.) Oops!

b.) \[ T_R = T_{R} - T_{C} = Pq - q^2 - 3q \]

c.) \[ \frac{\partial T_R}{\partial q} = P - 2q - 3 = 0 \quad \Rightarrow \quad q^* = \frac{P - 3}{2} \]

\[ \Rightarrow \quad P = 2q + 3 \]
\( \text{d.) } TR(q) = P \cdot q \quad \therefore \\
MR = \frac{\partial TR}{\partial q} = P \\
CC(q) = q^2 + 3q \quad \therefore \\
MC = \frac{\partial CC(q)}{\partial q} = 2q + 3 \\
\text{We saw in c.) that} \\
P = 2q + 3 \text{ which shows} \\
\text{that } MR = MC \text{ which comes} \\
\text{from the F.O.C.} \\
\text{e.) } P = 9 \quad \Rightarrow \\
q^* = \frac{9 - 3}{2} = 3 \\
MC\big|_{q=3} = 2(3) + 3 = 9 \\
MR\big|_{q=3} = P = 9 \quad \therefore \\
q^* = 3 \quad MR = MC = P = 9 \quad \therefore
2.  
\[ \pi^* = (9.3) - (3^2 + 3.3) \]
\[ = 27 - 18 = \$9 \]

3.  
\[ q^* = \frac{15 - 3}{2} = 6 \]

\[ MC \bigg|_{q=6} = 2(6) + 3 = \$15 \]

\[ MR = P = \$15 \quad \therefore \quad q^* = 6 \]

\[ MR = P = MC = \$15 \]

\[ \pi^* = (15 \cdot 6) - (6^2 + 6 \cdot 3) = \$36 \]

3.  
\[ P = \$5 \quad C(q) = 4 + 2q^2 + q \]

a.)  
\[ VC(q) = 2q^2 + q \]

\[ FC = \$4 \]

b.)  
\[ \pi^* = 5q - (2q^2 + q + 4) \]

c.)  
\[ \frac{d\pi}{dq} = 5 - 4q - 1 = 0 \quad \Rightarrow \quad 4q = 4 \]
\[ \Rightarrow \quad q^* = 1 \]
3. \( \frac{\partial^2 \Pi}{\partial q^2} = -4 < 0 \) \( \Rightarrow q^* = 1 \) is a max, not a min!

e. \( \Pi = (5 \cdot 1) - (2(1)^2 + 1 + 4) \)

\[= \$ -2 \]

f. Yes! If you fail to produce

\[\Rightarrow q = 0 \]

\[\Pi \bigg|_{q=0} = (0.5) - ((2 \cdot 0) + 0 - 4) \]

\[= \$ -4 \]

So, to minimize losses, we should produce.