Answers to Work Sheet # 4

1) \[ P = \int MP = \int MR - MC = \left( -0.6q + 460 \right) - \left( 4q + 23 \right) dq = 1.7q^2 + 437q \biggr|_0^{95} = \text{answer} \]

2) First create the graph. Consumers' surplus is the area between the demand and price graph. Next create the graph for Producer's surplus. Use algebra to solve for the points of intersection.

\[ CS = \int_{0}^{400} \text{Top} - \text{Bottom} = \int_{0}^{400} \left( -0.3q + 330 \right) - 210 dq = 24000 \]

\[ PS = \int_{0}^{100} \text{Top} - \text{Bottom} = \int_{0}^{100} 95 - \left( 0.2q + 75 \right) dq = 1000 \]

Point of equilibrium is at \( q = 510 \)

There is no problem 3)
4) \[ \int_{0}^{10} 30e^{0.02t} - 25e^{0.1t} \, dt = \frac{30}{0.02}e^{0.02} - \frac{25}{0.1}e^{0.1} \bigg|_{0}^{10} = -97.47 \] There is a deficit of $97.47 in billions

5) If Demand = 1100 – 10x and demand level is x = 80, then p = 300 and Consumers' Surplus is given to be
\[ CS = \int_{0}^{80} (1100 - 10x) - 300 \, dx = 60800 \]

6) Given the supply equation \( S(q) = 0.09q^2 \) and \( q = 200 \) then find \( p = 3600 \) and Producer's Surplus is given to be
\[ PS = \int_{0}^{200} 3600 - 0.09q^2 \, dq = 480000 \]

7) Given demand \( p = q^2 - 18q + 81 \) and supply is \( p = q^2 + 9q \), to find the point of equilibrium by setting the demand = to supply and solve to get \( q = 3 \). If \( q = 3 \) then \( p = 36 \).
\[ CS = \int_{0}^{3} (q^2 - 18q + 81) - 36 \, dq = \text{Find - answer} \quad \text{and} \quad PS = \int_{0}^{3} (q^2 + 9q) \, dq = \text{Find - answer} \]
8) a) The point of equilibrium is \( q = 2 \) and \( p = 12 \) so

\[ CS = \int_{0}^{2} (q^2 - 8q + 24) - 12\,dq \]

Find answer and

\[ PS = \int_{0}^{2} (q^2 + 4q)\,dq \]

Find answer

(sketch graph)

b) The point of equilibrium is \( q = 3 \) and \( p = 21 \) so

\[ CS = \int_{0}^{3} (q^2 - 12q + 48) - 21\,dq \]

Find answer and

\[ PS = \int_{0}^{3} (q^2 + 4q)\,dq \]

c) Find the point of equilibrium by setting demand = supply.

\[ 48 - 10q - q^2 = q^2 + 10q \] and \( 0 = 2q^2 + 20q - 48 \)

\( 0 = 2(q + 12)(q - 2) \) so \( q = 2 \) and \( p = 24 \)

\[ CS = \int_{0}^{2} (48 - 10q - q^2) - 24\,dq = 24q - 5q^2 - \frac{q^3}{3} \bigg|_{0}^{2} = (24(2) - 5(2)^2 - \frac{2^3}{3}) - (0) = \text{answer} \]

\[ PS = \int_{0}^{2} 24 - (q^2 + 10q)\,dq = \text{answer} \]

d) This problem was done in class.