Answer Key for Problem set #6

A. Profit Maximization

1. 

a) Firm’s demand curve for the product is flat at $P=6$.

$\text{TR} = P \times Q$, $\text{AR} = \text{TR} / Q$, and $\text{MR} = \text{TR}_{Q+1} - \text{TR}_Q$

<table>
<thead>
<tr>
<th>Q</th>
<th>TR</th>
<th>AR</th>
<th>MR</th>
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Table 1-1

a) $\text{TR} = 6 \times Q$

b) $\text{MR} = \text{AR} = 6$

Table 1-2
b) Firm demand curve is \( Q = 20 - 2P \). 
\[ P = 10 - 0.5Q \]
\[ TR = P \times Q = (10 - 0.5Q) \times Q = 10Q - 0.5Q^2 \]
\[ AR = \frac{TR}{Q} = 10 - 0.5Q = P \]

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<th>AR</th>
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Table 1-2

![TR vs Q graph](image1)

![MR, AR vs Q graph](image2)

Figure 3-1

c) Firm chooses \( Q \) so that \( MR = SMC \), then it will set \( P = SMC \). Here \( P = MR \) and therefore, \( P = MR = SMC \)

d) As you see from table 1-2 and Figure 1-2 b), MR < P. Therefore, whenever \( SMC = MR \), \( SMC < P \). This is inefficient since marginal social benefit is greater than short-term marginal cost and increasing output will increase net benefit of the society.
2.  

a) College Economics 1 texts.  
   Not competitive: prices greatly exceed the incremental cost of the last book produced, also prices vary from publisher to publisher. (Note that the textbook is usually selected by the professor instead of the student who actually has to purchase the book.)

b) Auto dealership  
   Not competitive: prices vary between buyers (of the same car model) depending on bargaining power and other issues. Therefore, price cannot equal marginal cost.

c) The US airline industry  
   Not competitive: prices vary tremendously between passengers on the same flight. Therefore, the price cannot equal marginal cost. Also, almost none of these fares come close to the small incremental cost of putting another passenger on a non-full flight.

d) The movie theater market  
   Not competitive: prices vary between customers. (e.g., student or senior discounts) Therefore, price cannot equal marginal cost.

e) Long distance telephone service providers  
   Not competitive: providers have different service and price packages. A single provider may also offer multiple packages. Therefore, price cannot equal to marginal cost.

f) Restaurants  
   Not competitive: the marginal cost in a non-full restaurant are very small, including just the ingredients and small amounts for labor and other inputs such as powder and soup. Also, the markup varies a lot between different meals. Prices does not equal marginal cost.

All industries above violate P=SMC.
B. Firm and Industry Costs

3. McDonald’s produces hamburgers at a constant LMC of $2. Plot LAC and LTC as a function of output.

\[
\text{LTC} = 2 \times Q \\
\text{LAC} = \text{LMC} = 2
\]

\[
\text{Figure 3-1}
\]

4. A fixed investment of $1 billion in R&D, constant marginal cost of $100,000 each.
\[
\text{LTC} = \text{1 b.} + 100,000 \times Q \\
\text{LAC} = \text{LTC} / Q \\
\text{LMC} = \text{LTC} \\
\text{LMC} = \text{LTC}_{Q+1} - \text{LTC}_Q = (\text{1 b.} + 100,000 \times (Q+1)) - (\text{1 b.} + 100,000 \times Q) = 100,000
\]

\[
\text{Figure 4-1}
\]

5. 

(a) \[
\begin{align*}
\text{FC} &= 9 \\
\text{SVC} &= 2q + q^2 \\
\text{SAVC} &= 2 + q \\
\text{SATC} &= 9/q + 2 + q \\
\text{SMVC} &= 2q
\end{align*}
\]

(b)
(c) \[ SMC = SATC \]

\[ \Rightarrow 2 + 2q = \frac{9}{q} + 2 + q \]

\[ \Rightarrow q = 3 \]

To show 3 is the minimum of SATC either show the derivative is 0 at q= 3, or show that if we replace q by (3+x) then SATC(3+x) > 8 for all x not 0.