1. a. \( MR = MC \implies \)
\[
TR = (12 - 2Q)Q = 12Q - 2Q^2
\]
\[
MR = \frac{\partial TR}{\partial Q} = 12 - 4Q
\]
\[
TC = 6 + Q^2
\]
\[
MC = \frac{\partial TC}{\partial Q} = 2Q
\]
\[
\therefore 12 - 4Q = 2Q
\]
\[
\implies Q^*_M = 2
\]
\[
P^* = 12 - 2(2) = 8
\]
\[
TR - TC
\]
\[
\text{b. } \Pi = \left[12(2) - 2(2)^2\right] - \left[6 + (2)^2\right]
\]
\[
= 24 - 8 - 6 - 4
\]
\[
= 6
\]
\[
(\text{or: } \Pi = (P - AC)Q \quad | \quad AC = \frac{TC}{Q}
\]
\[
= \left[P - \left(\frac{6}{Q} + Q\right)\right]Q
\]
\[
= \left[P - \left(\frac{6}{2} + 2\right)\right]2
\]
\[
= \left(P - \left(3 + 2\right)\right)2
\]
\[
= \left(P - 5\right)2
\]
\[
= 6
\]
C. For perfectly competitive:

\[ P = MC \implies 12 - 2Q = 2Q \implies Q^*_{pc} = 3 \]

\[ P_{pc} = 12 - 2(3) = 6 \]

\(\therefore\) Price is $2 less while quantity is 1 unit more.

\[ DWL = \frac{1}{2} (1 - 4) = 2 \]
2. a. \( MR = MC \Rightarrow \)
\[
TR = (70 - Q)Q = 70Q - Q^2
\]
\( MR = 70 - 2Q \)
\( MC = AC = 6 \)

\( 70 - 2Q = 0 \Rightarrow Q^*_M = 32 \)

\( P^*_M = 70 - 32 = 38 \)

\[
TR = \left(70 - (32)^2\right) - 6(32)
\]
\( TR = 1024 \)

b. \( MC = \frac{Q}{2} - 5 \)
\( MR = 70 - 2Q \)

\( \frac{Q}{2} - 5 = 70 - 2Q \)
\( Q^*_M = 30 \) and
\( P^*_M = 40 \) and
\( \Pi^*_M = 825 \)

c. \( MC = 0.0399Q^2 - 5 \)
\( MR = 70 - 2Q \)

\( 0.0399Q^2 - 5 = 70 - 2Q \)
$Q_m^* \approx 25$ (Rounded)  

$P_m^* = \$45$  

$T_m^* = \$792.50$  

$MC = 0.0399Q^2 - 5$  

As costs increase, $T_m$ go down
3. a.) \( MK_i = MC_i \) | \( i = \text{mkt 1 or 2} \)

\[ \Rightarrow \begin{array}{ll}
\text{mkt. 1} & \text{mkt. 2} \\
55 - 2Q = 5 & 55 - Q = 5 \\
A^*_m = 25 & A^*_m = 30 \\
P^*_m = \$30 & P^*_m = \$20 \\
\end{array} \]

\[ \Pi_1 = (P - AC)Q \]
\[ = (30 - 5)25 \]
\[ = 25 \cdot 25 \]
\[ = \$625 \]

\[ \therefore \Pi_m = \$625 + \$450 = \$1075 \]

b.) The monopolist must now keep the price difference between the two regions less than $5 or people in the $20 mkt will buy and resell.

\[ \therefore \text{In mkt 1 } P = \$25 \Rightarrow \]
\[ A^*_m = 55 - 25 = 30 \]
b) \[ TR_{m_1} = (25 - 5) \times 30 = \text{ $600$} \]
\[ TR = $600 + $450 = $1050 \]

\[ TTR_{m_2} \text{ remains the same} \]

c) Unified market:
\[ Q_1 = 55 - P \]
\[ Q_2 = 70 - 2P \]
\[ Q = 125 - 3P \]
\[ \Rightarrow P = \frac{125 - Q}{3} \]

\[ TR_m = \left( \frac{125 - Q}{3} \right)Q \]
\[ = \frac{125}{3}Q - \frac{Q^2}{3} \]

\[ MR = \frac{125}{3} - \frac{2}{3}Q = MC = 5 \]
\[ Q_m^* = 55, \quad P_m^* = \$23.3 \quad \text{and} \]
\[ TR_m = \text{ $1008} \]
a. Define Nash Equilibrium:
Nash Equilibrium is an outcome for which no player can improve his or her payoff by switching strategies given the strategies of his or her opponents.

b. The following normal form game illustrates the Prisoner's Dilemma. Both players took part in a crime, but the plaintiff has no evidence. Each player can either remain silent or can choose to betray the other. Given the following payoff matrix, determine the set of strategies that constitute a Nash Equilibrium and explain the intuition behind the solution you find.

<table>
<thead>
<tr>
<th></th>
<th>Silence</th>
<th>Betray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silence</td>
<td>-6, -6</td>
<td>-10, 0</td>
</tr>
<tr>
<td>Betray</td>
<td>0, -10</td>
<td>-5, -5</td>
</tr>
</tbody>
</table>

Player 2

Nash equilibrium: (Betray, Betray)
Neither player has any incentive to deviate from the strategy Betray because the alternative payoff is lower. In fact, the strategy Betray strictly dominates Silence. In other words, under no circumstance does the player do better by switching to Silence (holding the other player's strategy constant.)