a) 

<table>
<thead>
<tr>
<th>Price of Y</th>
<th>Demand for X</th>
<th>% Change in Dx</th>
<th>% Change in Py</th>
<th>Arc Cross Price Elasticity ($\epsilon_{xy}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$30$</td>
<td>$50$</td>
<td>$-1.225806$</td>
<td>$-1.428571$</td>
<td>$0.858065$</td>
</tr>
<tr>
<td>$5$</td>
<td>$12$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b) Goods X and Y are substitutes in consumption because the arc cross price elasticity of Demand is positive.

\[
\% \text{Change in } Dx = \frac{(B_3 - B_2)/\left((B_2 + B_3)/2\right)}{(a_3 - a_2)/\left((a_2 + a_3)/2\right)}
\]

\[
\% \text{Change in } Dy = \frac{(a_3 - a_2)/\left((a_2 + a_3)/2\right)}{(a_3 - a_2)/\left((a_2 + a_3)/2\right)}
\]

\[
\text{Arc cross price elasticity} = \frac{(B_3 - B_2)/\left((B_2 + B_3)/2\right)}{(a_3 - a_2)/\left((a_2 + a_3)/2\right)}
\]
2. Consider the following equations for market demand and supply:

\[ \begin{align*}
Q_s &= -20 + 3P \\
Q_d &= 220 - 5P
\end{align*} \]

(a) Calculate the consumer surplus for \( Q = 1 \) (5 Points)

(b) Calculate the producer surplus for \( Q = 1 \) (5 Points)

\[ \begin{align*}
P &= 30 \\
Q_s &= -20 + 3(30) \\
Q_s &= 70 \\
Q_d &= 220 - 5(30) \\
Q_d &= 70 \\
Q_s &= -20 + 3P \\
Q_d &= 220 - 5P < Q_s \quad \text{for } P = \frac{43.8}{5} \\
P &= 43.8 \\
0 &= -20 + 3P \\
\frac{20}{3} &= 3P \\
P &= 6.7 \\
Q_s &= -20 + 3P \\
1 &= -20 + 3P \\
21 &= 3P \\
\frac{21}{3} &= P \\
P &= 7 \\
Q_d &= 220 - 5P \\
120 &= -5P \\
-24 &= 5P \\
\frac{-24}{5} &= P \\
P &= 43.8
\end{align*} \]

\[ \begin{align*}
\text{Consumer surplus for } Q &= 1 \\
&= 43.8 \cdot 30 = 1380 \quad \text{(5 Points)}
\end{align*} \]

\[ \begin{align*}
\text{Producer surplus for } Q &= 1 \\
&= 30 - 7 = 23 \quad \text{(5 Points)}
\end{align*} \]
3. The government is concerned about the price of milk being too high. They claim that at the prevailing equilibrium price only a few rich people can afford to buy milk. In order to ensure that the price of milk is low and that there is enough milk available at that low price would you recommend that they: (A) Impose a price ceiling at an affordable price below the equilibrium price or (B) Give producers a per unit subsidy for every gallon that they produce. Explain your answer with a neatly labeled demand & supply graph of the milk market. (10 Points)

\[ P_{\text{milk}} \text{ is too high} \]

(B) Give producers a per unit subsidy for every gallon that they produce.

\[ P_{1} \rightarrow P_{2} \rightarrow P_{3} \]

\[ Q_{1} \rightarrow Q_{2} \rightarrow Q \]

I would recommend choice B because even though the suppliers gain many benefits from a per unit subsidy, the new equilibrium (point B) increases quantity supplied while lowering the price per gallon of milk.

A)\[ P_{\text{milk}} \rightarrow S \]

\[ P_{1} \rightarrow P_{2} \rightarrow P_{3} \]

\[ Q_{1} \rightarrow Q_{2} \rightarrow Q \]

I would not choose A because the price ceiling below the equilibrium will cause a shortage in quantity, Qs is much smaller than Qd and a black market in milk would/might be created.
4. Draw a two-panel graph that shows how the consumers demand curve for X is affected when the price of good Y increases but money income and the price of X stay the same. In the upper panel draw the budget constraint and indifference curves and show the consumers utility maximizing combinations of X & Y. In the lower panel draw the consumers demand curve for X. Show how the consumers demand curve for X is affected by this price change. Assume that X and Y are perfect complements. (10 Points)
5. Using demand & supply graphs illustrate two cases where the seller bears the entire burden of a per unit tax increase. (10 Points)

\[ E_D > E_S \]

Buyers have leverage, so sellers must pick up per unit tax. \( \Rightarrow \)

- Quantity drops from \( Q_1 \) to \( Q_2 \)
- Price stays the same

So the sellers suffer from a decrease in supply.

\[ E_D > E_S \]

Sellers pick up tax \( \Rightarrow \)

- Quantity and price stay the same @ \( P_t \) and \( Q_1 \)
- Supply curve grows up
6. Is the supply curve S1 is more elastic, less elastic or equally elastic at point A than supply curve S2 is at point B? Mathematically prove your answer.

\[ \varepsilon_1 = \frac{\Delta Q}{\Delta P} \left( \frac{P_1}{Q_1} \right) \]

\[ \varepsilon_2 = \frac{\Delta Q}{\Delta P} \left( \frac{P_2}{Q_1} \right) \]

\[ \frac{\Delta Q}{\Delta P} = \frac{\Delta Q}{\Delta P} \]

\[ \frac{P_1}{Q_1} < \frac{P_2}{Q_1}, \text{ so } \varepsilon_1 < \varepsilon_2 \]

10
7. Calculate the numerical value of the elasticity of supply at point X.

\[ E = \left| \frac{\Delta Q}{\Delta P} \right| \times \frac{P_1}{Q_1} \]

\[ = \left| \frac{(Q_1 - 0)}{(P_1 - 0)} \right| \times \frac{P_1}{Q_1} \]

\[ = \left| \frac{Q_1}{P_1} \right| \times \frac{P_1}{Q_1} \]

\[ = \left| \frac{1}{1} \right| \times \frac{1}{1} \]

\[ E_x = 1 \]
8. (a) Define Producer Surplus. (5 Points)
(b) Calculate producer surplus at the last unit sold (Q*) in the following graph. (5 Points)

a) Producer surplus =
the price you get -
the lowest price you would accept.

Ex: if you're willing to sell
a pair of jeans for $40 but you end up selling
them for $50, there is a producer surplus of $10.

(50 - 40 = $10)

b) \( P_1 - P_1 = 0 \)

The producer surplus at \( Q^* = 0 \)
because the suppliers are only willing to sell for one price \( (P_1) \)
and that is the price at which
the quantity \( (Q^*) \) is sold.

\( \boxed{10} \)
9. Name the three types of Capital and give one example of each type.
   (10 Points)

1. **Financial Capital** → *Money*
2. **Physical Capital** → *Machines, Land, Buildings*
3. **Human Capital** → *The knowledge of a skilled technician*
Starting from a position of equilibrium the expected future price of Pepsi rises. Explain with a graph of the Pepsi market what will happen to the equilibrium price and the equilibrium quantity of Pepsi. (10 Points)

$P^f \uparrow = Q_D \uparrow$

$Q_S \downarrow$

$P^* \uparrow$

$Q^* \uparrow, \downarrow, -$