Exercise 1 \( p = 40 \), total cost curve is
\[
C(Q) = 10 + \frac{1}{2}Q^2
\]
then
\[
MC = \frac{dC}{dQ} = Q
\]
\[
ATC = \frac{C}{Q} = \frac{10}{Q} + \frac{1}{2}Q
\]

a. In short run, the firm chooses \( Q \) that solves
\[
Max\{pQ - C(Q)\}
\]
\[
p = MC
\]
\[
Q^* = 40
\]

b. The firm is price taker and therefore the price is \( p = 40 \)

c. Profits are
\[
\Pi = pQ - C(Q)
\]
\[
= 40 \times 40 - 10 - 0.5 \times 40^2
\]
\[
= 0.5 \times 40^2 - 10
\]
\[
= 790
\]

d. In long run, because each firm earn a positive profit, entry will occur, that will drive the price down. Firms will enter until the profit becomes null.

Exercise 2 + graphs

1. \( MR = 100 - 2q \).
2. \( MC = 30 = AC \).
3. graph. \( p^M = 65 \) and \( q^M = 35 \).
4. Efficient level of milk production is 70 (where price= \( MC \)). At this level, \( W = 2450(= CS + \Pi = 2450 + 0) \). Under monopoly, \( CS^M = 612.5 \) and \( \Pi^M = 1225 \). Thus \( W^M = 1837.5 < 2450 \). \( DWL = 2450 - 1837.5 = 612.5 \).
Exercise 3:
1. Before the merger, $HHI_{before} = 10000\left(\left(\frac{100}{260}\right)^2 + \left(\frac{60}{260}\right)^2 + \left(\frac{40}{260}\right)^2 + \left(\frac{20}{260}\right)^2 + \left(\frac{10}{260}\right)^2\right) = 2455.6$

   $CR_4 = \left(\frac{100}{260}\right) + \left(\frac{60}{260}\right) + \left(\frac{40}{260}\right) + \left(\frac{30}{260}\right) = 0.88462$, meaning that 88% of the market sales are in the hand of the four biggest firms in the industry.

2. It is concentrated. Yes, the industry is oligopolistic.

3. After the merger, the $HHI$ increases at $HHI_{after} = 10000\left(\left(\frac{130}{260}\right)^2 + \left(\frac{60}{260}\right)^2 + \left(\frac{40}{260}\right)^2 + \left(\frac{20}{260}\right)^2 + \left(\frac{10}{260}\right)^2\right) = 3343.2$. The merger is likely to be challenge because (i) the original $HHI_{before} = 2455.6$ is greater than that in the Guidelines (1,800) and (ii) the new $HHI$, $HHI_{after}$ increases by 887.6, which is greater than in the guidelines.