2. [12 points] Link has started a business selling winter clothes for cats. Among his most successful products are his new kitten mittens. He is currently selling his mittens for $7 per set. Below is a graph of Link’s marginal cost \( MC(q) \) and marginal revenue \( MR(q) \), in dollars per set of mittens, if he makes \( q \) sets of mittens this winter. Due to a shortage of yarn, Link can make a maximum of 200 sets of mittens this winter. In order to start making mittens, Link must spend $40 on knitting supplies (in other words, it costs $40 to make 0 sets of mittens).

You do not need to show any work for this problem.

a. [3 points] Approximately how many sets of mittens should Link make this winter in order to maximize his profit?

Answer: Link should make about \( 104 \) sets of mittens.

b. [2 points] If the price per set is raised to $9, approximately how many sets of mittens should Link make in order to maximize his profit?

Answer: Link should make about \( 200 \) sets of mittens.

c. [3 points] Write an expression involving integrals which equals Link’s total profit if Link makes 150 sets of mittens. Your expression may involve the functions \( MR(q) \) and \( MC(q) \).

Solution:
\[
\int_0^{150} (MR(q) - MC(q)) \, dq - 40
\]

d. [4 points] Link makes a deal with a store that would like to buy his cat hats. If the store buys up to 50 hats, then each one will cost $10. If the store buys more than 50 hats, then Link will reduce the price of the entire order by $0.05 per hat for every additional hat over 50. (For example, if the store buys 52 hats, they will pay $9.90 per hat.) Write a formula for a function \( L(q) \) which gives Link’s revenue if he sells \( q \) hats to the store.

\[
L(q) = \begin{cases} 
 10q & \text{if } 0 \leq q \leq 50 \\
(10 - 0.05(q - 50))q & \text{if } q > 50 
\end{cases}
\]