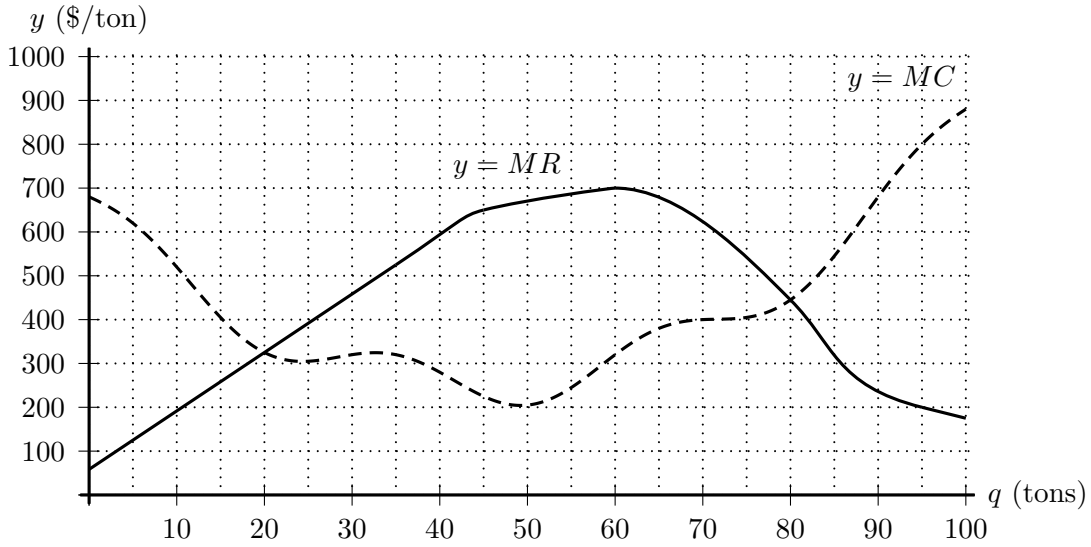
9. [9 points] With winter past and summer approaching, David is opening a business selling ice. Graphed below are his marginal revenue MR (solid line) and marginal cost MC (dashed line), in dollars per ton of ice.



a. [4 points] Carefully estimate the answer to each of the following based on the graphs above. You do not need to show your work.

(i) For what value(s) of q in the interval $[0, 100]$ is revenue maximized?

Answer: $q =$ **100**

(ii) For what value(s) of q in the interval $[0, 100]$ is MR maximized?

Answer: $q =$ **60**

(iii) For what value(s) of q in the interval $[0, 100]$ is profit maximized?

Answer: $q =$ **80**

(iv) For what value(s) of q in the interval $[0, 100]$ is $MR - MC$ maximized?

Answer: $q =$ **50**

b. [2 points] David is planning to sell 5 tons of ice but is considering selling 35 tons instead.

(i) Would David's profit increase or decrease if he changed the amount of ice sold from 5 tons to 35 tons? (Circle one.)

INCREASE **DECREASE**

(ii) By how much would his profit increase or decrease? (Circle the one best estimate.)

\$1000 **\$2000** \$4500 \$5250 \$6000

c. [3 points] Let $\pi(q)$ be David's profit, in dollars, if he sells q tons of ice. Suppose that David would make a profit of \$4000 if he sold 95 tons of ice. Find an equation for the tangent line to the graph of $y = \pi(q)$ at $q = 95$.

Solution: The slope of the tangent line is given by $\pi'(95)$, which we can read off the graph as the difference between MR and MC at $q = 95$, or about -600. Since the line passes through the point $(95, 4000)$, we therefore have the equation $y = 4000 - 600(q - 95)$.

Answer: $y = 4000 - 600(q - 95)$