

MATH 111 A
Exam I — Gold
Hints and Answers

1. (3 points each)
 - (a) ANSWER: Sketch a diagonal line that goes through the point $(2, 1)$ (500 gallons per hour means 1 thousand gallons in 2 hours.)
 - (b) HINT: Find the largest vertical distance between $I(t)$ and $O(t)$, when $O(t) > I(t)$. (The largest vertical distance occurs when the tangent line to $I(t)$ is parallel to $O(t)$.)
ANSWER: 0.9 thousand gallons
 - (c) HINT: Use the rolling ruler method to find the steepest diagonal line that intersects the graph of $I(t)$. (It touches the graph of $I(t)$ at about $t = 9.5$.) Compute its slope.
ANSWER: 0.6 thousand gallons
 - (d) HINT: Look for the time at which vertical distance between $I(t)$ and $O(t)$ is largest and $I(t) > O(t)$. (The largest vertical distance occurs when the tangent line to $I(t)$ is parallel to $O(t)$.)
ANSWER: from $t = 7$ to $t = 10$
 - (e) HINT: Look for a time at which the diagonal line is steeper than a secant line over a very short interval starting at that time (or steeper than the tangent line there).
ANSWER: $t =$ any time after 9.5

2. (3 points each)
 - (a) HINT: Compute the slope of the secant line through TC from $q = 4$ to $q = 5$. (Note: Since the quantity is measured in single Things in this case, the slope of the tangent at 4 is an approximation of the MC , but isn't the most appropriate measurement.)
ANSWER: approximately 21 dollars
 - (b) HINT: Draw reference lines of slope 70 and 200 through the origin. See where these reference lines intersect TC .
ANSWER: from $q = 3$ to $q = 8$ (or from $q = 2.4$ to $q = 8.2$)
 - (c) HINT: Approximate $TC(12)$ from the graph, subtract the value of FC to get $VC(12)$, and divide by 12.
ANSWER: approximately 39.17 dollars per Thing
 - (d) ANSWER: approximately 57 dollars

3.
 - (a) (3 points) HINT: The temperature doesn't change from $t = 2$ to $t = 4$. (The change in temp graph shows a ΔT of 0 at $t = 2$.) So, it's not graph (iii). The change in temp from $t = 4$ to $t = 6$ ($\Delta T = 1$) is smaller than the change in temp from $t = 6$ to $t = 8$ ($\Delta T = 1.5$).
ANSWER: (i)
 - (b) (5 points) F; F; T; T; T
 - (c) (3 points) HINT: Add the changes over the intervals that start at $t = 4, 6, 8,$ and 10 :
 $1 + 1.5 + 1.9 + 2$.
ANSWER: 6.4 degrees

4. (4 points each)
 - (a) ANSWERS: $q = 8$ and $q = 10$
 - (b) ANSWER: $x = \frac{9}{4}, y = 16$
 - (c) ANSWER: $x = \frac{2}{R-4}$