

**MATH 111 A, B**  
Winter 2005 - Exam I, Version 1  
Hints and Answers

1. (4 points each)
  - (a) HINT: Compute the slope of the secant line through the graph of  $O(t)$  at  $t = 4$  and  $t = 8$ .  
ANSWER: We accepted between 70 and 90 cars per hour.
  - (b) HINT: Use the rolling ruler method to find the time at which the diagonal line through the graph of  $O(t)$  is steepest.  
ANSWER: We accepted times between 13 and 16 (or 1 and 4 a.m.).
  - (c) HINT: Draw the graph of  $I(t)$ , a line through the origin that also goes through the point  $(2, 100)$ . See where this line intersects the graph of  $O(t)$ .  
ANSWER: We accepted times between 6 and 6.5 (or 6:00 and 6:30).
  
2. (4 points each)
  - (a) HINT: From  $t = 20$  to  $t = 30$ , the car travels on average 1.02 miles per minute. From  $t = 30$  to  $t = 40$ , the car travels on average 0.99 miles per minute. So, from  $t=20$  to  $t=30$ , the car travels a total of 10.2 miles and from  $t=30$  to  $t=40$ , it travels 9.9 miles.  
ANSWER: 20.1 miles
  - (b) HINT: Use a method similar to that of part (a) to determine how far the car goes in the first 30 minutes (26.6 miles) and divide by 30.  
ANSWER: 0.89 mpm
  - (c) HINT: Again, use the method from part (a) to determine how far the car goes from  $t=30$  to  $t=60$  (28.1 miles) and divide by 30 minutes.  
ANSWER: 0.94 mpm
  
3. (4 points each)
  - (a) HINT: Compute the slope of the tangent line to  $TR$  at  $q = 300$ .  
ANSWER: We accepted answers between \$1.30 and \$1.80.
  - (b) HINT: Sketch a diagonal line with slope 0.5 and one with slope 0.8. See where these lines intersect the graph of  $TR$ .  
ANSWER: from  $q$  =(something between 1100 and 1200) to  $q$  =(something between 1400 and 1500)
  - (c) HINT: See where the tangent to  $TR$  is parallel to  $VC$ . Profit is the vertical distance between  $TR$  and  $VC$  at that quantity, minus the value of  $FC$ .  
ANSWER: For  $q$ , we accepted answers between 700 and 800. For max profit, we accepted answers between \$325 and \$375.
  
4. (3 points each)
  - (a) ANSWER:  $P(t + 3) - P(t) = 7.8$
  - (b) ANSWER: The temperature changes faster from midnight to 5 a.m. than it does from 6 a.m. to 11 a.m.
  
5. (4 points each)
  - (a) ANSWER:  $x = \frac{35}{26}$
  - (b) ANSWER:  $x = \frac{4y-50}{p-15}$