10. [11 points] Suppose an online retailer uses robots to transport merchandise to the shipping area in its warehouse. Researchers are analyzing data from sales on November 28, 2014.

- Let \( r(h) \) be the total number of kilometers the warehouse robots had traveled in the first \( h \) hours of November 28, 2014.
- Let \( Q(h) \) be the total weight, in pounds, of the merchandise that had been transported to shipping by the warehouse robots in the first \( h \) hours of November 28, 2014.

Suppose that both \( r(h) \) and \( Q(h) \) are invertible and differentiable on the interval \( 0 < h < 24 \).

For each of the questions below, circle the one best answer. No points will be given for ambiguous or multiple answers.

a. [2 points] Which one of the following expressions is equal to the total number of pounds of merchandise the robots had transported to shipping on November 28 when the robots had traveled a total of 3 km that day?
   
i. \( Q(r(3)) \)  
ii. \( r(Q(3)) \)  
iii. \( r^{-1}(Q(3)) \)  
iv. \( r(Q^{-1}(3)) \)  
v. \( Q(r^{-1}(3)) \)

b. [2 points] Let \( m \) be a positive constant. Which one of the following expressions is equal to the total number of kilometers the robots had traveled two hours after they had transported a total of \( m \) pounds of merchandise to shipping?
   
i. \( r(m + 2) \)  
ii. \( r(Q^{-1}(m) + 2) \)  
iii. \( Q(2) + r(m) \)  
iv. \( Q^{-1}(m + 2) \)  
v. \( Q'(m) + 2 \)

c. [2 points] Which one of the following expressions is equal to the total number of pounds of merchandise transported by the warehouse robots between 1 am and 5 am?
   
i. \( Q(5) \)  
ii. \( Q'(5) - Q'(1) \)  
iii. \( \int_1^5 Q(h) \, dh \)  
iv. \( \int (Q(5) - Q(1)) \, dh \)  
v. \( \int_1^5 Q'(h) \, dh \)

d. [2 points] Which one of the following expressions is equal to the average rate (in pounds per hour) at which merchandise was transported by the robots between 8 am and 10 am?
   
i. \( \frac{Q'(10) + Q'(8)}{2} \)  
ii. \( \frac{Q'(10) - Q'(8)}{2} \)  
iii. \( \frac{Q(10) - Q(8)}{2} \)  
iv. \( \int_8^{10} Q(h) \, dh \)  
v. \( \int_8^{10} Q'(h) \, dh \)

e. [3 points] Circle the one equation below that best supports the following statement:

On November 28, the warehouse robots had traveled a total of 29 kilometers about half an hour after they had traveled a total of 25 kilometers.

i. \( r'(1) = -4 \)  
ii. \( r'(r^{-1}(25)) = 4 \)  
iii. \( r'(29) = 8 \)  
iv. \( (r^{-1})'(25) = \frac{1}{8} \)  
v. \( (r^{-1})'(25) = 4 \)