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. $\boxed{Q(r^{-1}(3))}$

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. $\boxed{r(Q^{-1}(m)+2)}$ 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. $\displaystyle\int_1^5 Q(h)\,dh$ iv. $\displaystyle\int (Q(5)-Q(1))\,dh$ v. $\boxed{\displaystyle\int_1^5 Q'(h)\,dh}$

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. $\dfrac{Q'(10)+Q'(8)}{2}$ ii. $\dfrac{Q'(10)-Q'(8)}{2}$ iii. $\boxed{\dfrac{Q(10)-Q(8)}{2}}$ iv. $\displaystyle\int_8^{10} Q(h)\,dh$ v. $\displaystyle\int_8^{10} Q'(h)\,dh$

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. $r'(\frac{1}{2}) = -4$ ii. $r'(r^{-1}(25)) = 4$ iii. $r'(29) = 8$ iv. $\boxed{(r^{-1})'(25) = \frac{1}{8}}$ v. $(r^{-1})'(25) = 4$