4. (12 points) Ellen and Renzo ran the Detroit marathon last weekend. The distance Ellen traveled (in meters) is given by $E(t)$ where t is time measured in seconds since the start of the race. Similarly, the distance in meters Renzo traveled is given by the function $R(t)$. For x measured in meters let $F(x) = R(E^{-1}(x))$. Assume that Ellen moves forward throughout the race–she does not even take a rest!

   (a) What is the practical interpretation of $F(50)$.

   We have
   $$F(50) = R(E^{-1}(50))$$
   which gives the distance, in meters, that Renzo has traveled when Ellen has traveled 50 meters.

   (b) After the initial blast of speed from her start, Ellen ran at a constant rate of 5 meters per second for $2 < t < 10$, and she had run a distance of 39 meters after 7 seconds. Renzo wore a device that tracked the distance he had run at one second intervals. The data he collected is summarized in the table below.

t	0	1	2	3	4	5	6	7	8	9	10
$R(t)$	0	10	16	22	28	34	40	46	52	58	64

   Use any of the information above to approximate $F'(39)$.

   $$F'(39) = R'(E^{-1}(39))(E^{-1})'(39) = R'(7)(E^{-1})'(3).$$
   From the table, we approximate $R'(7) = 6$, and we know $E^{-1}(39) = 7$ and $E'(7) = 5$. Thus, since
   $$(E^{-1})'(39) = \frac{1}{E'(E^{-1}(39))} = \frac{1}{E'(7)} = \frac{1}{5},$$
   we have $\boxed{F'(39) = \frac{6 \text{ meters (for Renzo)}}{5 \text{ meters (for Ellen)}}.}$

   (c) Give a practical interpretation of $F'(39)$.

   Since $F'(39)$ is in $\frac{\text{meters for Renzo}}{\text{meters for Ellen}}$, once Ellen has run 39 meters, if Ellen's distance increases by 1 meter, Renzo will travel approximately 1.2 meters.