1. [10 points] Kimberly is walking from her home to the local juice bar, and the function $D(t)$ gives her distance in meters from the juice bar t minutes after the moment of her departure from home. She walks in a straight line towards her destination, never stopping or backtracking.

a. [2 points] What is the sign of $D'(1)$, assuming that Kimberly is still walking 1 minute after having left home?

Solution: Negative because the distance between Kimberly and the juice bar is decreasing.

b. [2 points] Let c be a positive constant less than the distance between Kimberly's home and the juice bar. What mathematical expression gives Kimberly's velocity at the moment when she is c meters from the juice bar?

Solution:

$$D'(D^{-1}(c)) \text{ meters/minute.}$$

$D'(t)$ gives Kimberly's velocity t minutes after she departs. $D^{-1}(c)$ gives the time when she is c meters from the juice bar.

c. [2 points] For the rest of this problem, assume that $D(t)$ is a linear function. Five minutes after leaving, Kimberly is 600 meters from the juice bar, and another three minutes after that, she is only 350 meters from the juice bar. Write an explicit formula for $D(t)$.

Solution: $D(t)$ is a line which goes through the points $(5, 600)$ and $(8, 350)$. The slope of the line is

$$\frac{350-600}{8-5} = -\frac{250}{3} \approx -83.33.$$

Using point slope form, the equation for this line is

$$D(t) = -\frac{250}{3}(t-5) + 600.$$

d. [2 points] How long does it take Kimberly to get to the juice bar?

Solution: The answer here is the time when Kimberly's distance from the juice bar is zero. Setting

$$0 = -\frac{250}{3}(t-5) + 600$$

we get

$$t = 12.2 \text{ minutes}$$

e. [2 points] How far away from the juice bar does Kimberly live?

Solution: The answer here is $D(0) = 1016.67$ meters .