**5.** [14 points] Elphaba the squirrel is panicking because she has noticed that a human, Erin, is watching her. Elphaba starts to run and Erin is soon in full-blown pursuit as they both run straight down the street. Let $R(t)$ be Erin's distance from their starting point (in meters) $t$ minutes after the chase begins and $L(t)$ be Elphaba's distance from the starting point (in meters) $t$ minutes after the chase begins. The graphs of $R(t)$ (dashed) and $L(t)$ (solid) for the first 6 minutes of the chase are shown below.
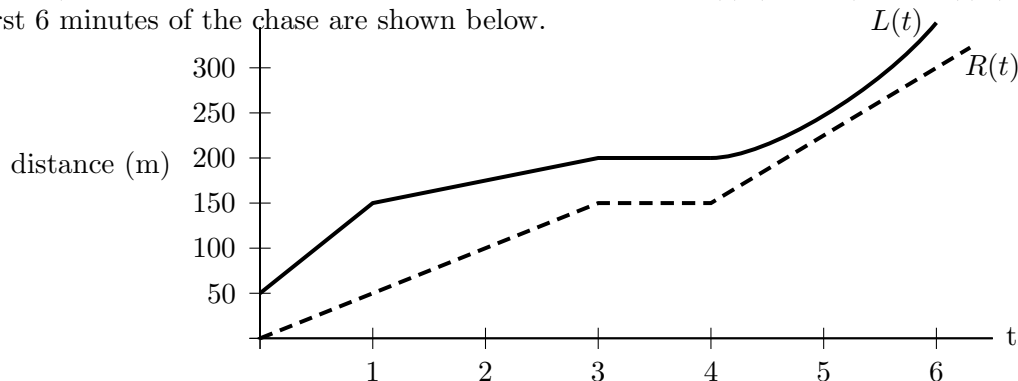


**a.** [1 point] Which of the following expressions gives the distance, in meters, between Elphaba and Erin $t$ minutes after the chase begins? *Circle the* ONE *best option.*

i. $L'(t) - R'(t)$   ii. $R'(t) - L'(t)$   iii. $\boxed{L(t) - R(t)}$   iv. $R(t) - L(t)$   v. $R^{-1}(L(t))$   vi. $L^{-1}(R(t))$

**b.** [2 points] What is Erin's velocity when $t = 0.5$? *Be sure to include units.*

*Solution:* We are looking for the slope of the dotted line that represents Erin's distance at time $t = 0.5$. This is $\frac{150-0}{3-0} = 50$. So Erin is travelling at 50 m/min.

**Answer:** _____ 50 **m/min**

**c.** [3 points] During which of the following time periods is Erin gaining on Elphaba? *Circle* ALL *correct answers.*

i. $0 \le t \le 0.75$   ii. $\boxed{1.25 \le t \le 2.75}$   iii. $3.25 \le t \le 3.75$   iv. $\boxed{4.25 \le t \le 4.75}$   v. $5.25 \le t \le 6$

*Solution:* Erin is gaining on Elphaba when Erin is travelling faster than Elphaba. So we are looking for time periods when the slope of Erin's graph is steeper than the slope of Elphaba's graph.

**d.** [3 points] During which of the following time periods is there at least one time when Erin and Elphaba are travelling at the same speed? *Circle* ALL *correct answers.*

*Solution:* Erin and Elphaba are travelling at the same speed when the slopes of their distance graphs are equal.

i. $0.25 \le t \le 0.75$   ii. $1.75 \le t \le 2.25$   iii. $2.25 \le t \le 2.75$   iv. $\boxed{3.25 \le t \le 3.75}$   v. $\boxed{4.75 \le t \le 5.25}$

**e.** [2 points] Circle all of the following events that could be occurring between the 3rd and the 4th minutes.

*Solution:* Neither Erin nor Elphaba is moving during this time.

i. Elphaba is getting further from Erin.   iii. $\boxed{\text{Elphaba has stopped.}}$

ii. $\boxed{\text{Erin is tying her shoe.}}$   iv. Erin is gaining on Elphaba.

**f.** [3 points] What is Elphaba's average velocity over the first 3 minutes of the chase? *Be sure to include units.*

*Solution:* Elphaba's average velocity over the first 3 minutes is given by
$$\frac{L(3) - L(0)}{3 - 0} = \frac{200 - 50}{3} = 50 \text{ m/min}.$$

**Answer:** _____ 50 **m/min**