1. [14 points] Hannah Haire and Ryan Rabbit meet for one last race. Once again, they both start at the west side of a large square field that is 10 km wide; it will end when one reaches the east side. The racers' (x, y) positions are given by the parametric equations below, where $(0, 0)$ represents the southwest corner of the field, x represents kilometers east of this corner, y represents kilometers north of this corner, and $t \geq 0$ is measured in hours after the race begins.

Hannah Haire: $\begin{cases} x = t^2 \\ y = \dfrac{t^2}{2} + 2 \end{cases}$ Ryan Rabbitt: $\begin{cases} x = 4t - t^2 \\ y = t^2 - t + 1 \end{cases}$

Be sure to justify your answers to the following questions algebraically.

a. [2 points] Who is going faster two hours into the race?

Answer: _____

b. [3 points] The race ends when the first racer reaches the east side of the field. When does the race end? Who wins?

Answer: Race ends at $t =$ _____ **Winner:** Hannah Ryan Tie

c. [3 points] Write an integral representing the distance, in km, that Ryan runs during the race.

Answer: _____

d. [3 points] Find all times at which Ryan and Hannah are in the same spot on the field. If there are none, write "none".

Answer: $t =$ _____

e. [3 points] Find all times at which Ryan is facing directly northeast (that is, halfway between directly north and directly east). If there are none, write "none".

Answer: $t =$ _____