11. [7 points] Two squirrels, Zini and Aladar, are quickly scavenging for their last acorns before returning to their dens for winter. At a time t seconds after they begin running, Zini's position on the diag is given by

$$x(t) = t, \qquad y(t) = t - 3$$

and Aladar's position is given by

$$x(t) = 4t, \qquad y(t) = t^2$$

for $0 \le t \le 5$. Assume $x(t)$ and $y(t)$ are measured in meters.

a. [3 points] Find Aladar's **speed** 1 second after the squirrels begin running. Remember to include units.

Solution: Aladar's speed at time $t = 1$ is

$$\sqrt{\left(\frac{dx}{dt}\Big|_{t=1}\right)^2 + \left(\frac{dy}{dt}\Big|_{t=1}\right)^2} = \sqrt{(4)^2 + (2)^2}$$
$$= \sqrt{20} \text{ m/s}$$

b. [4 points] Find the x- and y-coordinates of the point(s) where their **paths** intersect, if any.

Solution: The paths intersect if the two x-coordinates and two y-coordinates are equal at (possibly different) time values. That is, solutions to the system of equations

$$t = 4s$$
$$t - 3 = s^2$$

Subsituting $t = 4s$ into the second equation gives $s^2 - 4s + 3 = 0$, so $s = 1, 3$. Plugging in, we get the two possible intersection points (4,1) and (12,9). However, Zini would be at the point (12,9) when $t = 12$, which is outside of the domain, thus the only intersection of their paths is at the point (4,1).