

1. [12 points] Lara is working on homework while sitting outside when she notices a beetle crawling on her graph paper. The beetle's position t seconds after she starts watching is given by

$$\begin{cases} x(t) = (t-3)(t-5) \\ y(t) = 5 \sin\left(\frac{\pi t}{4}\right) \end{cases}$$

where $(0,0)$ is the origin, and the units on the x and y axes are centimeters (cm).

- a. [4 points] Does the beetle ever pass through the origin? Justify your answer.

- b. [4 points] Write an expression involving one or more integrals that gives the total distance, in cm, traveled by the beetle during the first three seconds that Lara is watching. **Do not** evaluate your integral(s). Show your work.

Answer: _____

- c. [4 points] What is the equation of the tangent line to the beetle's path at $t = 3$? Give your answer using Cartesian coordinates (expressing y in terms of x only).

Answer: $y =$ _____