4. [16 points] Buluu and Nyekundu the giraffes work on another art project. They paint on a large, square canvas, with corners at $(0, 0)$, $(0, 100)$, $(100, 0)$, and $(100, 100)$, with distances in yards. As Buluu moves, he leaves a trail of blue paint. As Nyekundu moves, she leaves a trail of red paint.

Buluu's position t minutes after the giraffes start painting is described by the parametric equations:

$$\begin{cases} x(t) = t^2 \\ y(t) = 40 + 2(t-5)^2 \end{cases}$$

and Nyekundu's position t minutes after the giraffes start painting is described by the parametric equations:

$$\begin{cases} x(t) = 25 + 20\sin(\pi t) \\ y(t) = 40 - (t-5)^2 \end{cases}$$

a. [5 points] If the giraffes ever collide, they produce a purple splotch on the canvas at the point of collision. Will the giraffes produce any purple splotches? If so, at **what time(s)** does this occur, and **where on the canvas** are the purple splotches located?

b. [6 points] Find an expression for Buluu's speed 3 minutes after the giraffes start painting. Make sure to include units.

c. [5 points] At what time does Nyekundu first leave the canvas? Make sure to fully justify your answer.