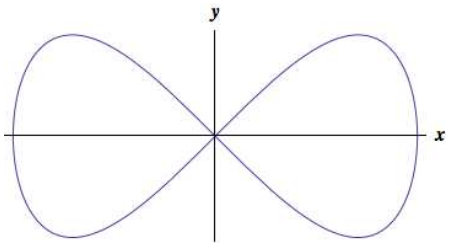
6. [13 points] A particle moves along the path given by the parametric equations

$$x(t) = a\cos t \qquad y(t) = \sin 2t \qquad \text{for } 0 \le t \le 2\pi.$$

where a is a positive constant. The graph of the particle's path in the x-y plane is shown below. In the questions below, show all your work to receive full credit.



a. [2 points] At which values of $0 \le t \le 2\pi$, does the particle pass through the origin?

b. [5 points] For what values of a are the two tangent lines to the curve at the origin perpendicular? Hint: Two lines are perpendicular if the product of their slopes is equal to -1.

c. [4 points] At what values of $0 \le t \le 2\pi$, does the curve have horizontal tangents?

d. [2 points] Find an expression that computes the length of the curve.