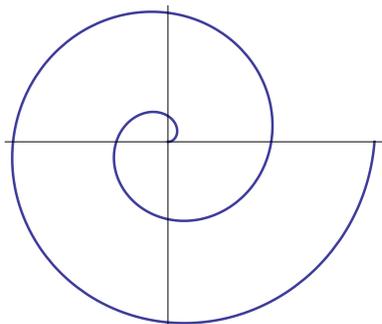


Name: \_\_\_\_\_

Score: \_\_\_\_\_

**Directions.** Show your work and write complete solutions or you may not receive credit. If you need more room, use the backs of the pages and indicate to the reader that you have done so.

1. (3 points) Match each pair of parametric equations with the corresponding graph.

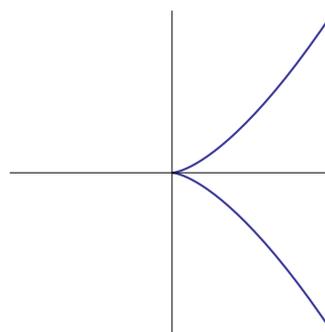
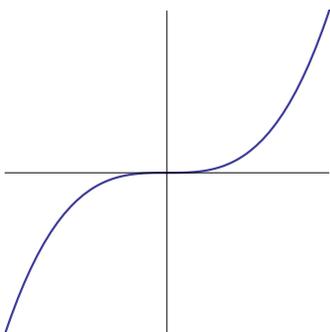
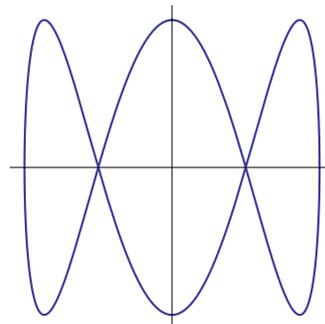


$$x = t^2, y = t^3$$

$$x = \sin t, y = \cos(3t)$$

$$x = t \cos(2t), y = t \sin(2t)$$

$$x = t, y = t^3$$

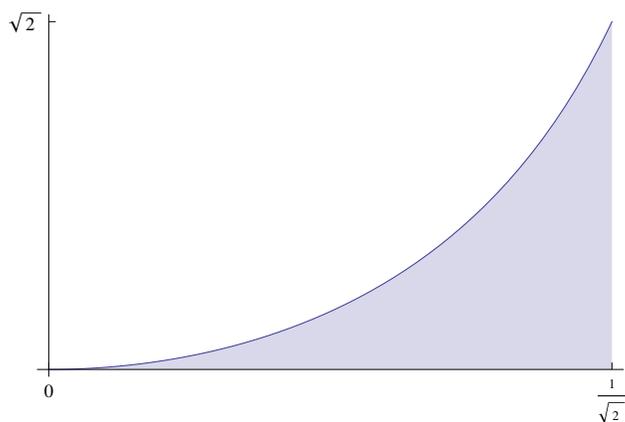


2. (4 points) What force function is required so that a particle of mass  $m$  has the position function  $\mathbf{r}(t) = \langle t^3 + t, t^2 + t, t \rangle$ ?

3. (4 points) Find the area enclosed by the parametric curve

$$x = \sin t, \quad y = \frac{1}{\cos t}, \quad 0 \leq t \leq \pi/4,$$

the  $x$ -axis, the  $y$ -axis, and the line  $x = 1/\sqrt{2}$ .



4. (9 points) For the vector function  $\mathbf{r}(t) = \langle 2 \sin t, 4t, 2 \cos t \rangle$  find each of the following:

(a) The unit tangent vector  $\mathbf{T}(t)$

(b) The principal unit normal vector  $\mathbf{N}(t)$ .

(c) The curvature  $\kappa(t)$ .