

1. (3 points) Which one of the following position functions has a trace that is on the curve  $x^2 + 3x - y + 2 = 0$ . Explain why.

a)  $\vec{p}(t) = \langle t - 2, t^2 - t \rangle$

b)  $\vec{\alpha}(t) = \langle 2t^2, t + 1 \rangle$

c)  $\vec{r}(t) = \langle t^2, 3t^2 + 1 \rangle$

2. (2 points) Modify your answer to the last problem so that it represents a position function with the particle moving on the same path twice as fast, but in the opposite direction, as the original.

3. (3 points) What is the slope of the tangent line to the trace of  $\vec{p}(t) = \langle 2 \cos(t), 3 \sin(t) \rangle$  when  $t = \frac{\pi}{4}$ ?

4. (2 points) Sketch a shaded region in the xy-plane for which the polar coordinates are  $1 \leq r \leq 2$  and  $\frac{\pi}{2} \leq \theta \leq \pi$ .

5. (5 points) Find the arc length of the trace for the curve parameterized by  $x(t) = \cosh(t)$  and  $y(t) = t$  for  $0 \leq t \leq 1$ .

6. (5 points) Find the area of the region that lies inside the cardioid  $r = 1 + \cos(\theta)$  and outside the cardioid  $r = 1 + \sin(\theta)$ . Sketch a picture of the curves and shade the region.