

**WRITE YOUR NAME:**

MAC 2313 B51 Spring 2024

Written homework #4

Due Tuesday February 6th, in Canvas

**Question 1.** The vector-valued function  $\mathbf{r}(t) = \langle 8 \cos 2t, 8 \sin 2t \rangle$  defines a curve in  $\mathbb{R}^2$ .

(i) What shape is the curve? Why?

(ii) Calculate  $\mathbf{r}'(t)$ , and verify explicitly that  $\mathbf{r}'(t)$  is orthogonal to  $\mathbf{r}(t)$  for all  $t$ .

**Question 2.** Find the length of the curve defined by  $\mathbf{r}(t) = \langle t, t, t^{3/2} \rangle$  for  $0 \leq t \leq 1$ .

**Question 3.** Consider the curve in  $\mathbb{R}^2$  defined by  $\mathbf{r}(t) = \langle 3t^2 - 1, 4t^2 + 5 \rangle$ .

(i). Explicitly find the arc length function  $s(t) = \int_0^t |\mathbf{r}'(u)| \, du$ .

(ii). Find the inverse of the function in (i), i.e. write  $t$  as a function of  $s$ .

(iii). Rewrite the curve using  $s$  as the parameter. What type of curve is it?