

## Math 203 — Vector-valued functions

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**Problem 1.** Make a vector equation  $\mathbf{r}(t)$  for a circle of radius 2 with center  $(-1, 3)$  that is traced counter-clockwise for  $0 \leq t \leq 2\pi$ . What point on the curve is given by time  $t = 0$ ?  $t = \pi/2$ ?  $t = 2\pi$ ?

**Problem 2.** Plot the curve given by  $\mathbf{r}(t) = \langle \cos(-t), \sin(-t) \rangle$  for  $0 \leq t \leq 2\pi$  by first plotting some example points using  $t = 0, \pi/2, \pi, 3\pi/2, 2\pi$ . What curve is it? What effect does the negative sign have?

**Problem 3.** Plot the curve given by  $\mathbf{r}(t) = \langle t, t^3 \rangle$  for  $-2 \leq t \leq 2$  by first plotting some example points using  $t = -2, -1, 0, 1, 2$ . Write the curve as an equation of the form  $y = f(x)$ .

**Problem 4.** Plot the curve given by  $\mathbf{r}(t) = \langle t^2, t \rangle$  for  $-2 \leq t \leq 2$  by first plotting some example points using  $t = -2, -1, 0, 1, 2$ . Write the curve as an equation of the form  $x = f(y)$ .

**Problem 5.** Make a vector equation  $\mathbf{r}(t)$  for a line that passes through the points  $P = (1, 2, 6)$  and  $Q = (-4, 3, 1)$  and goes from  $P$  to  $Q$  as you proceed forward in time. Use the vector equation of a line structure we learned in Section 10.5. What do you get for  $\mathbf{r}(0)$  and  $\mathbf{r}(1)$  with your equation? Make a different vector equation for the same line, except make it so that your equation takes you from  $Q$  to  $P$ .

**Problem 6.** Use CalcPlot3D to sketch the following curves in  $\mathbb{R}^3$ .

a.  $\mathbf{r}(t) = \langle \cos t, \sin t, \frac{t}{6\pi} \rangle, 0 \leq t \leq 6\pi$

b.  $\mathbf{r}(t) = \langle \cos t, \frac{t}{4\pi}, \sin t \rangle, 0 \leq t \leq 4\pi$