

## Math 203 — Vector-valued functions

---

**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 involving the variables  $x$  and  $y$ .

**Problem 5.** Make a vector equation  $\mathbf{r}(t)$  for a line that passes through the points  $P = (1, 2, 6)$  and  $Q = (-4, 3, 1)$  using the point-direction-vector form  $\mathbf{p} + t\mathbf{v}$  we learned last week with  $\mathbf{p} = \langle 1, 2, 6 \rangle$ . At what time  $t$  are you at the point  $P$ ? Where are you at time  $t = 1$ ? Explain how to make an equation so that you are at  $Q$  at time  $t = 0$  and at  $P$  at time  $t = 1$ .

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