**Parametric curves**

1. A disk of radius 2 cm slides at a speed $12\sqrt{2}$ cm/sec in the direction of $(1,1)$. As it slides it spins counterclockwise at 3 revolutions per second. Measuring time in seconds, at time $t = 0$ the disk’s center is at the origin $(0,0)$.

Find parametric equations for the trajectory of the point $P$ on the edge of the disk, which is initially at $(2,0)$.

**Answer:** We will parametrize the curve by time $t$ in seconds. To do this we split the motion into translation of the center and rotation about the center and use vectors to do the analysis.

See the figure below. At time $t$ the center has moved to $C$ and the edge point $P$ has rotated $6\pi t$ radians. (3 rev./sec = $6\pi$ radians/sec.) Thus

$$\overrightarrow{OC} = 12\sqrt{2}t \left( \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right) = (12t, 12t)$$

and

$$\overrightarrow{CP} = (2 \cos(6\pi t), 2 \sin(6\pi t)).$$

Putting these together we get

$$\overrightarrow{OP} = \overrightarrow{OC} + \overrightarrow{CP} = (12t + 2 \cos(6\pi t), 12t + 2 \sin(6\pi t))$$

$$\Leftrightarrow \quad x = 12t + 2 \cos(6\pi t), \quad y = 12t + 2 \sin(6\pi t).$$