13.1, number 9: **The position vector of an object at time t is $\vec{r}(t) = (\sin t)\,\vec{i} + (\cos t)\,\vec{j}$. Find the velocity vector and the acceleration vector of the object at time $\pi/4$ and time $\pi/2$. Draw these vectors on the graph of the path of the object; put the tail of each vector on the position of the object at the given times. (Of course, the object is traveling on the circle $x^2 + y^2 = 1$.)**

Answer:

$$\vec{v}(t) = (\cos t)\,\vec{i} - (\sin t)\,\vec{j}, \quad \vec{a}(t) = -(\sin t)\,\vec{i} - (\cos t)\,\vec{j}.$$

$$\vec{v}\left(\frac{\pi}{4}\right) = (\cos\frac{\pi}{4})\,\vec{i} - (\sin\frac{\pi}{4})\,\vec{j} = \boxed{\frac{\sqrt{2}}{2}\,\vec{i} - \frac{\sqrt{2}}{2}\,\vec{j}},$$

$$\vec{a}\left(\frac{\pi}{4}\right) = -(\sin\frac{\pi}{4})\,\vec{i} - (\cos\frac{\pi}{4})\,\vec{j} = \boxed{-\frac{\sqrt{2}}{2}\,\vec{i} - \frac{\sqrt{2}}{2}\,\vec{j}}.$$

$$\vec{v}\left(\frac{\pi}{2}\right) = (\cos\frac{\pi}{2})\,\vec{i} - (\sin\frac{\pi}{2})\,\vec{j} = \boxed{0\,\vec{i} - 1\,\vec{j}},$$

$$\vec{a}\left(\frac{\pi}{2}\right) = -(\sin\frac{\pi}{2})\,\vec{i} - (\cos\frac{\pi}{2})\,\vec{j}\,\boxed{-1\,\vec{i} - 0\,\vec{j}}.$$

Pictures for 13.1 #9

$$\vec{a}\left(\tfrac{\pi}{4}\right) = -\vec{r}\left(\tfrac{\pi}{4}\right)$$

$$\vec{a}\left(\tfrac{\pi}{2}\right) = -\vec{r}\left(\tfrac{\pi}{2}\right)$$