

12.1.6 Differentiate both sides, twice:

$$\begin{aligned}\mathbf{r} &= \left(4 \cos \frac{t}{2}, 4 \sin \frac{t}{2} \right); \\ d\mathbf{r} &= \left\langle -2 \sin \frac{t}{2} dt, 2 \cos \frac{t}{2} dt \right\rangle; \\ \mathbf{v} &= \frac{d\mathbf{r}}{dt} = \left\langle -2 \sin \frac{t}{2}, 2 \cos \frac{t}{2} \right\rangle; \\ d\mathbf{v} &= \left\langle -\cos \frac{t}{2} dt, -\sin \frac{t}{2} dt \right\rangle; \\ \mathbf{a} &= \frac{d\mathbf{v}}{dt} = \left\langle -\cos \frac{t}{2}, -\sin \frac{t}{2} \right\rangle.\end{aligned}$$

Then when $t = \pi$:

$$\begin{aligned}\mathbf{v} &= \left\langle -2 \sin \frac{\pi}{2}, 2 \cos \frac{\pi}{2} \right\rangle = \langle -2, 0 \rangle; \\ \mathbf{a} &= \left\langle -\cos \frac{\pi}{2}, -\sin \frac{\pi}{2} \right\rangle = \langle 0, -1 \rangle.\end{aligned}$$

And when $t = 3\pi/2$:

$$\begin{aligned}\mathbf{v} &= \left\langle -2 \sin \frac{3\pi/2}{2}, 2 \cos \frac{3\pi/2}{2} \right\rangle = \langle -\sqrt{2}, -\sqrt{2} \rangle; \\ \mathbf{a} &= \left\langle -\cos \frac{3\pi/2}{2}, -\sin \frac{3\pi/2}{2} \right\rangle = \left\langle \frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2} \right\rangle.\end{aligned}$$

(You should also draw a sketch.)