

$$d) \quad a = \begin{pmatrix} \cos t \\ \sin t \end{pmatrix} \quad t$$

$$\vec{v}_{t+1} = \vec{v}_t + \Delta t \cdot \vec{a}_t$$

$$\vec{x}_{t+1} = \vec{x}_t + \Delta t \cdot \vec{v}_{t+1}$$

$$\vec{v}_1 = \begin{pmatrix} 0 \\ 0 \end{pmatrix} + \frac{\pi}{4} \cdot \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \frac{\pi}{4} \cdot \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$\vec{x}_1 = \begin{pmatrix} 1 \\ 0 \end{pmatrix} + \frac{\pi}{4} \cdot \frac{\pi}{4} \cdot \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 + \frac{\pi^2}{16} \\ 0 \end{pmatrix}$$

$$\vec{v}_2 = \begin{pmatrix} \frac{\pi}{4} \\ 0 \end{pmatrix} + \frac{\pi}{4} \cdot \begin{pmatrix} \cos \frac{\pi}{4} \\ \sin \frac{\pi}{4} \end{pmatrix} = \frac{\pi}{4} \begin{pmatrix} 1 + \cos(\frac{\pi}{4}) \\ \sin(\frac{\pi}{4}) \end{pmatrix}$$

$$\vec{x}_2 = \begin{pmatrix} 1 + \frac{\pi^2}{16} \\ 0 \end{pmatrix} + \frac{\pi}{4} \cdot \begin{pmatrix} \frac{\pi}{4} \\ 0 \end{pmatrix} + \frac{\pi}{4} \begin{pmatrix} \cos(\frac{\pi}{4}) \\ \sin(\frac{\pi}{4}) \end{pmatrix}$$

$$= \begin{pmatrix} 1 + \frac{\pi^2}{16} \\ 0 \end{pmatrix} + \begin{pmatrix} \frac{\pi^2}{16} + \frac{\pi^2}{16} \cdot \cos(\frac{\pi}{4}) \\ \frac{\pi^2}{16} + \frac{\pi^2}{16} \cdot \sin(\frac{\pi}{4}) \end{pmatrix}$$

$$= \begin{pmatrix} 1 + \frac{\pi^2}{16} \cdot \left(1 + \frac{\sqrt{2}}{2}\right) \\ 1 + \frac{\pi^2}{16} \cdot \left(1 + \frac{\sqrt{2}}{2}\right) \end{pmatrix} = \begin{pmatrix} 1 + \frac{\pi^2}{16} \cdot \left(2 + \frac{\sqrt{2}}{2}\right) \\ \frac{\pi^2}{16} \cdot \left(2 + \frac{\sqrt{2}}{2}\right) \end{pmatrix}$$

$$\vec{v}_3 = \frac{\pi}{4} \begin{pmatrix} 1 + \cos(\frac{\pi}{4}) \\ \sin(\frac{\pi}{4}) \end{pmatrix} + \frac{\pi}{4} \cdot \begin{pmatrix} 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 + \cos(\frac{\pi}{4}) \\ 1 + \sin(\frac{\pi}{4}) \end{pmatrix} \cdot \frac{\pi}{4}$$

$$\vec{x}_3 = \begin{pmatrix} 1 + \frac{\pi^2}{16} \cdot \left(2 + \frac{\sqrt{2}}{2}\right) \\ \frac{\pi^2}{16} \cdot \frac{\sqrt{2}}{2} \end{pmatrix} + \frac{\pi}{4} \cdot \frac{\pi}{4} \cdot \begin{pmatrix} 1 + \cos(\frac{\pi}{4}) \\ 1 + \sin(\frac{\pi}{4}) \end{pmatrix}$$

$$= \begin{pmatrix} 1 + \frac{\pi^2}{16} \cdot (3 + \sqrt{2}) \\ \frac{\pi^2}{16} \cdot (1 + \sqrt{2}) \end{pmatrix}$$

$$\vec{v}_4 = \frac{\pi}{4} \begin{pmatrix} 1 + \cos(\frac{\pi}{4}) \\ 1 + \sin(\frac{\pi}{4}) \end{pmatrix} + \frac{\pi}{4} \cdot \begin{pmatrix} \cos \frac{3\pi}{4} \\ \sin \frac{3\pi}{4} \end{pmatrix} = \frac{\pi}{4} \begin{pmatrix} 1 \\ 1 + \sqrt{2} \end{pmatrix}$$

$$\vec{x}_4 = \begin{pmatrix} 1 + \frac{\pi^2}{16} \cdot (3 + \sqrt{2}) \\ \frac{\pi^2}{16} \cdot (1 + \sqrt{2}) \end{pmatrix} + \frac{\pi^2}{16} \cdot \begin{pmatrix} 1 \\ 1 + \sqrt{2} \end{pmatrix} = \begin{pmatrix} 1 + \frac{\pi^2}{16} \cdot (4 + \sqrt{2}) \\ \frac{\pi^2}{16} \cdot (2 + \sqrt{2}) \end{pmatrix}$$