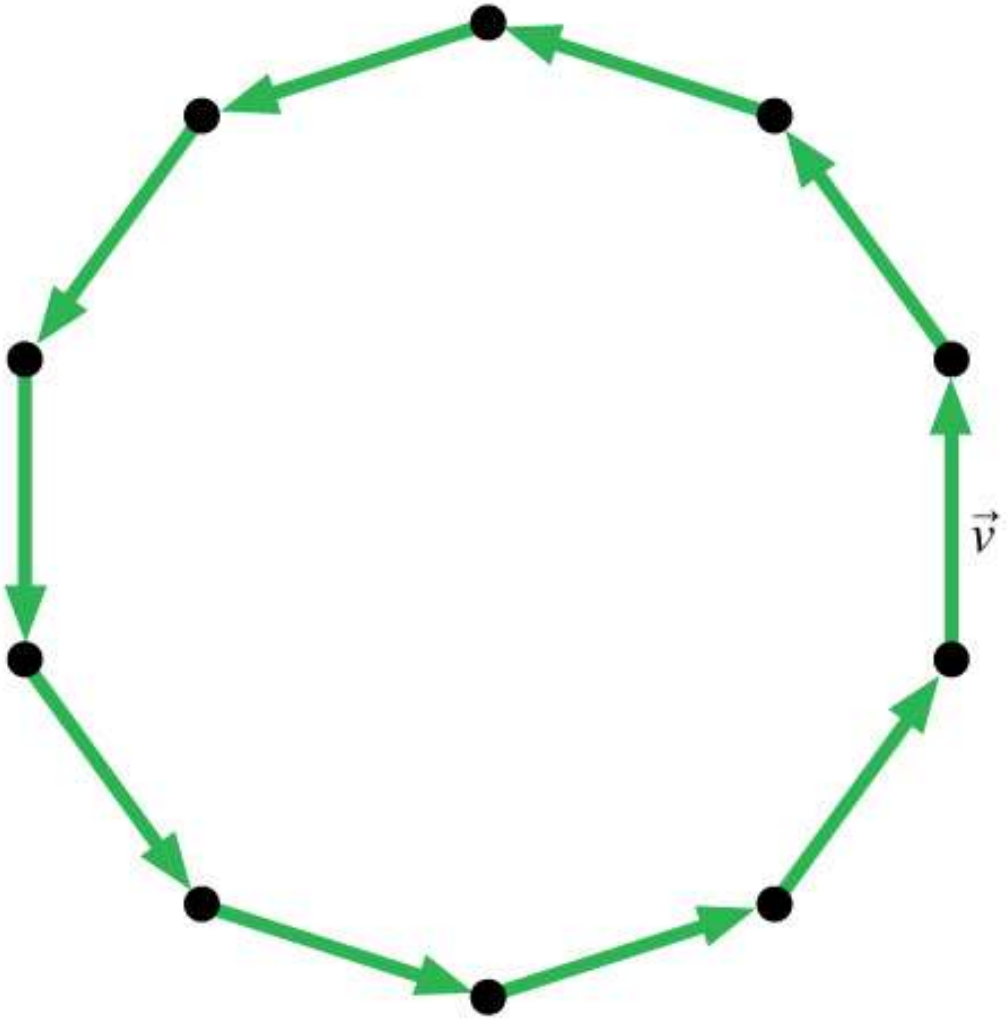
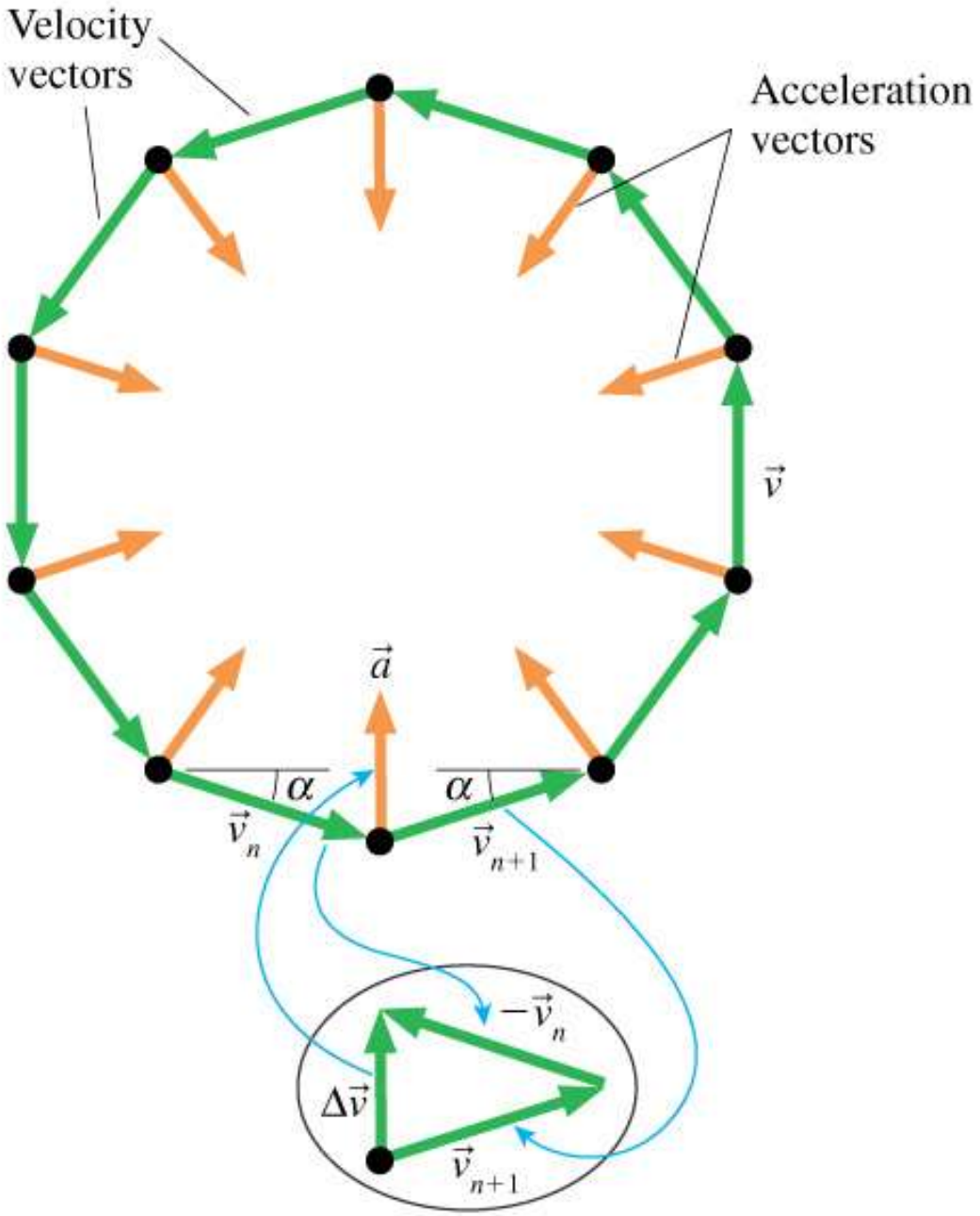
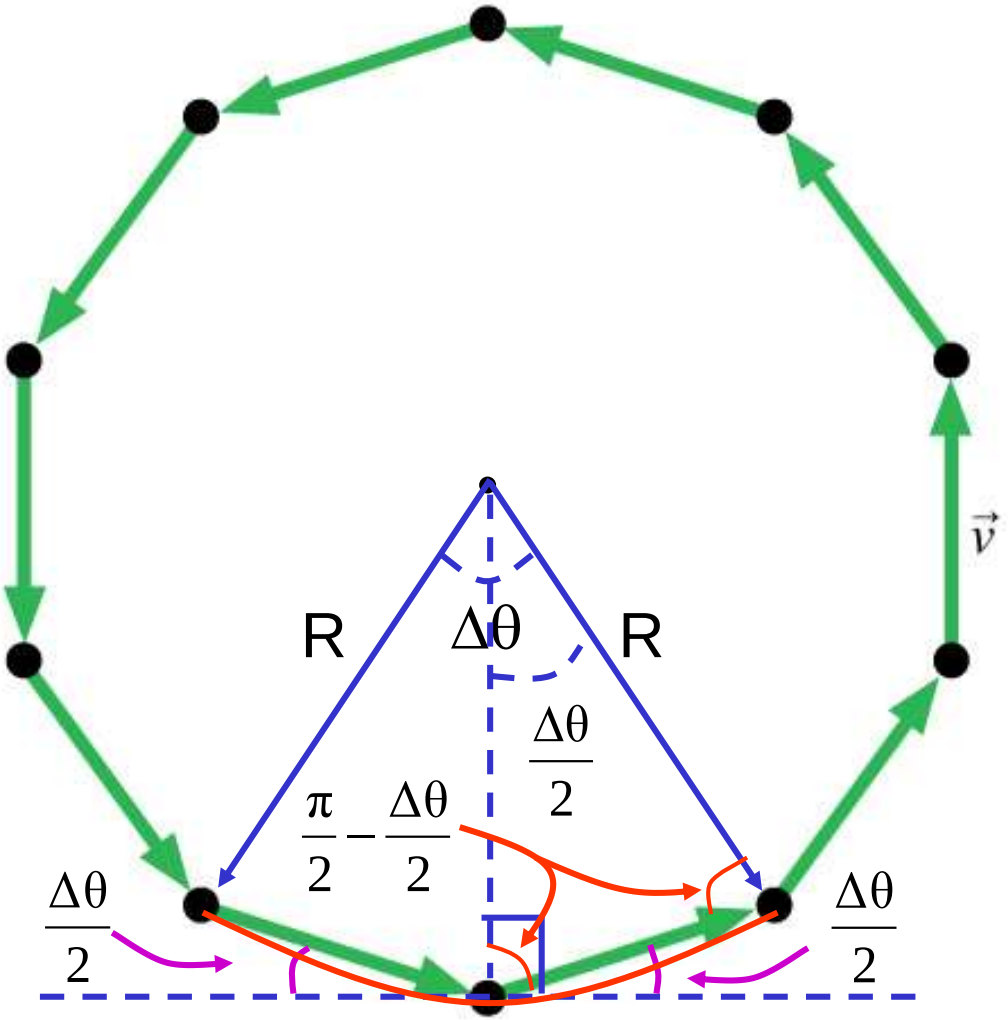


The lengths of the velocity vectors are the same, indicating constant speed, but the direction of each vector is different. This is a changing velocity.



$$\Delta\theta = \frac{1}{R}\Delta S$$



$$\vec{v}_i = \hat{i}v\cos(\tfrac{\Delta\theta}{2}) - \hat{j}v\sin(\tfrac{\Delta\theta}{2}) \qquad \vec{v}_f = \hat{i}v\cos(\tfrac{\Delta\theta}{2}) + \hat{j}v\sin(\tfrac{\Delta\theta}{2})$$

$$\Delta\vec{v} = \hat{j}\,v\,2\sin(\tfrac{\Delta\theta}{2})$$

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$$\Delta\vec{v} = \hat{j}\, v\, 2\sin(\tfrac{\Delta\theta}{2})$$

$$= \hat{j}\, v\, 2 \times \frac{\Delta\theta}{2} \qquad \textit{for small angles}$$

$$= \hat{j}\, v \Delta\theta$$

$$= \hat{j} v \frac{\Delta S}{R}$$

$$\vec{a} = \frac{\Delta\vec{v}}{\Delta t}$$

$$= \hat{j}\, \frac{v}{R}\, \frac{\Delta S}{\Delta t}$$

$$= \hat{j}\, \frac{v^2}{R}$$

Non-Uniform Motion