$$\vec{r}$$

$$\Delta\vec{r}$$

$$\vec{v}$$

$$\Delta\vec{v}$$

$$\vec{a}$$

$$\vec{v} \approx \frac{\Delta\vec{r}}{\Delta t}$$

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

$$\frac{|\Delta\vec{v}|}{v} = \frac{|\Delta\vec{r}|}{r}$$

$$a \approx \frac{|\Delta\vec{v}|}{\Delta t} = \frac{v|\Delta\vec{r}|}{r\Delta t} \approx \frac{v^2}{r}$$

$$a = \frac{v^2}{r}$$