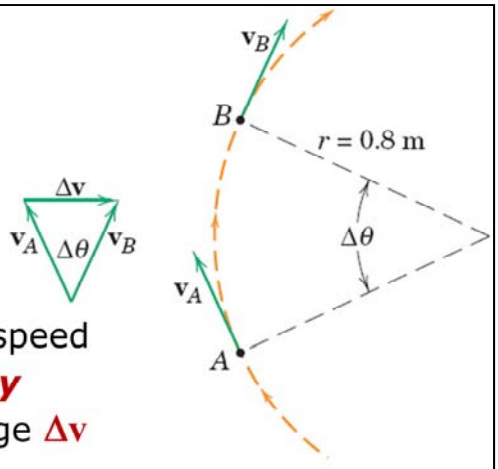
Question of the Day



A particle moves in a circular path of radius r = 0.8 m with constant speed (v) of 2 m/s. The ***velocity*** undergoes a vector change $\Delta\mathbf{v}$ from ***A*** to ***B***.

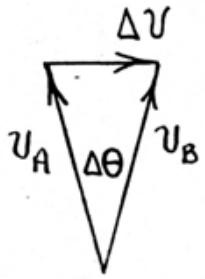
Express the magnitude of $\Delta\mathbf{v}$ in terms of v and $\Delta\theta$. Express the time interval Δt in terms of v, $\Delta\theta$, and r. Obtain the magnitude of average acceleration by computing $\Delta\mathbf{v}/\Delta t$.

2/108 $v_A = v_B = v = 2$ m/s

$$\Delta v = 2v \sin\frac{\Delta\theta}{2} = 4\sin\frac{\Delta\theta}{2} \text{ m/s}$$

$$\Delta t = \frac{r\,\Delta\theta}{v} = \frac{0.8\,\Delta\theta}{2} = 0.4\Delta\theta \text{ s}$$

$$a_{av} = \frac{\Delta v}{\Delta t} = \frac{4\sin\frac{\Delta\theta}{2}}{0.4\,\Delta\theta} = 5\,\frac{\sin\frac{\Delta\theta}{2}}{\Delta\theta/2}$$



	$\Delta\theta$	$\frac{\Delta\theta}{2}$	$\frac{\Delta\theta}{2}$ rad	$\sin\frac{\Delta\theta}{2}$	a_{av}, m/s^2	% diff.
(a)	30°	15°	0.262	0.259	4.94	1.1
(b)	15°	7.5°	0.1309	0.1305	4.99	0.3
(c)	5°	2.5°	0.0436	0.0436	4.998	0.03

$$a_n = \frac{v^2}{\rho} = \frac{2^2}{0.8} = 5 \text{ m/s}^2$$