The magnitude of displacement of a particle moving in a circle of radius 'a' with constant angular speed ω varies with time 't' as :

(A) 2 a sin ωt;

(B) 2 a sin ωt/2;

(C) 2 a cos ωt;

(D) 2 a cos ωt/2;

Please do specify the method by which u got ur answer...

Particle position:

$$\vec{R} = \mathrm{a}\cos(\omega t)\,\vec{\imath} + \mathrm{a}\sin(\omega t)\vec{\jmath}$$

At t=0:

$$\overrightarrow{R_0} = \mathrm{a}\vec{\imath}$$

Displacement:

$$\vec{d} = \vec{R} - \overrightarrow{R_0} = a\cos(\omega t)\,\vec{\imath} + a\sin(\omega t)\,\vec{\jmath} - \mathrm{a}\vec{\imath} = a(\cos(\omega t) - 1)\vec{\imath} + a\sin(\omega t)\,\vec{\jmath}$$

$$d = \sqrt{\left(a(\cos(\omega t) - 1)\right)^2 + (a\sin(\omega t))^2} = a\sqrt{2 - 2\cos(\omega t)} = a\sqrt{2(1 - \cos(\omega t))}$$

$$1 - \cos(\omega t) = 2(\sin(\omega t/2))^2$$

$$d = a\sqrt{2 * 2(\sin(\omega t/2))^2} = 2a\sin(\omega t/2)$$

Answer $d = 2a\sin(\omega t/2)$ **(B)**