DPP - 1

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1.

	Displacement	Distance
A to C	2R	πR
A to B	$\sqrt{2}$R	πR/2
A to D	$\sqrt{2}$R	3πR/2
A to A	0	2πR

2. Radius = 1 m

one revolution → 10 sec

1 min 5 sec → 65 sec
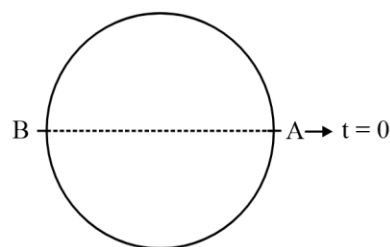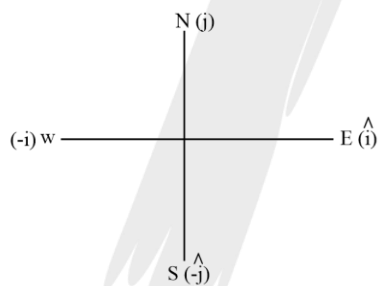
In 65 second number of revolution = 6.5

Displacement

$\parallel$

2R = 2m

3. $\vec{S} = 30\hat{j} + 20\hat{i} - 20\hat{i} - 20\hat{j}$

$\vec{S} = 10\hat{j}$

4. $S = \sqrt{(2R)^2 + (\pi R)^2}$
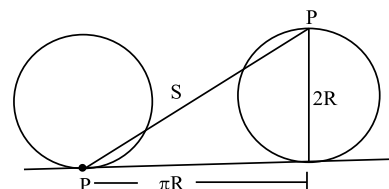
$S = R\sqrt{4 + \pi^2}$

5. 2 m → 8 sec

4 m → 8 sec

6 m → 8 sec

8 m → 8 sec

13 m → 5 sec

Total time = 37 sec

6. Average speed $= \frac{\text{total distance}}{\text{total time}}$

$\langle v \rangle = \frac{v_1 t_1 + v_2 t_2}{t_1 + t_2} = \frac{200 \times 10 + 20 \times 100}{30}$ $\langle v \rangle = 133.33 \text{ m/s}$

7. $\langle v \rangle = \frac{\text{total distance}}{\text{total time}}$

$\langle v \rangle = \frac{3.75}{2/3} = 5.625 \text{ km/h}$

8. $S = (4t^2 + 5t - 6) \text{cm}$

$v = \frac{ds}{dt} = 8t + 5$

$t = 0 \qquad v = 5 \text{ cm/s}$

$t = 4 \qquad v = 37 \text{ cm/s}$

9. $\vec{v_1}$ & $\vec{v_2}$ making angle θ with each other.

$|\bar{v}_2 - \bar{v}_1| = \sqrt{v_1^2 + v_2^2 - 2v_1 v_2 \cos \theta}$

$|\Delta v| = v\sqrt{4\sin^2 \theta/2} = 2v\sin \frac{\theta}{2}$

$|\bar{v}_1| = v \quad |\bar{v}_2| = v \quad \left(\cos \theta = 1 - 2\sin^2 \frac{\theta}{2}\right)$

$\langle a \rangle = \frac{\Delta v}{t} = \frac{2v\sin \theta/2}{\frac{R\theta}{v}} = \frac{2v^2 \sin \theta/2}{R\theta}$

10. $\vec{v}_i = 20 \text{ m/s} \, \hat{j}$

$\vec{v}_f = 20 \text{ m/s} \, \hat{i}$

$\vec{v}_f - \vec{v}_i = 20 \text{ m/s} \, \hat{i} - 20 \text{ m/s} \, \hat{j}$

$= 20\hat{i} - 20j$

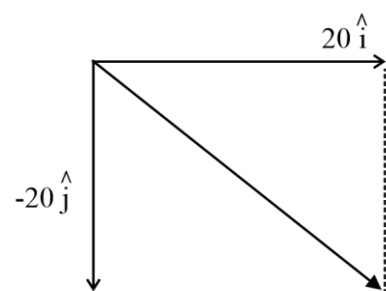$|\Delta \bar{v}| = 20\sqrt{2} \text{ E} - \text{S}$

$= 20\sqrt{2} \text{ S} - \text{E}$

11. $x = 8t - 3t^2$

$v = 8 - 6t$

$v_{av} = \frac{\int v dt}{\int dt} = \frac{[8t - 3t^2]_0^1}{[t]_0^1}$

$\int |v| dt = \text{total distance}$

12. $S = \frac{1}{3}t^3 - t^2 + t$

$v = \frac{ds}{dt} = \frac{3t^2}{3} - 2t + 1 = t^2 - 2t + 1$

$a = \frac{dv}{dt} = 2t - 2$

$a = 0 \qquad t = 1 \text{ sec}$

$v_{t=1} = 1 - 2 + 1 = 0 \qquad t = 1 \quad S = \frac{1}{3} - 1 + 1 = \frac{1}{3}$

13. $x \propto t^{1/2}$

$v \propto \frac{1}{2}t^{-1/2}$

$a \propto \frac{1}{2} \times \left(-\frac{1}{2}\right)t^{-3/2}$

$a \propto v^3$

14. $|\text{displacement}| \leq |\text{distance}|$

15. $v = (2t + 3)\text{m/s}$

$v_{av} = \frac{\int v\,dt}{\int dt} = \frac{\int_0^3 (2t+3)dt}{\int_0^3 dt}$

$v_{av} = \frac{18}{3} = 6 \text{ m/s}$

16. $x = at^2 \qquad y = at^2$

$v_x = \frac{dx}{dt} = 2at\,\hat{\imath}$

$v_y = 2bt\,\hat{\jmath}$

$|\bar{v}| = \sqrt{4a^2t^2 + 4b^2t^2}$

$|\bar{v}| = 2t\sqrt{a^2 + b^2}$