A+ Academy – Online Teaching

فيزياء طبية (تحضيري)

Topic: Medical physics

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Lecture: (7)

Vectors and motion in two dimension Part (3)

WhatsApp (00962781598320)

Motion in 2-Dimensions

The Position, Velocity, and Acceleration Vectors

<u>The displacement</u> $\Delta\hat{r}$ of a particle is defined as its change in position in some time interval.

$\Delta\vec{\mathbf{r}} = \vec{\mathbf{r}}_{\mathbf{f}} - \vec{\mathbf{r}}_{\mathbf{i}}$	m

Where:

$\Delta\vec{r}$: *Displacement* ***(m).***

$\vec{r}_f$ *: Final position (m).*

$\vec{r}_i$: Initial position (m).

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<u>The average velocity</u> $\mathbf{v}_{avg}$ of a particle is defined as the particle's displacement Δx divided by the time interval Δt during which that displacement occurs:

$\vec{\mathbf{v}}_{\mathrm{avg}} = \dfrac{\Delta\vec{r}}{\Delta t}$	m/s

<u>The instantaneous velocity:</u>

$v_x = \dfrac{d\vec{r}}{dt}$	m/s

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<u>The average acceleration</u> $\boldsymbol{a_{avg}}$ of the particle is defined as the *change* in velocity Δv_x divided by the time interval Δt during which that change occurs:

$\vec{\mathbf{a}}_{\text{avg}} = \dfrac{\Delta\vec{\mathbf{v}}}{\Delta t}$	m/s^2

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<u>Instantaneous acceleration:</u>

$\vec{\mathbf{a}} = \dfrac{d\vec{\mathbf{v}}}{dt}$	m/s^2

$V_f = V_i + at$	(1)
$\Delta\vec{r} = V_i\, t + \dfrac{1}{2}\, a\, t^2$	(2)
$V_f^2 = V_i^2 + 2a\Delta\vec{r}$	(3)
$\bar{V} = \left(\dfrac{v_f + v_1}{2}\right) = \dfrac{\Delta\vec{r}}{\Delta t}$	(4)

Ex (1): If the position oh the particle is given by $\vec{r}(t) = (3t^2 + 2)\,\hat{\imath} + (t^2 - 1)\,\hat{\jmath}\, m,$ Find.

1. Displacement at [1, 3] s.
2. The average velocity at $t_1 = 1$ s and t2 = 2 s.
3. The average velocity at t = 4 s.
4. The speed velocity at t = 2 s.

Ex (2): If the coordinate of the car is given by $\vec{r}(t) = (3t^2 + 2t)\,\hat{\imath} + \ (3t^2)\,\hat{\jmath}\ m$, find.

1. The acceleration at t = 3s.
2. The average acceleration at t[0, 3]s.

Ex (3): an object is moving in x-y plane with $x(t) = 18t^2$ m and $y(t)= 4t - 5t^2$. What is the magnitude and the direction of the acceleration after 3 s.

Ex (4): A particle moving with initial velocity $-2\,\hat{\imath} + 4\,\hat{\jmath}$ m/s, undergoes a constant acceleration $-2\,\hat{\imath} - \hat{\jmath}$ m/s^2, find

1. The velocity after 2 s.
2. The speed after 4 s.

Ex (5): A particle start from the origin with initial velocity 7 $\hat{\imath}$ m/s, and moving with constant acceleration, if it position after 2 s become $\vec{r} = 12\,\hat{\imath} - 6\,\hat{\jmath}$ m. find the acceleration.

Ex (6): At t =0 s, the position of particle is (-2,-1) m, and its velocity is 3 $\hat{\jmath}$ m/s if its moves with $\hat{\imath} + \hat{\jmath}$ m/s^2. What is the position at t = 2s.

Ex (7): A particle moves in the x-y plane with constant acceleration given by a= -4 $\hat{j}$ m/s^2, at t = 0 s its position is $10\hat{\imath}$ m and its velocity is $-2\hat{\imath} + 8\hat{\jmath}$ m/s. What is the distance from origin to the particle at t =2s.

Ex (8): A car moves 10 km toward east, 20 km toward north of the east with 37^o, finally it goes 2 km west. What is the magnitude of the net displacement