

71 - கணிதம் பரீட்சை (2) ①  
2020 - 2021

- ① கொடுக்கப்பட்ட வெக்டர்கள்  
ஒன்றுக்கொன்று செங்குத்தான  
வெக்டர்கள் (orthogonal vector)

$$\vec{A} = 2\hat{i} + 3\hat{j}, \vec{B} = 4\hat{i} - 5\hat{j}$$

$$\boxed{\vec{A} \cdot \vec{B}} = (2\hat{i} + 3\hat{j}) \cdot (4\hat{i} - 5\hat{j})$$

$$= 2(4) + 3(-5)$$

$$= 8 + (-15)$$

$$= 8 - 15$$

$$= -7 \neq 0$$

செங்குத்தான வெக்டர்கள் அல்ல  
(not orthogonal vector)

$$\vec{A} = 5\hat{i} + 2\hat{j} \text{ பதில் } \vec{B} = 2\hat{i} - 5\hat{j}$$

$$\vec{A} \cdot \vec{B} = (5\hat{i} + 2\hat{j}) \cdot (2\hat{i} - 5\hat{j})$$

$$= 5(2) + 2(-5)$$

$$= 10 + (-10)$$

$$= 10 - 10 = 0$$

செங்குத்தான வெக்டர்கள்  
It is orthogonal vector

3

② ஒரு பொருள் நகர்ந்து கொண்டிருக்கிறது

$$\vec{F} = m\vec{a}$$

x ஈழா (direction)

$$F_x = ma_x \rightarrow ①$$

y ஈழா

$$F_y = ma_y \rightarrow ②$$

z ஈழா (direction)

$$F_z = ma_z \rightarrow ③$$

$$① + ② + ③$$

$$F_x \hat{i} + F_y \hat{j} + F_z \hat{k} =$$

$$ma_x \hat{i} + ma_y \hat{j} + ma_z \hat{k}$$

③ ஒரு பொருள் ஈழாவுகிறது

$$\vec{P} = 0$$

x ஈழா (direction)

$$P_x = 0 \rightarrow ①$$

y ஈழா

$$P_y = 0 \rightarrow ②$$

z ஈழா

$$P_z = 0 \rightarrow ③$$

$$P_x \hat{i} + P_y \hat{j} + P_z \hat{k} =$$

$$0\hat{i} + 0\hat{j} + 0\hat{k}$$

- ④ താഴെ പറയുന്നവയുടെ ഭൗതിക ബാധകത  $\vec{F}_1 + \vec{F}_2 + \vec{F}_3 = \vec{F}_4$

x direction (x-axis)

$$F_{1x} + F_{2x} + F_{3x} = F_{4x}$$

→ ①

z

y axis

$$F_{1y} + F_{2y} + F_{3y} = F_{4y} \rightarrow ②$$

z axis

$$F_{1z} + F_{2z} + F_{3z} = F_{4z} \rightarrow ③$$

- ⑤ ദിശാസൂചകങ്ങളുടെ സമാന്തര  $\vec{r}_1 = 3\hat{i} + 4\hat{j}$   
 ആയിട്ട്  $\vec{r}_2 = \hat{i} + 2\hat{j}$  ദിശാസൂചകങ്ങളുടെ  
 സമാന്തര ദിശയിൽ കിടക്കുന്നവയുടെ  
 (displacement) മാറ്റം ( $\Delta\vec{r}$ )  
 കണ്ടെത്തുക

കിടക്കുന്നവയുടെ മാറ്റം  
 (Displacement Vector)

$$\Delta\vec{r} = \vec{r}_2 - \vec{r}_1$$

$$\vec{r}_1 = 3\hat{i} + 4\hat{j}$$

$$\vec{r}_2 = \hat{i} + 2\hat{j}$$

$$\Delta\vec{r} = (\hat{i} + 2\hat{j}) - (3\hat{i} + 4\hat{j})$$

$$\Delta \vec{r} = (\hat{i} + 2\hat{j}) - (3\hat{i} + 4\hat{j})$$

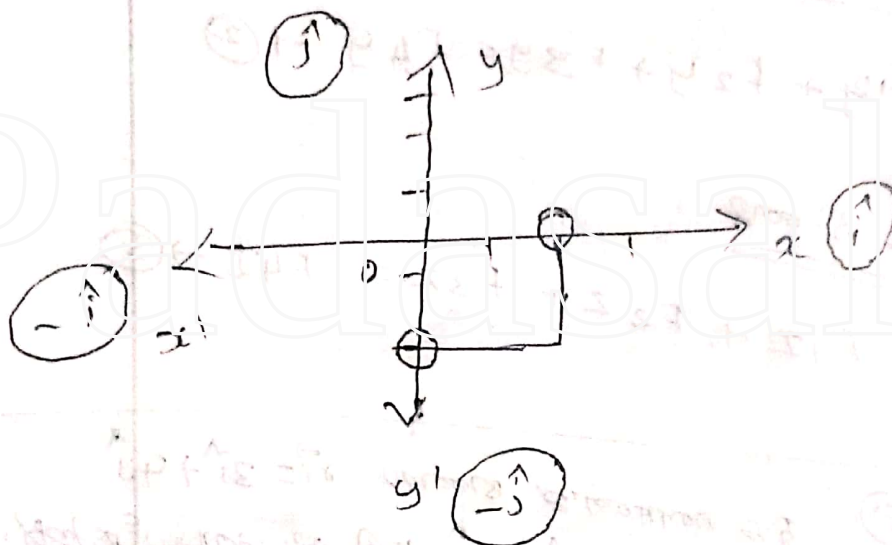
$$\Delta \vec{r} = \hat{i} + 2\hat{j} - 3\hat{i} - 4\hat{j}$$

$$\Delta \vec{r} = -2\hat{i} - 2\hat{j}$$

Displacement vector

இடப்பெயர்ச்சி வெக்டர்

$$\Delta \vec{r} = -2\hat{i} - 2\hat{j}$$



⑥ ஒரு துகள் 5 அலகுகளில்  
இடைவெளி (position vector)

$$\vec{r}_1 = 5\hat{i} + 6\hat{j} \text{ லிருந்து இடைவெளி}$$

$$\vec{r}_2 = 2\hat{i} + 3\hat{j} \text{ க்கு மாற்றியது}$$

அதன்மூலம் சராசரி இடைவெளி  
(Average velocity) என்ன?

Average velocity

(சராசரி இடைவெளி)

$$\vec{r}_1 = 5\hat{i} + 6\hat{j}$$

$$\vec{r}_2 = 2\hat{i} + 3\hat{j}$$

$$t = 5 \text{ sec (200119)}$$

Average velocity  
(சராசரி திசைவேகம்)

$$v_{\text{average}} = \frac{\Delta \vec{r}}{\Delta t}$$

$$\Delta \vec{r} = (\vec{r}_2 - \vec{r}_1)$$

$$\Delta \vec{r} = (2\hat{i} + 3\hat{j}) - (5\hat{i} + 6\hat{j})$$

$$\Delta \vec{r} = 2\hat{i} + 3\hat{j} - 5\hat{i} - 6\hat{j}$$

$$\Delta \vec{r} = -3\hat{i} - 3\hat{j}$$

$$\Delta \vec{r} = -3(\hat{i} + \hat{j})$$

$$v_{\text{average}} = \frac{\Delta \vec{r}}{\Delta t}$$

$$\Delta t = 5 \text{ sec}$$

$$v_{\text{average}} = \frac{-3(\hat{i} + \hat{j})}{5}$$

7) ஒரு வெக்டர்  $\vec{r}$  கொடுக்கப்பட்டுள்ளது

$$\vec{r} = 3\hat{i} + 2\hat{j}$$

அதன் ஒருங்கிணைந்த வெக்டர் (unit vector)

$$\hat{r} = \frac{\vec{r}}{|\vec{r}|}$$

$$|\vec{r}| = \sqrt{x^2 + y^2 + z^2}$$

$$\vec{r} = 3\hat{i} + 2\hat{j}$$

$$|\vec{r}| = \sqrt{(3)^2 + (2)^2}$$

$$\hat{r} = \frac{3\hat{i} + 2\hat{j}}{\sqrt{9+4}} = \frac{3\hat{i} + 2\hat{j}}{\sqrt{13}}$$

$$\hat{r} = \frac{3\hat{i} + 2\hat{j}}{\sqrt{13}}$$

ii)  $\vec{r} = 2\hat{i} - 3\hat{j} - 9\hat{k}$

அதன் ஒருங்கிணைந்த வெக்டர்

(unit vector)

$$\hat{r} = \frac{\vec{r}}{|\vec{r}|}$$

$$\vec{r} = \frac{2\hat{i} - 3\hat{j} - 9\hat{k}}{\sqrt{(2)^2 + (-3)^2 + (-9)^2}}$$

$$\vec{r} = \frac{2\hat{i} - 3\hat{j} - 9\hat{k}}{\sqrt{4 + 9 + 81}}$$

$$\boxed{\vec{r} = \frac{2\hat{i} - 3\hat{j} - 9\hat{k}}{\sqrt{94}}}$$

(iii)  $2\hat{i} + 2\hat{j} - 6\hat{k}$  (35 marks)

ஒரு ஐக்கம் (unit vector)

$$\boxed{\vec{r} = \frac{\vec{r}}{|\vec{r}|}}$$

$$\vec{r} = \frac{2\hat{i} + 2\hat{j} - 6\hat{k}}{\sqrt{(2)^2 + (2)^2 + (-6)^2}}$$

$$\vec{r} = \frac{2\hat{i} + 2\hat{j} - 6\hat{k}}{\sqrt{4 + 4 + 36}}$$

$$\vec{r} = \frac{2\hat{i} + 2\hat{j} - 6\hat{k}}{\sqrt{44}}$$

$$\boxed{\vec{r} = \frac{2\hat{i} + 2\hat{j} - 6\hat{k}}{\sqrt{44}}}$$

Ex 14

$$y = x \rightarrow \frac{dy}{dx} = 1$$

$$y = x^2 \rightarrow \frac{dy}{dx} = 2x$$

$$y = x^3 \rightarrow \frac{dy}{dx} = 3x^2$$

$$y = x^4 \rightarrow \frac{dy}{dx} = 4x^3$$

$$y = x^5 \rightarrow \frac{dy}{dx} = 5x^4$$

$$y = x^6 \rightarrow \frac{dy}{dx} = 6x^5$$

$$y = x^7 \rightarrow \frac{dy}{dx} = 7x^6$$

$$y = x^8 \rightarrow \frac{dy}{dx} = 8x^7$$

$$y = x^n \rightarrow \frac{dy}{dx} = nx^{n-1}$$

$$y = \sin x \rightarrow \frac{dy}{dx} = \cos x$$

$$y = \cos x \rightarrow \frac{dy}{dx} = -\sin x$$

$$y = \text{constant} \rightarrow \frac{dy}{dx} = 0$$

Exm 4 (function)

$$x = A_0 + A_1 t + A_2 t^2$$

find:

$$\frac{dx}{dt} = \frac{d}{dt} (x)$$

$$= \frac{d}{dt} (A_0 + A_1 t + A_2 t^2)$$

$$= 0 + A_1(1) + A_2 \cdot 2 t^{2-1}$$

$$= A_1 + 2 A_2 t$$

$$\boxed{\frac{dx}{dt} = A_1 + 2 A_2 t}$$

$$\frac{d^2 x}{dt^2} = \frac{d^2}{dt^2} (A_1 + 2 A_2 t)$$

$$= 0 + 2 A_2 (1)$$

$$= 2 A_2 (1)$$

$$\boxed{\frac{d^2 x}{dt^2} = 2 A_2}$$

$$x = 2 - 5t + 6t^2 \text{ for } t \geq 0$$

Find (velocity)

find:

(10)

$$x = 2 - 5t + 6t^2$$

$$\frac{dx}{dt} = \frac{d}{dt} (x)$$

$$= \frac{d}{dt} (2 - 5t + 6t^2)$$

$$= 0 - 5(1) + 6(2)t^{2-1}$$

$$= -5 + 12t$$

$$\boxed{\frac{dx}{dt} = -5 + 12t}$$

$$\boxed{v = -5 + 12t \text{ ms}^{-1}}$$

$x = 2 - 5t + 6t^2$  ධ්වනි සමීකරණය  
 ධ්වනි (Acceleration)

ඉන්ද්‍රිය:

$$\frac{dx}{dt} = \frac{d}{dt} (x)$$

$$= \frac{d}{dt} (2 - 5t + 6t^2)$$

$$= 0 - 5(1) + 6(2)t^{2-1}$$

$$\boxed{v = -5 + 12t \text{ ms}^{-1}}$$

$$\begin{aligned}\frac{d^2x}{dt^2} &= \frac{d^2}{dt^2} (x) \\ &= \frac{d^2}{dt^2} (-5 + 12t) \\ &= (-0) + 12(1) \\ &= 0 + 12\end{aligned}$$

$$a = 12 \text{ ms}^{-2}$$

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