الموضوع : التاريخ 5 / 11 / ٢٠١٩

* Mechanic *

Reference :-

1- Physics (Part 1) by: Robert Resnick and DAVID HALLIday

2- Physics for scientists and engineers by:- Douglas (2nd edition)

3- physics for Scientists and engineers by. erway (6th edition

تحويلات الكميات :

للأطوال الطويلة

$1 A^{\circ} = 10^{-10} m$

$1 A^{\circ} = 10^{-10} \times 10^{3} mm = 10^{-7} mm$

$1 m m = 10^{7} A^{\circ}$

وحدات أطياف

$1 F = 10^{-15} m$

$1 nm = 10^{-9} m$

$1 micro = 10^{-6} m$

الكتلة :

$1 \mu g_m = 10^{-6} g_m = 10^{-6} \times 10^{3} kg = 10^{-9} kg$

CLEAR

CH.1 علم الفيزياء

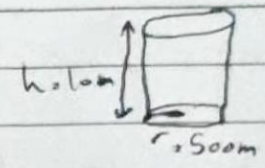
SI (MKS) (cgs)
- length: Meter
- mass: kg or gm
- Time: S → s

النظام البريطاني
- length: ft
- force: pound
- Time: S

1 in = 2.54 cm

$$1\ ft = 12\ in\left(\frac{2.54\ cm}{1\ in}\right)\left(\frac{1\ m}{100\ cm}\right) = 0.3048\ m$$

$V = \pi r^2 h$



$\cong 3 \cdot (500)^2 (10)$

$\cong 3 * 25 * 10^4 * 10$

$\cong 80000000\ m$

قانون البندول

$$T = 2\pi\sqrt{\frac{L}{g}}$$

$$= \sqrt{\frac{[L]}{[L]/[T]^2}}$$

$$= \sqrt{\frac{1}{1/[T]^2}} = \sqrt{[T]^2} = T$$

Length [L]
time [T]

CLEAR

① الكمية الفيزيائية : المسافة (Distance) الوحدة الأساسية المتر m.

1 Fermi = 10^{-15} m فيرمي

1 Angstrom = 10^{-10} m انجستروم A°

1 nano meter = 10^{-9} m نانومتر nm

1 micro meter = 10^{-6} m ميكرومتر μm

1 millimeter = 1mm = 10^{-3} m ملليمتر

1 Centemeter = 1Cm = 10^{-2} m سنتيمتر

1 KiloMeter = 1Km = 10^{3} كيلومتر

② الكتلة : Mass الوحدة الأساسية Kg.

1 microgram = $1\mu g = 10^{-6}$ gm = 10^{-9} Kg ميكروجرام

1 milligram = 1mg = 10^{-3} gm = 10^{-6} kg ملليجرام

1 gram = 1gm = 10^{-3} Kg جرام

1 ton = 10^{6} gm = 10^{3} Kg 1 طن

③ الزمن : Time الوحدة الأساسية الثانية sec.

1 pico second = 1ps = 10^{-12} sec بيكوثانية

1 nano second = 1ns = 10^{-9} sec نانوثانية

1 micro second = $1\mu s = 10^{-6}$ sec = ميكروثانية

1 millisecond = 1ms = 10^{-3} sec. ملليثانية

1 minute = 1min = 60 sec 1 دقيقة

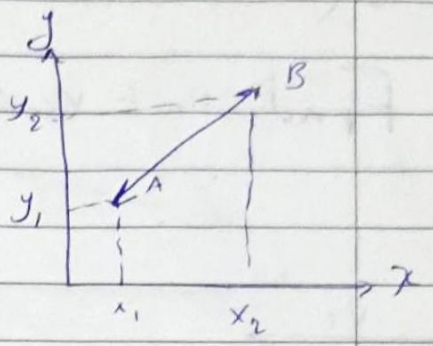
1 hour = 1 hr = 3600 sec 1 ساعة

الموضوع : التاريخ / / ٢٠١

Ch. 2

Vectors فيه اتجاهات

Scalars فيه قيمة



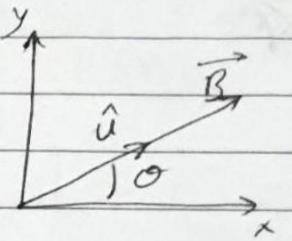
$$\vec{AB} = (x_2 - x_1)\,\hat{i} + (y_2 - y_1)\,\hat{j}$$

Homework → إثبات

$$\vec{BA} = -\vec{AB}$$

$$\vec{A} = |A|\,\hat{u}$$

$$\vec{B} = |B|\,\hat{u}$$

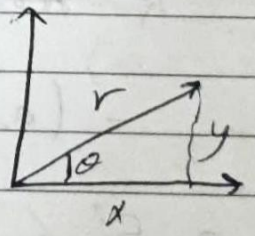


let $\vec{B} = 5\hat{i} + 10\hat{j}$

$$|B| = \sqrt{x^2 + y^2}$$

$$\hat{u} = \frac{\vec{B}}{|B|} = \frac{5\hat{i} + 10\hat{j}}{\sqrt{25 + 100}}$$

$$= \frac{5\hat{i}}{\sqrt{125}} + \frac{10\hat{j}}{\sqrt{125}}$$



$$\sin\theta = \frac{y}{r} \Rightarrow y = r\sin\theta$$

$$\cos\theta = \frac{x}{r} \Rightarrow x = r\cos\theta$$

$$\tan\theta = \frac{y}{x}$$

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

CLEAR

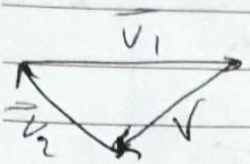
الموضوع : Homework التاريخ 11 / 11 / ٢٠١٩

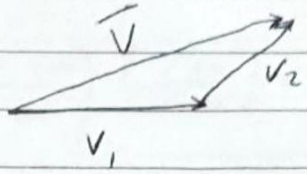
$A(2,1)$

$B(-1,2)$

Find unit vector in direction of $\overrightarrow{AB}$

عمل الطلاب





$$\vec{V} = \vec{V}_1 + \vec{V}_2$$

$$\vec{a} = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$$

$$\vec{b} = b_x\hat{i} + b_y\hat{j} + b_z\hat{k}$$

$$\vec{R} = \vec{a} + \vec{b}$$

$$= (a_x + b_x)\hat{i} + (a_y + b_y)\hat{j} + (a_z + b_z)\hat{k}$$

$$a = 5\hat{i} + 6\hat{j} \qquad b = 2\hat{i} + 4\hat{k}$$

$$\vec{R} = (5+2)\hat{i} + (6)\hat{j} + (4)\hat{k}$$

$$\hat{U} = \frac{\vec{R}}{|R|}$$

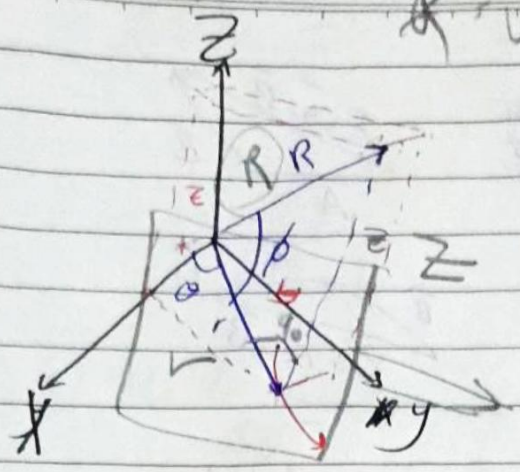
CLEAR

$$R = \sqrt{r^2 + z^2}$$

التاريخ / / ٢٠١

الموضوع :

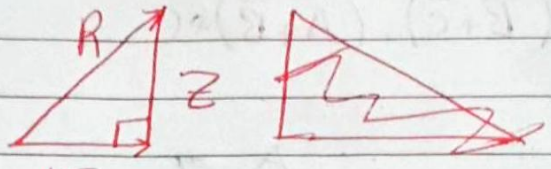
$$R = \sqrt{x^2 + y^2 + z^2}$$

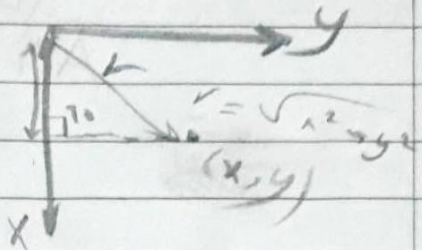


$$R^2 = r^2 + z^2$$

$$R^2 = x^2 + y^2 + z^2$$

$$\therefore R = \sqrt{x^2 + y^2 + z^2}$$





x, y, z ⇐ rectangular Coor.

r, θ, ϕ ⇐ Spherical Coor.

r, θ, z ⇐ Cylindered Coor.

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

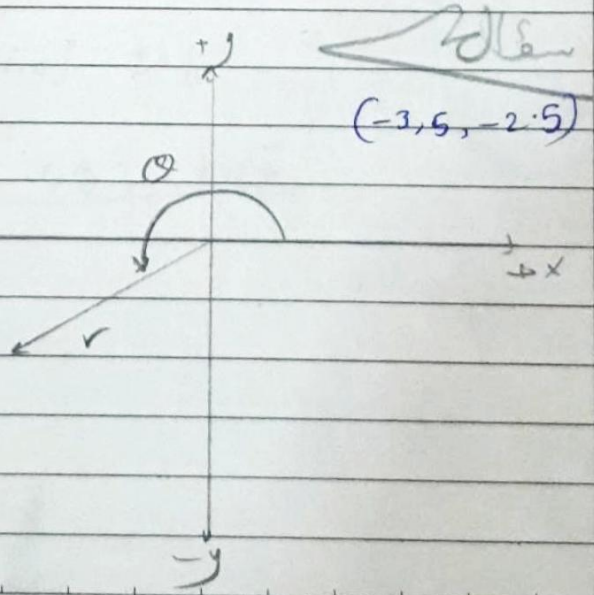
مثال

(-3.5, -2.5)

$$r = \sqrt{(-3.5)^2 + (-2.5)^2} = 4.3m$$

$$\theta = \tan^{-1}\left(\frac{y}{x}\right) = 0.71 \text{ rad}$$

$$\theta = 216$$



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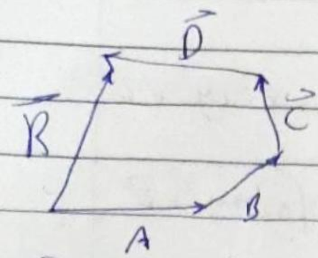
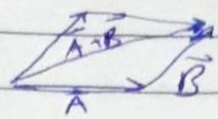
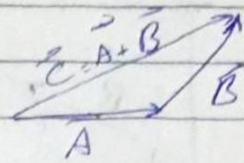
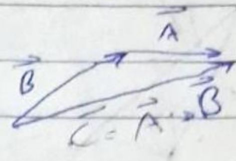


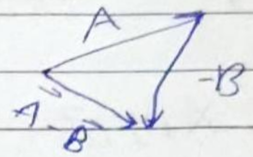






$\vec{R} = \vec{A} + \vec{B} + \vec{C} + \vec{D}$

$\vec{A} + (\vec{B} + \vec{C}) = (\vec{A} + \vec{B}) + \vec{C}$



$\vec{A} - \vec{B} = \vec{A} + (-\vec{B})$

المستوي العمودية

Homework

الموضوع :

التاريخ ١٢ / ١١ / ٢٠١٩

$\vec{A}$, $\vec{B}$ $\quad A = 12$ units

$B = 8$ unit

$\vec{R} = \vec{A} + \vec{B}$

ما أكبر وأقل قيمة

(سؤال ناقص طالب)

a) 14.6 unit

b) 12

c) 20

D) كل واحدة

كل موجود

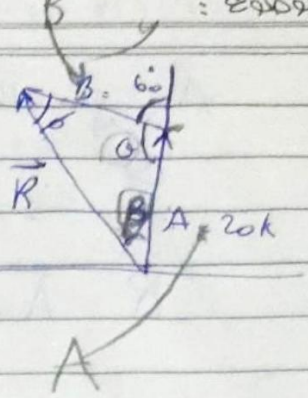
مركبات :-

$\vec{A} = 5\hat{i} + 8\hat{j} - 4\hat{k}$

$5\vec{A} = 25\hat{i} + 40\hat{j} - 20\hat{k}$

$-6\vec{A} = -30\hat{i} - 48\hat{j} + 24\hat{k}$

CLEAR



$\theta = 180 - 60 = 120^\circ$

$R^2 = A^2 + B^2 - 2AB\cos\theta$ ←

$R = \sqrt{A^2 + B^2 - 2AB\cos\theta}$ ←

$R = \sqrt{(20)^2 + (35)^2 - 2(20)(35)\cos\theta}$

$R = 48.2\ km$

قانون الجيب ← $\frac{\sin\beta}{B} = \frac{\sin\theta}{R} = \frac{\sin\phi}{A}$ ← أو

$\frac{\sin\beta}{35} = \frac{\sin 120}{48.2}$ $\quad \frac{A}{\sin B} =$

$\beta = 39.9^\circ$

$\sin\beta = \frac{35 \times \sin 120}{48.2}$

$\beta = \sin^{-1}(\quad) = 39.9^\circ$

$\sin\beta = \frac{\text{المقابل}}{\text{الوتر}}$

$\Rightarrow \frac{\text{المقابل}}{\text{الوتر}} * \frac{1}{\text{المقابل}} = \frac{1}{\text{الوتر}}$

$\frac{1}{\text{الوتر}} = \frac{1}{\text{الوتر}}$

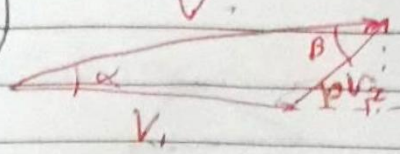
وهكذا الحل صحيح

CLEAR

الموضوع : التاريخ / / ٢٠١

$$\frac{\sin\beta}{V_1} = \frac{\sin\theta}{V} = \frac{\sin\alpha}{V_2}$$

$$\frac{V_1}{\sin\beta} = \frac{V}{\sin\theta} = \frac{V_2}{\sin\alpha}$$



$$V = |\vec{V}| = \sqrt{V_1^2 + V_2^2 + 2V_1V_2\cos\theta}$$

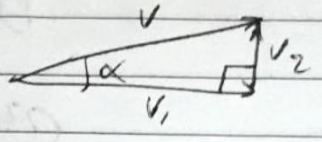
ملاحظة :

$$\sin\theta = \sin(180-\theta)$$

$$\cos\theta = -\cos(180-\theta)$$

(جيب الزاوية يساوي جيب متمم الزاوية)

$\vec{V_1} \perp \vec{V_2}$



$$V^2 = V_1^2 + V_2^2$$

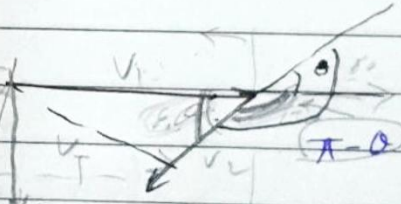
$$V = \sqrt{V_1^2 + V_2^2}$$

$$\tan\alpha = \frac{V_2}{V_1}$$

①

$$V = \sqrt{V_1^2 + V_2^2 + 2V_1V_2\cos(\pi-\theta)}$$

$$V = \sqrt{V_1^2 + V_2^2 - 2V_1V_2\cos\theta}$$



$\cos(\pi-\theta) = \cos\pi\cdot\cos\theta + \sin\pi\sin\theta$

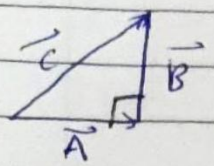
$= -\cos\theta$

$\cos(\theta+\beta) = \cos\theta\cos\beta + \sin\theta\sin\beta$

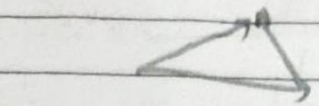
$\sin(\theta+\beta) = \sin\theta\cos\beta + \cos\beta\sin\theta$

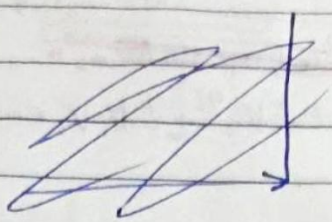
CLEAR

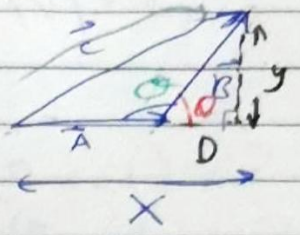
$\vec{A}$, $\vec{B}$



$C = \sqrt{A^2 + B^2 - 2AB\cos\theta}$







$y = B\sin\phi$

$D = B\cos\phi$ $\quad X = A + BD$

$C^2 = y^2 + X^2$

$= B^2\sin^2\phi + (A + BD)^2$

$= B^2\sin^2\phi + (A + B\cos\phi)^2$

$= B^2\sin^2\phi + A^2 + 2AB\cos\phi + B^2\cos^2\phi$

$C^2 = A^2 + B^2\underbrace{(\sin^2\phi + \cos^2\phi)}_{\Rightarrow 1} + 2AB\cos\phi$

$C^2 = A^2 + B^2 + 2AB\cos\phi$

$\cos(\pi - \phi) = -\cos(\phi)$

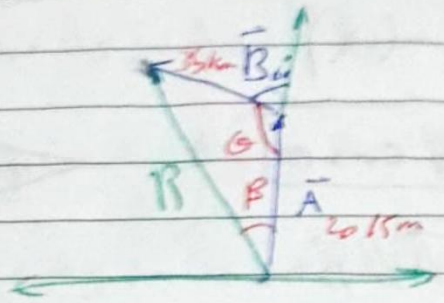
$C^2 = A^2 + B^2 + 2AB\cos(\pi - \theta)$

CLEAR

$$C^2 = A^2 + B^2 - 2AB\cos\theta$$

$$C = \sqrt{A^2 + B^2 - 2AB\cos\theta}$$

سؤال ٤٤



$$\rightarrow R = \sqrt{A^2 + B^2 - 2AB\cos\theta}$$

$$\rightarrow R = \sqrt{2^2 + (5)^2 - 20 \times 35\cos(120 - 40)}$$

Sum

$$\vec{A} = 2\hat{i} + 2\hat{j}$$

$$\vec{B} = 2\hat{i} - 4\hat{j}$$

$$\vec{R} = \vec{A} + \vec{B} = (2+2)\hat{i} + (2+(-4))\hat{j} =$$

$$= 4\hat{i} + (2-4)\hat{j}$$

$$= 4\hat{i} - 2\hat{j} \qquad \tan\theta = \frac{R_y}{R_x}$$

$R_x = 4$
$R_y = -2$

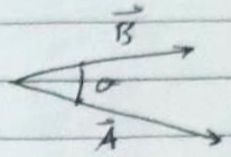
CLEAR

التاريخ / / ٢٠١ الموضوع :

Multiplication of Vectors

1. Dot product (·)
2. cross Pro. (X)

$$\vec{A}\cdot\vec{B} = |A||B|\cos\theta$$



$\theta = 0 \qquad \vec{A} \parallel \vec{B}$

$$\vec{A}\cdot\vec{B} = |A||B|$$

$$\vec{A} \perp \vec{B} \Rightarrow \theta = 90^\circ \Rightarrow A\cdot B = 0$$

$\hat{i}\cdot\hat{i} = 1 \qquad i\cdot j = 0$

$\hat{j}\cdot\hat{j} = 1 \qquad \hat{S}\cdot k = 0$

$\hat{k}\cdot\hat{k} = 1 \qquad k\cdot i = 0$

if we have C, A, B

$$(\vec{A}+\vec{B})\cdot\vec{C} = \vec{C}\cdot\vec{A} + \vec{C}\cdot\vec{B}$$

$$\vec{A}\cdot\vec{B} = A_x B_x + A_y B_y + A_z B_z$$

CLEAR

الموضوع : التاريخ / / ٢٠١

$$\vec{A} = A_x i + A_y j + A_z k$$

$$\vec{B} = B_x i + B_y j + B_z k$$

$$\vec{A}\cdot\vec{B} = (A_x i + A_y j + A_z k)\cdot(B_x i + B_y j + B_z k)$$

$$= A_x i \cdot B_x i + A_x i \cdot B_y j + A_x i \cdot B_z k + A_y j \cdot B_x i +$$

$$A_y j \cdot B_y j + A_y j \cdot B_z k + A_z k \cdot B_x i + A_z k \cdot B_y j + A_z k \cdot B_z k$$

$$\vec{A}\cdot\vec{B} = A_x B_x + A_y B_y + A_z B_z$$

$$\vec{V} = \vec{V_1} + \vec{V_2}$$

Q| drive formula

$$V^2 = \vec{V}\cdot\vec{V}$$

$$V = \sqrt{V_1^2 + V_2^2 + 2V_1V_2\cos\theta}$$

$$\vec{V} = \vec{V_1} + \vec{V_2}$$

$$\vec{V}\cdot\vec{V} = (V_1 + V_2)\cdot(V_1 + V_2)$$

$$V^2 = (V_1\cdot V_1) + (V_1\cdot V_2) + (V_2\cdot V_1) + (V_2\cdot V_2)$$

الزاوية المحصورة بين $\vec{V_1}, \vec{V_2}$ ← زاوية التقاطع تعتبر صفر

$$= (|V_1|\cdot|V_1|\cos 0) + (|V_1|\,|V_2|\cos\theta) + (|V_1|\,|V_2|\cos\theta) + (|V_2|\,|V_2|\cos 0)$$

$$V^2 = (V_1^2) + (V_2^2) + 2(V_1V_2\cos\theta)$$

$$V = \sqrt{V_1^2 + V_2^2 + 2V_1V_2\cos\theta}$$

CLEAR

H.W

الموضوع : التاريخ / / ٢٠١

Q) drive formula $\vec{V} = V_1 - V_2$

$$V = \sqrt{V_1^2 + V_2^2 - 2V_1V_2\cos\theta}$$

$$\vec{V} = \vec{V_1} - \vec{V_2}$$

if $V^2 = \vec{V}\cdot\vec{V}$

$$\therefore V^2 = (\vec{V_1} - \vec{V_2})(\vec{V_1} - \vec{V_2})$$

$$V^2 = (V_1 \cdot V_1) - (V_1 V_2) - (V_2 V_1) + (V_2 V_2)$$

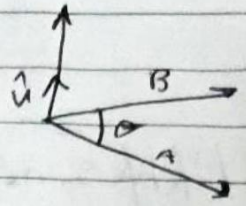
$$V^2 = V_1^2 - 2V_1V_2 + V_2^2$$

CLEAR

الموضوع : التاريخ / / ٢٠١

$$\vec{A} \times \vec{B} = |A|\,|B| \sin\theta\, \hat{u}$$

$$\vec{A}\times\vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix}$$



$$= (A_y B_z - A_z B_y)\hat{i} - (A_x B_z - A_z B_x)\hat{j} + (A_x B_y - A_y B_x)\hat{k}$$

① if $\vec{A} \parallel \vec{B} \Rightarrow \vec{A}\times\vec{B} = 0$ Because $\sin 0 = 0$

② if $A \perp B \Rightarrow \vec{A}\times\vec{B} = |A||B| \Rightarrow$ Because $\sin 90 = 1$

③ $A \times B = -\vec{B}\times\vec{A}$

$i \times i = 0$, $\hat{j}\times\hat{j} = 0$, $k \times k = 0$

A

$i \times \hat{j} = \hat{k}$

$j \times k = i$

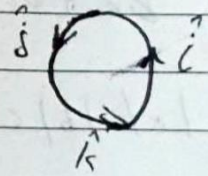
$k \times i = \hat{j}$

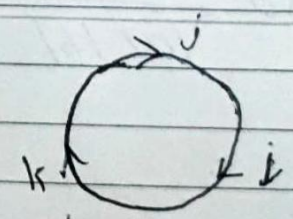
B

$i \times \hat{k} = -j$

$k \times j = -i$

$j \times i = -\hat{k}$





clockwise

باتجاه عقارب الساعة

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ex Prove $\hat{a}$ and $\hat{b}$ are parallel.

$\hat{a} \times \hat{b} = ?\ 0$

$\vec{a} = 6\hat{i} + 8\hat{j} + 10\hat{k}$

$\vec{b} = 3\hat{i} + 4\hat{j} + 5\hat{k}$

$\hat{a} \times \hat{b} = |a||b| \sin\theta \rightarrow \vec{a} \times \vec{b} = 0$

$$\vec{a} \times \vec{b} = \begin{vmatrix} i & j & k \\ 6 & 8 & 10 \\ 3 & 4 & 5 \end{vmatrix}$$

$= i(40-40) - j(30-30) + k(24-24)$

$= 0$

$\therefore \vec{a} \parallel \vec{b}$

$\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}$

$\vec{b} = 2\hat{i} + \hat{j} - 2\hat{k}$

① Find $\vec{a} \times \vec{b}$ ⇒ it was exam

② Find θ between $\vec{a}$ and $\vec{b}$

$\vec{a} \cdot \vec{b} = |a||b| \cos\theta$

$\cos\theta = \dfrac{\vec{a} \cdot \vec{b}}{|a||b|}$.

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