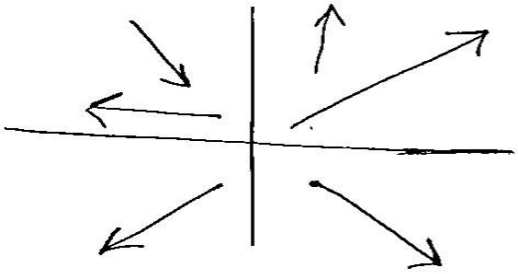
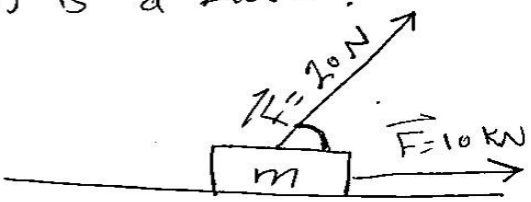
Al-Mustaqbal University College
Department of Medical Instrumentation Techniques Engineering
Class: second stage
Subject: Mathematics II
Lecturer: Dr. Diyar Hussain Habbeb
Lecture: Lec 1

linear Algebra

①

vectors : any thing has (magnitude) & (direction)
for example the force (F) is a factor.



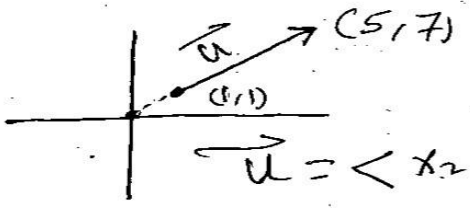


• اختلاف اطوال المتجهات يعني اقوة متجه له قيمة مختلفة عن الاخر.
• طول المتجه = القيمة .

• بالرياضيات جميع المتجهات يجب ان تبدأ من نقطة الاصل (0,0) لذلك عندما يكون المتجه ليس من نقطة الاصل وله نقطتان، نقطة بدايته (x_1, y_1) ونقطة نهايته (x_2, y_2) نستخدم عملية (التصفير) للمتجه كـ:-

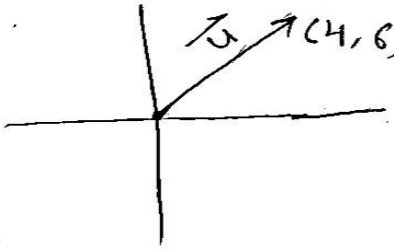
$$\vec{u} = \langle x_2 - x_1, y_2 - y_1 \rangle$$

EX:-



$$\vec{u} = \langle x_2 - x_1, y_2 - y_1 \rangle$$

Sol:- $\vec{u} = \langle 5-1, 7-1 \rangle \Rightarrow \vec{u} = \langle 4, 6 \rangle$



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(2)

Determination the length and direction of vectors:

(1) $|\vec{u}| = \sqrt{u_1^2 + u_2^2}$

(2) $\cos\theta = \frac{u_1}{|\vec{u}|}$

(3) $\sin\theta = \frac{u_2}{|\vec{u}|}$

Ex:- Find the length and direction of $\vec{u}$?

$\vec{u} = \langle 1, \sqrt{3} \rangle$

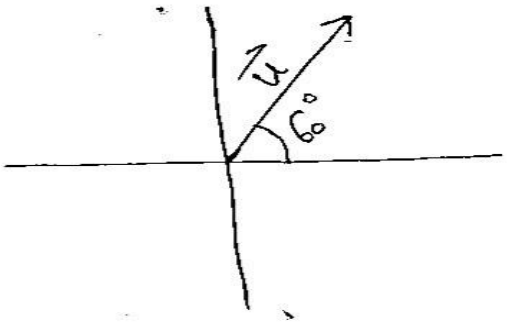
Sol:

$|\vec{u}| = \sqrt{u_1^2 + u_2^2} = \sqrt{1^2 + \sqrt{3}^2} = \sqrt{4} = 2$

$\cos\theta = \frac{u_1}{|u|} = \frac{1}{2}$

$\sin\theta = \frac{u_2}{|u|} = \frac{\sqrt{3}}{2}$

$\Rightarrow \theta = \frac{\pi}{3} = 60^\circ$



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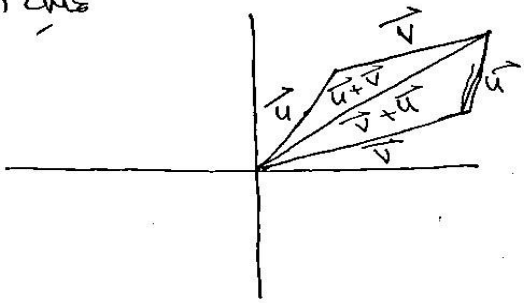
Operations on Factor

③

① Addition operation: عملية الجمع



let $u = (u_1, u_2, u_3)$

$v = (v_1, v_2, v_3)$

$$\vec{u} + \vec{v} = (u_1+v_1, u_2+v_2, u_3+v_3)$$

$$\vec{u} + \vec{v} = (v_1+u_1, v_2+u_2, v_3+u_3)$$

$$\vec{u} + \vec{v} = \vec{v} + \vec{u} \Rightarrow$$ إذن عملية الجمع ابدالية

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② multiply by Scalar (عملية الضرب بـ ثابت)

$$\vec{u} = (u_1, u_2, u_3)$$

$$k \cdot u = (ku_1, ku_2, ku_3)$$

الضرب توزيع على جمع المركبات

Notes :-

① if $k > +1 \Rightarrow$ change the magnitude only, and remain have the same direction.

② if $k > -1 \Rightarrow$ change (magnitude + direction).

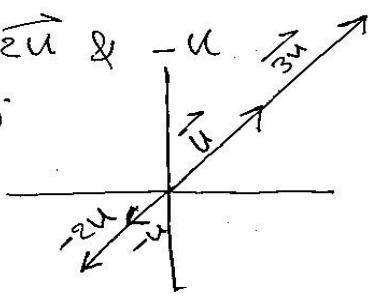
③ if $k = -1 \Rightarrow$ change the direction only.

Ex:- if $\vec{u} = \langle 3, 5 \rangle$, find $3\vec{u}$, $-2\vec{u}$ & $-u$

$\vec{u} = 3i + 5j$, $-u = -3i - 5j$

$3\vec{u} = (9i + 15j)$

$-2\vec{u} = -6i - 10j$



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Ex:- Prove that the length of $k.u$ equal to ④ Prope

$|k|\cdot|u|$, $\vec{u} = \langle u_1, u_2, u_3 \rangle$.

Sol:-

$k.u = (ku_1, ku_2, ku_3)$

$|ku| = \sqrt{(ku_1)^2 + (ku_2)^2 + (ku_3)^2}$

$|k.u| = \sqrt{k^2.(u_1 + u_2 + u_3)^2}$

$|k.u| = \sqrt{k^2}\left(\sqrt{u_1^2 + u_2^2 + u_3^2}\right)$

$|ku| = |k|\cdot|u|$

③ The difference between vectors (2nd, 5th)

$u - v = u + (-v)$

$u - v \ (u_1 - v_1), (u_2 - v_2), (u_3 - v_3)$.

Ex:- let $u = \langle -1, 3, 1 \rangle$

$v = (4, 7, 0)$ Find ① $2u + 3v$ ② $u - v$

③ $|\frac{1}{3}.v|$

Sol:- $2u = \langle -2, 6, 2 \rangle$, $3v = \langle 12, 21, 0 \rangle$

① $2u + 3v = \langle 10, 27, 2 \rangle$

② $u - v = (-1, 3, 1) - (4, 7, 0)$

$u - v = (-5, -4, 1)$

③ $|\frac{1}{3}.u| = |\frac{1}{3}|.|u|$

$= |\frac{1}{3}|\sqrt{(-1)^2 + (3)^2 + (1)^2} \Rightarrow \frac{1}{3}\cdot\sqrt{11} = \frac{\sqrt{11}}{3}$

نهاية المحاضرة الاولى