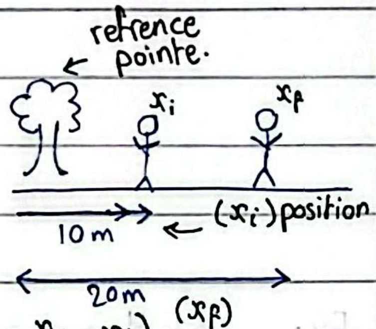
Subject Monday 6/10/2025

* chapter(2) :-

* Motion in 1 Dimention [1D]

Kinematics



① position :-

② Displacement $\boxed{\pm}$: $(\Delta x = x_f - x_i)$

③ Distance $\boxed{+}$ (d = total distance)

④ velocity $\boxed{\pm}$ → $\bar{V} = \frac{\Delta x}{\Delta t}$. average المتوسط

$$\boxed{V = \frac{x_f - x_i}{t_f - t_i}}$$

[Instantaneous] $\boxed{V = \frac{dx}{dt}}$

⑤ speed $\boxed{+}$

$$\boxed{S = \frac{\text{total distance}}{\text{total time}}}$$

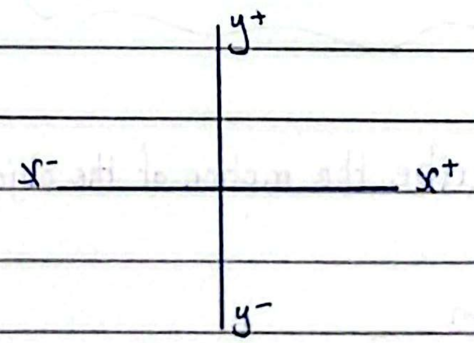
Date No.

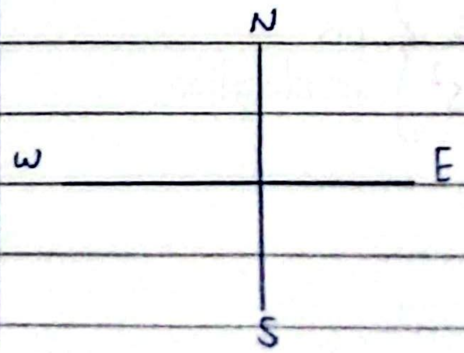
Kinematic دراسة حركة الجسم
refrence point نقطة مرجعية
position موقع
Displacement الإزاحة
Distance المسافة
velocity السرعة
instantaneous السرعة اللحظية
Acceleration التسارع

⑥ Acceleration [a] $\boxed{\pm}$

$$\boxed{\bar{a} = \frac{\Delta V}{\Delta t} = \frac{V_f - V_i}{t_f - t_i}}$$

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



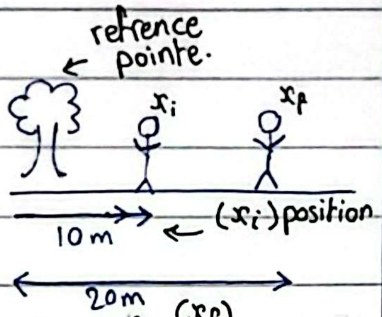


Monday 6/10/2025

* chapter(2):

* Motion in 1 Dimention [1D]

Kinematics



① position :-

② Displacement : $(\Delta x = x_f - x_i)$ ±

③ Distance (d = total distance) +

④ velocity ± → $\bar{v} = \frac{\Delta x}{\Delta t}$. average المتوسط

$$\boxed{v = \frac{x_f - x_i}{t_f - t_i}}$$

[Instantaneous] $\boxed{v = \frac{dx}{dt}}$

⑤ speed +

$$\boxed{S = \frac{\text{total distance}}{\text{total time}}}$$

Kinematic دراسة حركة الجسم
refrence point نقطة مرجعية
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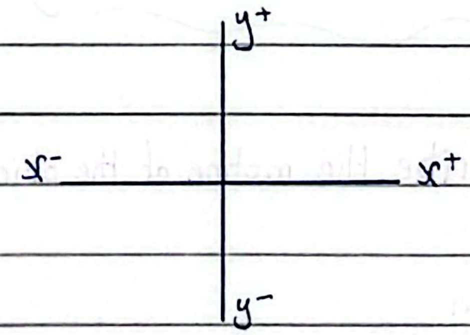
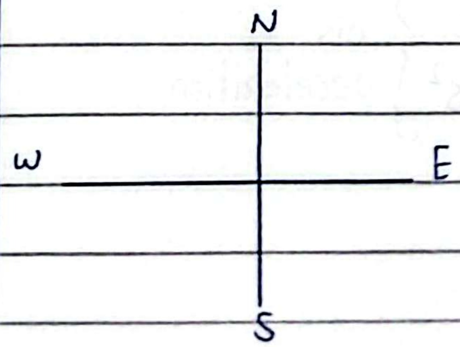
velocity السرعة
instantaneous السرعة اللحظية
Acceleration التسارع

⑥ Acceleration [a] ±

$$\boxed{\bar{a} = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}}$$

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





Subject Monday 6/10/2025

$\Delta x = +, -$

$v = +, -$

$a = +, -$

$a, v \Rightarrow$ same sign

$\left.\begin{matrix} a+, v+ \\ a-, v- \end{matrix}\right\} \Rightarrow$ acceleration تسارع

$a, v \Rightarrow$ opposite sign

$\left.\begin{matrix} a+, v- \\ a-, v+ \end{matrix}\right\} \Rightarrow$ deceleration تباطؤ

* S.I units :

$[x] = m$ $[a] = m/s^2$

$[v] = m/s$ m, s, kg

Ex: describe the motion of the object:

$\left.\begin{matrix} \Delta x = 3m \\ v = 7 m/s \\ a = -2 m/s^2 \end{matrix}\right\}$ deceleration

deceleration تباطؤ

Equation of motion ← معادلات الحركة.

[afkar academy] مرجع للدراسة

Casio 991ES] ← نوع الآلة الحاسبة

Ex: $\left.\begin{matrix} \Delta x = 4m \\ v = -8 m/s \\ a = -10 m/s^2 \end{matrix}\right\}$ acceleration

* Equation of motion :

$\boxed{v_f = v_i + at}$

$\boxed{v_f^2 = v_i^2 - 2a\Delta x}$

$\boxed{\Delta x = v_i t + \frac{1}{2} a t^2}$

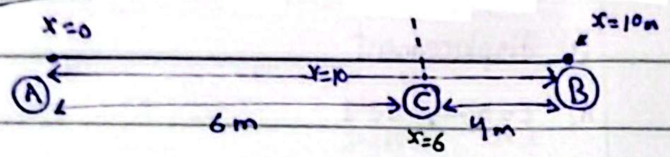
$\bar{x} = \frac{x_f - x_i}{2}$

$\bar{v} = \bar{x} t = \left(\frac{x_f - x_i}{2}\right) t$

* chapter 2 ع pdf الكتاب
page : 21 من أول

Subject: wednesday 8/10/2025

Ex:



① find distance from Ⓐ → Ⓒ

$d = 10 + 4 = 14\ m$

مسافة Ⓐ مسافة Ⓒ

(10) متر (4) متر

② find displacement from Ⓐ → Ⓒ

$\Delta x = x_f - x_i$

$= 6 - 0 = 6m$

Ex:

$x = 4t^2 + 5t + 6$

① displacement : $t=0 \rightarrow t = 1s.$

$x_i = 6$, $x_f = 15$

$\Delta x = x_f - x_i$

$= 15 - 6$

$\Delta x = 9m$

② Average velocity. from $t=0 \rightarrow t=1$

$x_i = 6$, $x_f = 15$

$\bar{v} = \frac{x_f - x_i}{t_f - t_i} = \frac{15-6}{1-0} = 9 m/s$

or

$\bar{v} = \frac{v_1 + v_2}{2} = \frac{5+13}{2} = 9 m/s$

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

$v(0) = 5$

$v(1) = 13$

distance المسافة

Graphical relationship العلاقة البيانية

Freely falling السقوط الحر

Lunched إطلاق

return العودة

③ Average acceleration from $t=0 \rightarrow t=1$

قيم من السؤال اللي قبل

$\bar{a} = \frac{v_f - v_i}{t_f - t_i} = \frac{13-5}{1-0} = 8 m/s^2$

or

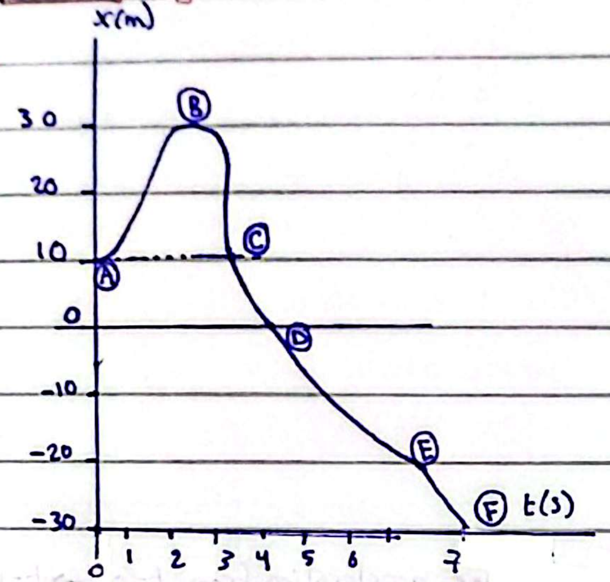
$\bar{a} = \frac{a_1 + a_2}{2}$ $\qquad a = \frac{dv}{dt} = 8$

$\bar{a} = \frac{8+8}{2} = 8\ m/s^2$

N O T E B O O K

wednesday 8/10/2025

Ex: 2.1 page: 24



① $\Delta x = ??$ A → F

$\Delta x = x_f - x_i$

$= -30 - 10$

$= -40 m$

② $\bar{v} = ??$ A → F

$\bar{v} = \frac{x_f - x_i}{t_f - t_i} = \frac{-30-10}{7-0} = \frac{-40}{7}$ m/s

③ speed = ?? A → F

بحسب كل المسافات اللي مشاها الجسم

$S = \frac{\text{total distance}}{\text{total time}} = \frac{80}{7} = 11.4$ m/s

Ex: 2.3 / page: 27

$x(t) = -4t + 2t^2$

① displacement

A) $t=0 \rightarrow t=1$
$x_i = 0 \quad x_f = -2$

$\Delta x = x_f - x_i = -2 - 0 = -2$ m

B) $t=1 \rightarrow t=3$
$x_i = -2 \quad x_f = 6$

$\Delta x = x_f - x_i$

$= 6 - -2 = 8$ m

② average velocity * مطلوب حله بطريقتين هيرد الدكتور بره *

A) $t=0 \longrightarrow t=1s$
$x_i = 0 \quad x_f = -2$

طريقة (1) $\bar{v} = \frac{x_f - x_i}{t_f - t_i} = \frac{-2-0}{1-0} = -2$ m/s

طريقة (2) $\bar{v} = \frac{v_1 + v_2}{2} \qquad v = \frac{dx}{dt} = -4 + 4t$

$= \frac{0 + -4}{2} \qquad v_1(0) = -4$

$= -2$ m/s $\qquad v_2(1) = 0$

③ instantaneous velocity at $t = 2.5s$

$t=2.5$

$v = \frac{dx}{dt} = -4 + 4t = 6$ m/s

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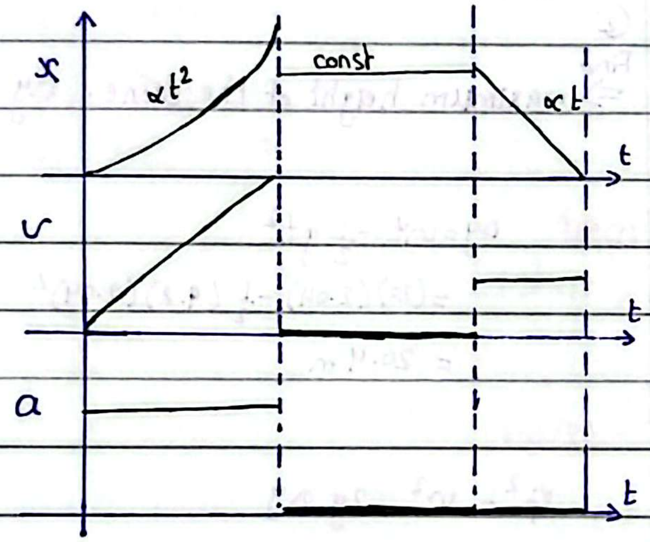
⊠ Graphical Relationship

العلاقة البيانية

$\boxed{x} \xrightarrow{\frac{dx}{dt}} \boxed{v} \xrightarrow{\frac{dv}{dt}} \boxed{a}$

$\xleftarrow{\int v\,dt} \qquad \xleftarrow{\int a\,dt}$



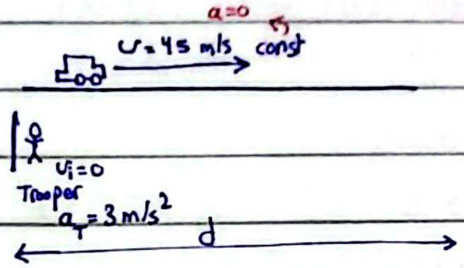
⊠ Equation of motion

*** a [acceleration] must be concstant.

1. $v_f = v_i + at$
2. $v_f^2 = v_i^2 + 2a\Delta x$
3. $\Delta x = v_i t + \frac{1}{2}at^2$
4. $\bar{v} = \frac{v_i + v_f}{2}$
5. $\Delta x = \bar{v}t = \left(\frac{v_i + v_f}{2}\right)t$

very important

$\boxed{\text{Ex : 2.8}}$ page : 39



* How long does it take → Time هنعرف إزاي (t)

$\Delta x_{car} = v_i t + \cancel{\frac{1}{2}\overset{(0)}{a}t^2}$

$\boxed{\Delta x_{car} = v_i t} \rightarrow \boxed{\Delta x_{car} = 45\,t}$

$\Delta x_{Trooper} = \cancel{\overset{(0)}{v_i} t} + \frac{1}{2}at^2$

$\boxed{\Delta x_{Trooper} = \frac{1}{2}at^2}$

$\boxed{\Delta x_{Trooper} = \frac{3}{2}t^2}$

* بما إنه المسافة نفسها اللي قطعها Trooper هي نفسها المسافة اللي قطعها car $[\Delta x_{car} = \Delta x_{Trooper}]$

$45\cancel{t} = \frac{3}{2}t^{\cancel{2}}$.

$\boxed{t = 30}$

مهم

* But Trooper start after 1s .

$t = 30 + 1 \rightarrow \boxed{t_{trooper} = 31\,s}$

N O T E B O O K

Wednesday 8/10/2025

☒ freely falling 80

$\Delta x \longrightarrow \Delta y$

$t \longrightarrow t$

$v_x \longrightarrow v_y$

$a \longrightarrow -g$

$$\boxed{g = 9.8\ m/s^2}$$

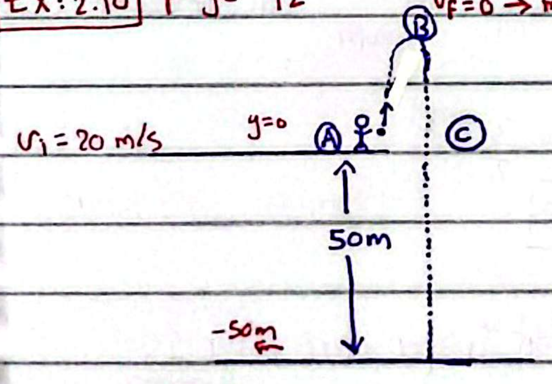
1. $v_f = v_i - gt$
2. $v_f^2 = v_i^2 - 2g\,\Delta y$
3. $\Delta y = v_i t - \frac{1}{2} g t^2$

$\bar{v} = \frac{v_i + v_f}{2}$

$\Delta y = \left(\frac{v_i + v_f}{2}\right) t$

* **Ex: 2.10** page: 42

$v_f = 0 \rightarrow$ max hight



* كيف عرفت إنه الحجر تم رميه للأعلى وليس للأسفل : هون إشارة v بتحدد ، اذا كانت ⊕ الحجر نرمى للأعلى ، اذا كانت ⊖ الحجر نرمى للأسفل . [في تشارع السقوط الحر]

مرتبع

① Find

$\Rightarrow t = ??\ \Rightarrow$ max hight $(v_f = 0)$

$v_f = v_i - gt$

$0 = 20 - (9.8)t$

$$\boxed{t = 2.04\,s}$$

② Find

$\Rightarrow$ maximum height of the stone. Δy

طريقة (1) $\Delta y = v_i t - \frac{1}{2} g t^2$

$= (20)(2.04) - \frac{1}{2}(9.8)(2.04)^2$

$= 20.4\ m$

طريقة (2)

$v_f^2 = v_i^2 - 2g\,\Delta y$

$2g\,\Delta y = v_i^2 - v_f^2$

$\Delta y = \frac{v_i^2 - v_f^2}{2g}$

$\Delta y = \frac{(20)^2 - (0)}{2(9.8)} = 20.4\ m$

* ملاحظة عند الحل إذا كان فيه معادلة فيها جميع المعطيات هادي السؤال عدا المعطى الي بدي اجاوب عليه بفضل استخدامها على استخدام معادلة ثانية يكون انا طالعت واحد من معطياتها في فرع قبل .

* سأل الدكتور إذا ؟
بدل 5 m خلّ يوصل
الأرض فهون بتصير
بالوسط
Δy مش -50

Subject: wednesday 8/10/2025 [redacted] Date No.

Ex: 2-10

تابع للصفحة الي →

③ ⇒ At point Ⓒ find $v_f = ??$ $\Delta y = 0$

↑ لأن الجسم رجع لنقطة البداية

$$v_f^2 = v_i^2 - 2g\cancel{\Delta y}^{(0)}$$

$$v_f^2 = (20)^2$$

$$\sqrt{v_f^2} = \sqrt{400}$$

$v_f = \pm 20$ → $v_f = +20$ (Lunched) إطلاق

→ $v_i = -20$ (return) العودة

هذا الجواب

* ملاحظة لما يطلب الـ velocity وتكون إطلاق Lunched ↑ تكون ⊕

اما لما يطلب velocity وتكون عودة return ↓ تكون ⊖

④ ⇒ Find the velocity and position of stone at $t = 5s$

$\left.\begin{matrix}\Delta y\ ?\\ v\end{matrix}\right\}$ $t = 5s$

$$v_f = v_i - gt$$
$$= 20 - 9.8(5)$$
$$= -29\ m/s$$

$$\Delta y = v_i t - \frac{1}{2}gt^2$$
$$= 20(5) - \frac{1}{2}(9.8)(5)^2$$
$$= -22.5\ m$$

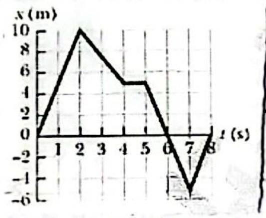
⑤ ⇒ velocity befor reach the grand.

$\Delta y = -5\ m$

$$v_f^2 = v_i^2 - 2g\Delta y$$
$$= (20)^2 + 2(9.8)(+50)$$
$$= 1380\ m/s$$

☒ اسئلة على chapter 2 من الدكتور 8ص

1 The position versus time for a certain particle moving along the x-axis is shown in Figure, Find the averag velocity in the time intervals



(a) 0 to 2s

$$\bar{v} = \frac{x_f - x_i}{t_f - t_i} = \frac{10-0}{2-0} = 5\ m/s$$

(b) 0 to 4s :- $\bar{v} = \frac{5-0}{4-0} = 1.25\ m/s$

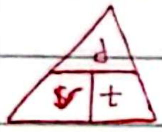
(c) 2s to 4s :- $\bar{v} = \frac{5-10}{4-2} = -2.5\ m/s$

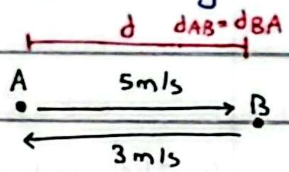
(d) 4s to 7s :- $\bar{v} = \frac{-5-5}{7-4} = -3.3\ m/s$

(e) 0 to 8s :- $\bar{v} = \frac{0-0}{8-0} = 0\ m/s$

Monday 13/10/2025

[3] A person walks first at a constant speed of 5 m/s along a straight line from point (A) to point (B) and then back along the line from (B) to (A) at a constant speed of 3 m/s.
(a) what is her average speed over the entire trip? (b) what is her average velocity over the entire trip?





(a) average speed = $\frac{\text{total distanc}}{\text{total time}}$

$$S = \frac{d_{AB} + d_{BA}}{t_{AB} + t_{BA}} = \frac{2d}{\left(\frac{d}{v_{AB}} + \frac{d}{v_{BA}}\right)}$$

$$S = \frac{2d}{\frac{d v_{BA} + d v_{AB}}{v_{AB} \cdot v_{BA}}} = \frac{2\cancel{d}\,(\overset{5}{v_{AB}} \cdot \overset{3}{v_{BA}})}{\cancel{d}\,(\overset{3}{v_{BA}} + \overset{5}{v_{AB}})}$$

$$S = \frac{30}{8} = 3.75 \text{ m/s}$$

الازاحة صفر لأنه راح ورجع لنفس النقطة

(b) $\bar{v} = \frac{\Delta x}{\Delta t} = \frac{0-0}{\Delta t} = 0$

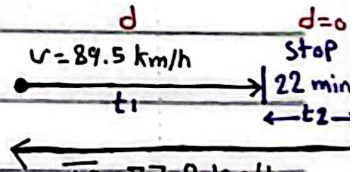
[4] A particle moves according to the equation $x = 10t^2$, where x is in meters and t is in seconds. (a) Find the average velocity for the time interval from 2s to 3s. (b) Find the average velocity for the time interval from 2s to 2.10s.

(a) $\bar{v} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i} = \frac{90-40}{3-2} = 50$ m/s

(b) $\bar{v} = \frac{44.1-40}{2.10-2} = 41$ m/s

[13] A person takes a trip, driving with a constant speed of 89.5 km/h for a 22 min rest stop. If the person's average speed is 77.8 km/h, (a) how much time is spent on the trip and (b) how far does the person travel?

22 min $\left(\frac{1h}{60 min}\right)$ = 0.3667h



(b) $S = \frac{d_1 + 0}{t_1 + t_2}$

$$77.8 = \frac{d_1}{\frac{d_1}{89.5} + \frac{0.3667 \cdot 89.5}{89.5}} \Rightarrow 77.8 = \frac{89.5\, d_1}{d + 32.82}$$

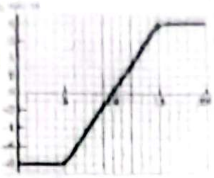
$\boxed{d_1 = 219}$

(a) $t_1 = \frac{d_1}{v} = \frac{219}{89.5} = \boxed{2.45\,h}$

NOTEBOOK

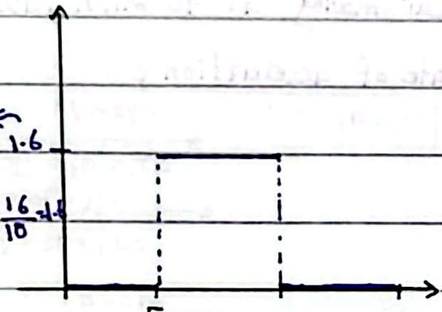
Monday 13/10/2025

[15] A velocity-time graph for an object moving along the x-axis is shown in Figure. (a) Plot a graph of the acceleration versus time. Determine the average acceleration of the object (b) in the time interval $t = 5s$ to $t = 15s$ and (c) in the time interval $t = 0$ to $t = 20s$.



(a)

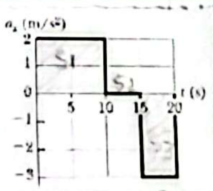
$\bar{a} = \frac{v_f - v_i}{t_f - t_i} = \frac{8 - -8}{15 - 5} = \frac{16}{10} = 1.6$



(b) $\bar{a} = \frac{v_f - v_i}{t_f - t_i} = \frac{8 - -8}{15 - 5} = 1.6 \ m/s^2$

(c) $\bar{a} = \frac{8 - (-8)}{20 - 0} = 0.8 \ m/s^2$

[19] A particle starts from rest ($v_i = 0$) and accelerates as shown in Figure. Determine (a) the particle's speed at $t = 10s$ and at $t = 20s$ and (b) the distance traveled in the first 20s.



(a) Speed ⇒ Area under curve.

$S_1 = (2)(10) = 20 \ m/s$

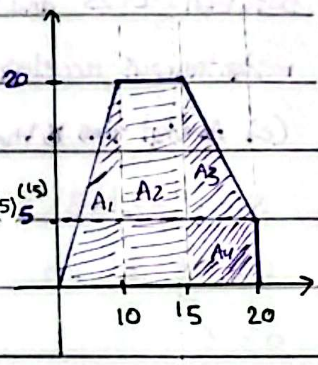
$S_2 = 0$

$S_3 = (-3)(5) = -15$

at $t = 10s$ ⇒ $S = 20 \ m/s$

at $t = 20$ ⇒ $S = S_1 + S_2 + S_3 = 20 + 0 + -15 = 5 \ m/s$.

(b) distance from $t=0 \rightarrow t = 20$ Area under v curve.



$d = A_1 + A_2 + A_3 + A_4$

$= \frac{1}{2}(10)(20) + (20)(5) + (\frac{1}{2})(5)(15) + (5)(5)$

$= 100 + 100 + 37.5 + 25$

$d = 262.5 \ m$

Monday 13/1/2025

[20] An object moves along the x axis according to the equation $x=3t^2-2t+3$, where x is in meters and t is in seconds. Determine (a) the average velocity between t=2s and t=3s, (b) the instantaneous velocity at t=2s and t=3s, (c) the average acceleration between t=2s and t=3s. and (d) the instantaneous acceleration at t=2s and t=3s

(e) At what time is the object at rest? ($v=0$)

$x=3t^2-2t+3 \quad x(2)=11 \quad / \quad x(3)=24$

$v=6t-2 \quad v(2)=10 \,/\, v(3)=16$

$a=6$

(c) $\bar{a}=\dfrac{v_f-v_i}{t_f-t_i}=\dfrac{16-10}{3-2}=6\ m/s^2$

(d) $a=\dfrac{dv}{dt}=6$

$\left.\begin{aligned} a(2)&=6\,m/s^2 \\ a(3)&=6\,m/s^2 \end{aligned}\right\} \Rightarrow$ constant acceleration

(a) $\bar{v}=\dfrac{x_f-x_i}{t_f-t_i}=\dfrac{24-11}{3-2}=13\ m/s$

(b) $v=\dfrac{dx}{dt}$

$v(2)=10\ m/s$

$v(3)=16\,m/s$

(e) $v=0 \Rightarrow t=??$

$0=6t-2 \Rightarrow 6t=2 \Rightarrow \boxed{t=0.33}$

* [24] The minimum (الحد الأدنى) distance required to stop a car moving at 35 mi/h is 40ft. what is the minimum stopping distance for the same car moving at 70 mi/h, assuming the same rate of acceleration?

$\boxed{a_1=a_2=a}$

$v_{i_1}=35\,mi/h$ ⟶ stop $v_{f_1}=0$

$\Delta x_1=d_1=40ft$

$v_{i_2}=70\ mi/h$ ⟶ stop $v_{f_2}=0$

$\Delta x_2=d_2=??$

$\cancel{v_{f_1}^2}=v_{i_1}^2+2a_1\Delta x_1 \qquad \boxed{v_{i_1}^2=-2a\Delta x_1}$

$\cancel{v_{f_2}^2}=v_{i_2}^2+2a_2\Delta x_2 \qquad \boxed{v_{i_2}^2=-2a_2\Delta x_2}$

$\dfrac{v_{i_1}^2}{v_{i_2}^2}=\dfrac{\cancel{-2a_1}\Delta x_1}{\cancel{-2a_2}\Delta x_2} \Rightarrow \Delta x_2=\dfrac{\Delta x_1 v_{i_2}^2}{v_{i_1}^2}$

$\Delta x_2=\dfrac{40(70)^2}{(35)^2}$

$\boxed{\Delta x_2=160\,ft}$

Subject Monday 13 / 01 / 2025 Date No.

[38] A particle moves along the x-axis. Its position is given by the equation $x = 2+3t-4t^2$, $v = 3-8t$ / $a = -8$ with x in meters and t in seconds. Determine (a) its position when it changes direction and (b) its velocity when it returns to the position it had at $\boxed{t=0}$.

(a) $0 = 3-8t$ $\quad v_f = 0$

$8t = 3 \Rightarrow \boxed{t = 0.375}$

$x = 2+3(0.375)-4(0.375)^2$

$\boxed{x = 2.56 \text{ m}}$

(b) $v_f = ??$ when $\Delta x = 0$ [return to initial position]

$\boxed{t=0}$ $x(0) = 2m$
$v(0) = 3$
$a(0) = -8$

$v_f^2 = v_i^2 \cancel{+2a\Delta x}$

$v_f^2 = (3^2) \Rightarrow \sqrt{v_f^2} = \sqrt{9} \Rightarrow v_f = \pm 3$

$\cancel{v_f = 3}$ $\quad v_f = -3$

[return]

[42] A baseball is hit so that it travels straight upward after being struck by the bat. A fan observes that it takes 3s for the ball to reach its maximum height. Find (a) the ball's initial velocity and (b) the height it reches.

$v_f = 0$ max hight
$t = 3s$
$v_i = ??$

(a) $v_i = ??$

$v_f = v_i - gt$

$0 = v_i - (9.8)(3)$

$\boxed{v_i = 29.4 \text{ m/s}}$

(b) $\Delta y = ??$

$\Delta y = v_i t - \frac{1}{2} g t^2$

$= (29.4)(3) - \frac{1}{2}(9.8)(3)^2$

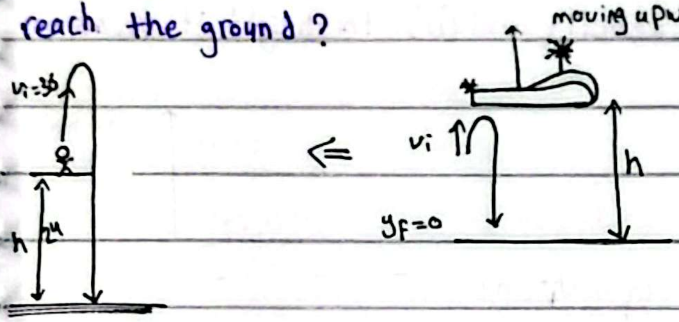
$\Delta y = 88.2 - 44.1$

$\boxed{\Delta y = 44.1 \text{ m/s}}$

Monday 13/10/2025

$\boxed{50}$ The height of a helicopter above the ground is given by $h = 3t^3$, where h is in meters and t is in seconds. At $t = 2s$. The helicopter releases a small mailbag.

How long after its release does the mailbag reach the ground? ($t = ??$)



$h = 3t^3$ at $\boxed{t=2}$

$v = 9t^2$

$v(2) = 9(2)^2 = 36$ m/s

$h(2) = 3(2)^3 = 24$m

$\Delta y = v_i t - \frac{1}{2} g t^2$

لأن الكتلة تحت الزيرو ← $-24 = 36\,t - \frac{1}{2}(9.8)\,t^2$

$4.9t^2 - 36t - 24 = 0$ } حل الآلة الحاسبة

$\boxed{t_1 = 7.96\ s}$ * نكبس على SETUP ثم رقم 5 وبعده رقم 3 :

نهمل $\cancel{t_2 = -0.61}$

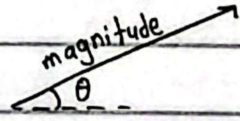
Chapter $\boxed{3}$ vectors,

physical Quantity

- scalar Quantits → magnitude
- victor Quantits → magnitude, direction

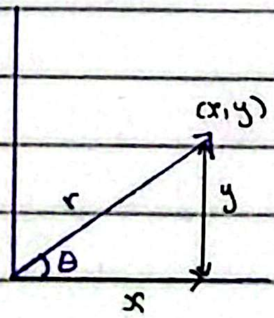
* scaler : Temprature / mass / Volume / work / Time / speed / distance.

* vectors : Force / accelerats / velocity / displacement / momentum / pressure.

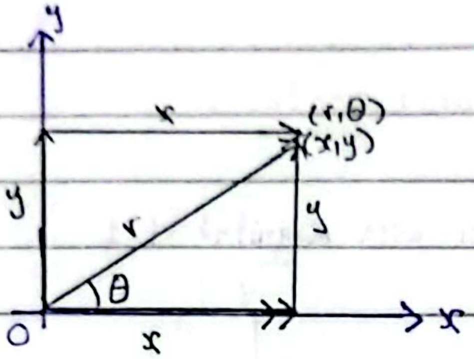


(x,y) = cartesian

(r,θ) = Polar



wednesday 15/10/2025



$\sin\theta = \frac{y}{r}$, $\cos\theta = \frac{x}{r}$

$\boxed{y = r\sin\theta}$ $\boxed{x = r\cos\theta}$

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

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

* ملاحظة لما نطلع قيمة زاوية على الآلة الحاسبة يجب تحويل الآلة الحاسبة إلى نظام
* (D) ~~...~~ الدرجات

Ex:

polar → cartesian

$P(\underset{r}{5}, \underset{\theta}{30^\circ}) \longrightarrow (x, y)$

$x = r\cos\theta = 5\cos 30 = 4.33$

$y = r\sin\theta = 5\sin 30 = 2.5$

$(4.3, 2.5)$

Ex: $P(4,3) \longrightarrow (r, \theta)$

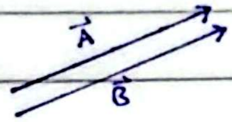
$r = \sqrt{x^2+y^2} = \sqrt{(4)^2 + (3)^2} = 5$

$\theta = \tan^{-1}\left(\frac{3}{4}\right) = 36.8^\circ$

$P(5, 36.8^\circ)$

* some vectors properties خصائص

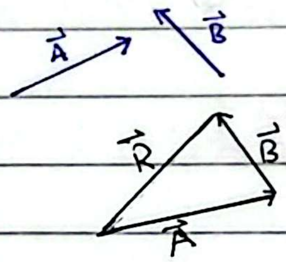
1. Equality :-



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

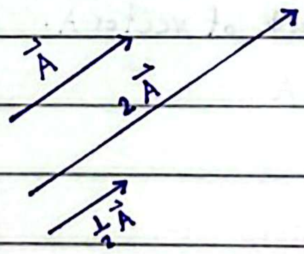
2. Adding vectors

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

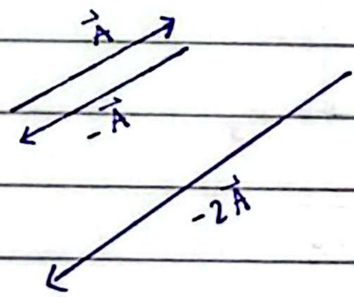


$\vec{R} = \vec{A} + \vec{B}$

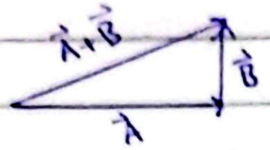
3. multiplication with Constant (scaler) ضرب



4. Negative vector

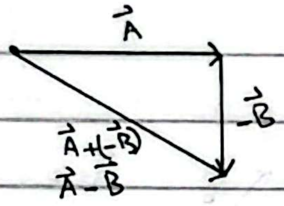


wednesday 15/10/2025



$\vec{A} - \vec{B}$

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



صيغة الكتابة/طريقة الكتابة

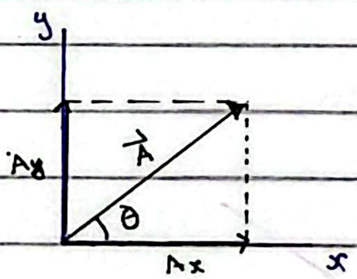
⊛ Vector Notation :-

$\vec{A}$ = The vetor A

$|\vec{A}|$ = The magnitude of vector A.

A = magnitude of A

⊛ Component of vectors :-

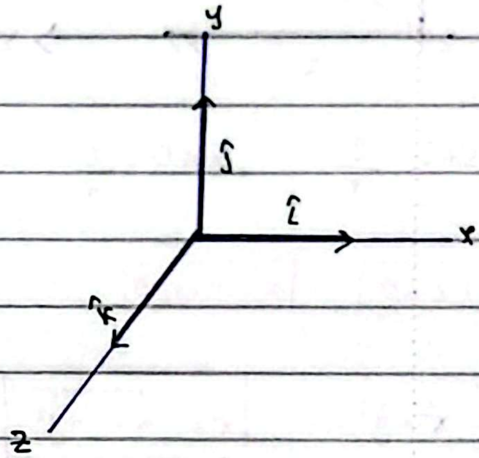


$$|\vec{A}| = \sqrt{A_x^2 + A_y^2}$$

$$\theta = \tan^{-1}\left(\frac{A_y}{A_x}\right)$$

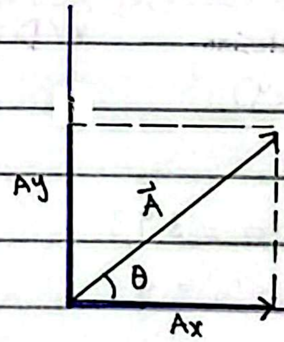
⊛ unit vector 80

vector with magnitud of 1



$\hat{i}, \hat{j}, \hat{k}$ = unit vector

$|\hat{i}| = |\hat{j}| = |\hat{k}| = 1$



$$\boxed{\vec{A} = A_x\hat{i} + A_y\hat{j}}$$

$$|\vec{A}| = \sqrt{A_x^2 + A_y^2}$$

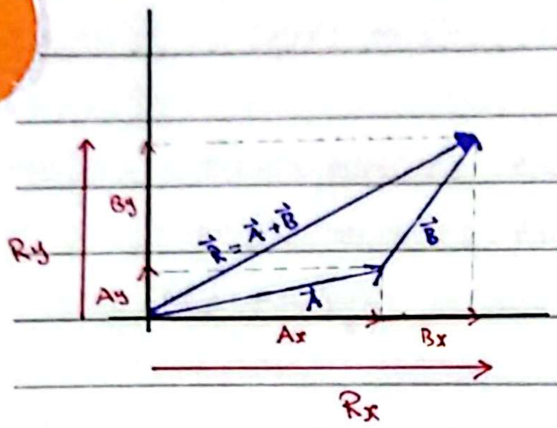
$$\theta = \tan^{-1}\left(\frac{A_y}{A_x}\right)$$

pvopertes خصائص

maltiplication ضرب

vector Notation صيغة الكتابة/طريقة الكتابة

Subject wednesday 15/10/2025



$\vec{R} = R_x \hat{i} + R_y \hat{j}$

$\vec{A} + \vec{B} = (A_x + B_x)\hat{i} + (A_y + B_y)\hat{j}$

$|\vec{A} + \vec{B}| = \sqrt{(A_x + B_x)^2 + (A_y + B_y)^2}$

Ex: $\vec{A} = 5\hat{i} + 6\hat{j}$

$\vec{B} = 3\hat{i} - 4\hat{j}$

$\vec{A} + \vec{B} = (5+3)\hat{i} + (6+-4)\hat{j} = 8\hat{i} + 2\hat{j}$

دائمًا + بالخط نستعملها في الأصل حتى لو كانا سالب (-)

دائمًا (+)

$\vec{A} - \vec{B} = (5-3)\hat{i} + (6-{-4})\hat{j} = 2\hat{i} + 10\hat{j}$

دائمًا (+)

$\vec{B} - \vec{A} = (3-5)\hat{i} + (-4-6)\hat{j} = -2\hat{i} - 10\hat{j}$

$\vec{A} - 2\vec{B} = (5-2(3))\hat{i} + (6-2(-4))\hat{j}$

$= -\hat{i} + 14\hat{j}$

يتبع

الربع الأول (4,2)

1) $|\vec{A} + \vec{B}| = \sqrt{2^2 + 4^2} = 2.9$

$\theta = \tan^{-1}\left(\frac{2}{4}\right) = 26.5$

2) $|\vec{A} - \vec{B}| = \sqrt{(2)^2 + (10^2)} = 10.2$

الربع الأول (2,10)

$\theta = \tan^{-1}\left(\frac{10}{2}\right) = 78.6$

الربع الثالث (-2,-10)

3) $|\vec{B} - \vec{A}| = \sqrt{(-2)^2 + (-10)^2} = 10.2$

$\theta = \tan^{-1}\left(\frac{10}{2}\right) = 78.6 + 180 = 258.6$

4) $|\vec{A} - 2\vec{B}| = \sqrt{(-1)^2 + (14)^2} = 14.04$

(-1,14) الربع الثاني

$\theta = \tan^{-1}\left(\frac{14}{1}\right) = 85.9$

$\theta = 180 - 85.9 = 94.1$

(*) $\vec{A} \cdot \vec{B}$ dot product (ضرب) chapter 7

(*) $\vec{A} \times \vec{B}$ crox product physics 2

(*) Dot product ::

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

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

$$\left.\begin{array}{l} \hat{i}\cdot\hat{i} = 1 \\ \hat{j}\cdot\hat{j} = 1 \\ \hat{k}\cdot\hat{k} = 1 \end{array}\right\} \qquad \left.\begin{array}{l} \hat{i}\cdot\hat{j} = \hat{i}\cdot\hat{k} = 0 \\ \hat{j}\cdot\hat{k} = \hat{j}\cdot\hat{i} = 0 \\ \hat{k}\cdot\hat{i} = \hat{k}\cdot\hat{j} = 0 \end{array}\right\}$$

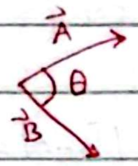
$$\boxed{\vec{A}\cdot\vec{B} = A_x B_x + A_y B_y + A_z B_z}$$

Wednesday 15/10/2025

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

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

$\theta = \cos^{-1}\left(\dfrac{\vec{A} \cdot \vec{B}}{|\vec{A}||\vec{B}|}\right)$



(*) أسئلة من الدكتور على chapter 3 : problems

cartesion نفس الي

[2] The rectangular coordinates of a point are given by (2, y), and its polar coordinates (r, 30°). Determine (a) the value of y and (b) the value of r.

(a) $y = r \sin\theta = r \sin 30$

$y = 2.3\ (0.5) = \boxed{1.15}$

r = ??

$x = r\cos\theta$

$2 = r \cos 30 \quad \frac{\sqrt{3}}{2}$

$\boxed{r = 2.3}$

[4] Two points in a plane have polar coordinates (2.50 m, 30°) and (3.80 m, 120°). Determine (a) the cartesian coordinates of these point and (b) the distance between them.

مستوى

المسافة بين النقطتين

(a)

$P_1\ (2.50, 30^\circ) \longrightarrow (x, y)$

$x = r\cos\theta = 2.50 \cos 30 = 2.17 \quad \boxed{x = 2.17}\ m$

$y = r\sin\theta = 2.50 \sin 30 = 1.25 \quad \boxed{y = 1.25}\ m$

$P_1\ (2.17, 1.25)$ → Cartesian

$P_2\ (3.80, 120^\circ) \rightarrow (x, y)$

$x = r\cos\theta = 3.80 \cos 120 = -1.9$ m

$y = r\sin\theta = 3.80 \sin 120 = 3.29$ m

$P_2\ (-1.9, 3.29)$

(b) Distance between them ⇒ r

$r = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$

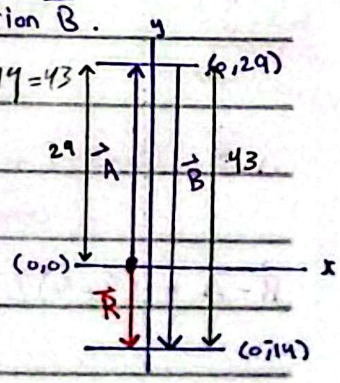
$r = \sqrt{\underbrace{(2.17 - -1.9)^2}_{16.6} + \underbrace{(1.25 - 3.29)^2}_{4.16}}$

$r = \sqrt{20.76}$

$\boxed{r = 4.55\ m}$

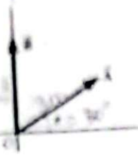
[8] vector $\vec{A}$ has a magnitude of 29 units and points in the positive y direction. when vector $\vec{B}$ is added to $\vec{A}$, the resultant vector $\vec{A} + \vec{B}$ point in the negative y direction with a magnitude of 14 units, Find the magnitude and direction $\vec{B}$.

$\left.\begin{array}{l} \vec{A} = 29\hat{j} \\ \vec{B} = -43\hat{j} \end{array}\right\}$ $|\vec{B}| = 29 + 14 = 43$



Monday 20/10/2025

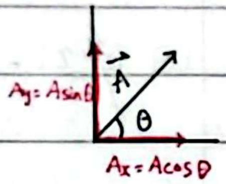
[11] The displacement vector $\vec{A}$ and $\vec{B}$ shows in figure both have magnitudes of 3m. The direction of vector $\vec{A}$ is $\theta = 30°$, find graphically (a) $\vec{A}+\vec{B}$, (b) $\vec{A}-\vec{B}$, (c) $\vec{B}-\vec{A}$, and (d) $\vec{A}-2\vec{B}$. [Report all angles counterclockwise from positive x-axis].



$\vec{A} = 3\cos 30\,\hat{i} + 3\sin 30\,\hat{j}$

$\boxed{\vec{A} = 2.6\hat{i} + 1.5\hat{j}}$

$\vec{B} = 0\hat{i} + 3\hat{j}$



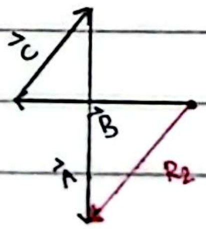
(a) $\vec{A}+\vec{B} = 2.6\hat{i} + 4.5\hat{j}$

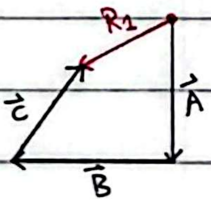
(b) $\vec{A}-\vec{B} = 2.6\hat{i} - 1.5\hat{j}$

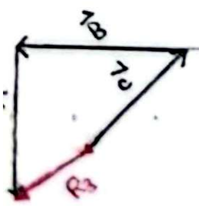
(c) $\vec{B}-\vec{A} = -2.6\hat{i} + 1.5\hat{j}$

(d) $\vec{A}-2\vec{B} = 2.6\hat{i} - 4.5\hat{j}$

[12] Three displacements are $\vec{A} = 200$m due south, $\vec{B} = 250$m due west, and $\vec{C} = 150$m at 30° east of north. (a) Constructe a separate diagram for each of the following possible ways of adding these vectors: $\vec{R}_1 = \vec{A}+\vec{B}+\vec{C}$, $\vec{R}_2 = \vec{B}+\vec{C}+\vec{A}$, $\vec{R}_3 = \vec{C}+\vec{B}+\vec{A}$. (b) Explain what you can conclude from comaring the diagrams.







[19] A vector has an x component of -25 units and a y compnent 40 units. Find the magnitude and direction of this vector.

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

الاحداثيات (-25,40)

$|\vec{A}| = \sqrt{(25)^2 + (40)^2} = 47.2$

$\phi = \tan^{-1}\left(\frac{40}{25}\right) = 57.9$

$\theta = 180 - 57.9 = 122.01$

[23] Consider the two vectors $\vec{A} = 3\hat{i} - 2\hat{j}$ and $\vec{B} = -\hat{i} - 4\hat{j}$. Calculate (a) $\vec{A}+\vec{B}$, (b) $\vec{A}-\vec{B}$ (c) $|\vec{A}+\vec{B}|$, (d) $|\vec{A}-\vec{B}|$, and (e) the direction of $\vec{A}+\vec{B}$ and $\vec{A}-\vec{B}$.

(a) $\vec{A}+\vec{B} = 2\hat{i} - 6\hat{j}$

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

(c) $|\vec{A}+\vec{B}| = \sqrt{(2)^2 + (-6)^2} = 6.3$

(d) $|\vec{A}-\vec{B}| = \sqrt{(4)^2 + (2)^2} = 4.5$

(e) → direction $\vec{A}+\vec{B}$

الاحداثيات (2,-6)

$\phi = \tan^{-1}\left(\frac{6}{2}\right) = 71.6$

$\theta = 360 - 71.6 = 288.4°$

→ direction $\vec{A}-\vec{B}$

الاحداثيات (4,2)

$\theta = \tan^{-1}\left(\frac{2}{4}\right) = 26.6°$

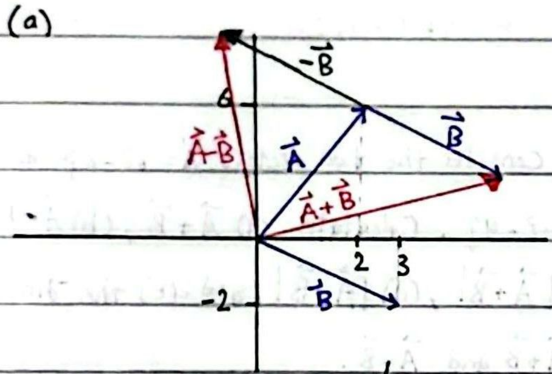
* الدكتور ما بدو θ
بدو ال directions

N O T E B O O K

Monday 20/10/2025

26 Given the vectors $\vec{A} = 2\hat{i} + 6\hat{j}$ and $\vec{B} = 3\hat{i} - 2\hat{j}$ (a) draw the vector sum $\vec{C} = \vec{A} + \vec{B}$ and the vector difference $\vec{D} = \vec{A} - \vec{B}$. (b) Calculate $\vec{C}$ and $\vec{D}$, in terms of unit vector. (c) calculate $\vec{C}$ and $\vec{D}$ in terms of polar coordinates, with angles measured with respect to the positive x-axis.

(a)



(b) $\vec{C} = \vec{A} + \vec{B} \Rightarrow \boxed{\vec{C} = 5\hat{i} + 4\hat{j}}$ / $\vec{D} = \vec{A} - \vec{B} \Rightarrow \boxed{\vec{D} = -\hat{i} + 8\hat{j}}$

(c) $\vec{C} \Rightarrow r = \sqrt{(5)^2 + (4)^2} = 6.4$ — الربع الأول $(5, 4)$

$\theta = \tan^{-1}\left(\frac{4}{5}\right) = 38.7$

$\vec{C}\ (6.4, 38.7^\circ) \rightarrow$ polar coordinates

$\vec{D} \Rightarrow r = \sqrt{(-1)^2 + (8)^2} = 8.1$ — الربع الثاني $(-1, 8)$

$\phi = \tan^{-1}\left(\frac{8}{1}\right) = 82.9$

$\theta = 180 - 82.9 = 97.1$

$\vec{D}\ (8.1, 97.1^\circ) \rightarrow$ polar coordinates

31 Consider the three displacement vectors $\vec{A} = 3\hat{i} - 3\hat{j}$, $\vec{B} = \hat{i} - 4\hat{j}$, and $\vec{C} = -2\hat{i} + 5\hat{j}$. Use the component method to determine (a) the magnitude and direction of $\vec{D} = \vec{A} + \vec{B} + \vec{C}$ and (b) the magnitude and direction of $\vec{E} = -\vec{A} - \vec{B} + \vec{C}$

(a) $\vec{D} = 2\hat{i} - 2\hat{j}$

$|\vec{D}| = \sqrt{(2)^2 + (2)^2} = 2.8$ — الربع الرابع $(2, -2)$

$\phi = \tan^{-1}\left(\frac{2}{2}\right) = 45$

$\theta = 360 - 45 = 315^\circ$

(b) $\vec{E} = -6\hat{i} + 12\hat{j}$ — الربع الثاني $(-6, 12)$

$|\vec{E}| = \sqrt{(6)^2 + (12)^2} = 13.4$

$\phi = \tan^{-1}\left(\frac{12}{-6}\right) = 63.4$

$\theta = 180 - 63.4 = 116.6^\circ$

34 Vector $\vec{B}$ has x, y and z components of 4, 6, and 3 units, respectively: Calculate (a) the magnitude of $\vec{B}$ and (b) the angle that $\vec{B}$ makes with each coordinate axis.

a) $\vec{B} = 4\hat{i} + 6\hat{j} + 3\hat{k}$

$|\vec{B}| = \sqrt{(4)^2 + (6)^2 + (3)^2} = 7.8$

b)

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$\boxed{37}$ (a) Taking $\vec{A} = 6\hat{i} - 8\hat{j}$ units, $B = -8\hat{i}+3\hat{j}$ units, and $\vec{C} = 26\hat{i} + 19\hat{j}$ units, determine a and b such that $a\vec{A} + b\vec{B} + \vec{C} = 0$. (b) A

(a) $(6a - 8b + 26 = 0) \times 8$

$(-8a + 3b + 19 = 0) \times 6$

$\cancel{48a} - 64b + 208 = 0$

$-\cancel{48a} + 18b + 114 = 0$

$-46b + 322 = 0$

$\boxed{b = 7}$

$\boxed{a = 5.4}$

(b) $A = \sqrt{(6)^2 + (-8)^2} = 10$

$\vec{R} = \vec{d_1} + \vec{d_2} + \vec{d_3} + \vec{d_4}$

$= (100 + -300 - 130 - 100)\hat{i} + (-300 + -75 + 173)\hat{j}$

$= -130\hat{i} - 202\hat{j}$

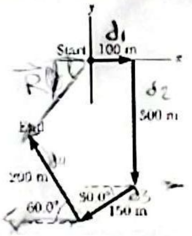
$|\vec{R}| = \sqrt{(-130)^2 + (-202)^2} = 240\,m$

$\emptyset = \tan^{-1}\left(\frac{202}{130}\right) = 57.2$

$(-130, -202)$

$$\boxed{\begin{gathered}\theta = 57.2 + 180 \\ \theta = 237.2\end{gathered}}$$

$\boxed{51}$ A person going for awalk follows the path shown in Figure, The total trip consists of four straight line paths. At the end of the walk, what is the person's resultant displacement measured from the starting poit ?



$d_1 = 100\hat{i}$

$d_2 = 300\cos \overset{90}{\cancel{270}}\,\hat{i} + 300\sin \overset{90}{\cancel{270}}\,\hat{j} \Rightarrow d_2 = -300\hat{j}$

$d_3 = -150\cos 30\,\hat{i} + -150\sin 30\,\hat{j} \Rightarrow d_3 = -130\hat{i} - 75\hat{j}$

$d_4 = -200\cos 60\,\hat{i} + 200\sin 60\,\hat{j} \Rightarrow d_4 = -100\hat{i} + 173\hat{j}$

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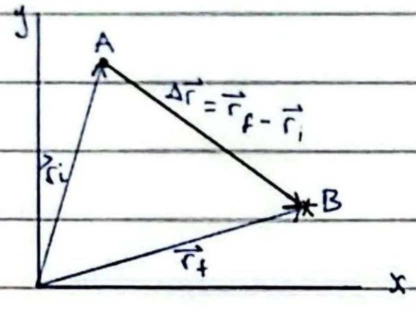
Chapter 4 Motion in 2D



① displacement :

$$\Delta\vec{r} = \vec{r}_f - \vec{r}_i$$

$$\Delta\vec{r} = \Delta x\,\hat{i} + \Delta y\,\hat{j}$$

$$\boxed{r = x\hat{i} + y\hat{j}}$$

② velocity

$$\boxed{\vec{V}_{avg} = \frac{\Delta\vec{r}}{\Delta t}}$$

$$= \frac{\Delta x}{\Delta t}\hat{i} + \frac{\Delta y}{\Delta t}\hat{j}$$

$$\boxed{\vec{V}_{avg} = \vec{V}_x\hat{i} + \vec{V}_y\hat{j}}$$

$$\vec{V} = \frac{d\vec{r}}{dt}$$

$$= \frac{dx}{dt}\hat{i} + \frac{dy}{dt}\hat{j}$$

③ Acceleration

$$\vec{a}_{avg} = \frac{\Delta\vec{V}}{\Delta t}$$

$$= \frac{\Delta V_x}{\Delta t}\hat{i} + \frac{\Delta V_y}{\Delta t}\hat{j}$$

$$\vec{a} = \frac{d\vec{V}}{dt}$$

$$= \frac{dV_x}{dt}\hat{i} + \frac{dV_y}{dt}\hat{j}$$

* speed : $|\vec{V}| = \text{speed}$

④ Equation of Motion :

a must be constant :

$$\boxed{\vec{V}_f = \vec{V}_0 + \vec{a}t} \rightarrow \vec{V}_{fx} = \vec{V}_{0x} + \vec{a}_x t,\quad \vec{V}_{fy} = \vec{V}_{0y} + \vec{a}_y t$$

$$\boxed{V_f^2 = V_0^2 + 2\vec{a}\,\Delta\vec{r}} \rightarrow V_{fx}^2 = V_{0x}^2 + 2a_x\Delta x,\quad V_{fy}^2 = V_{0y}^2 + 2a_y\Delta y$$

$$\boxed{\Delta\vec{r} = \vec{V}_0 t + \frac{1}{2}\vec{a}t^2} \rightarrow \Delta x = V_{0x}t + \frac{1}{2}a_x t^2,\quad \Delta y = V_{0y} + \frac{1}{2}a_y t^2$$

$$\vec{V}_{avg} = \frac{1}{2}(\vec{V}_0 + \vec{V}_f)$$

$$\Delta\vec{r} = \frac{1}{2}(\vec{V}_0 + \vec{V}_f)t$$

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$\vec{v}_f \begin{cases} \to v_{fx} \\ \to v_{fy} \end{cases}$ $\quad v_0 \begin{cases} \to v_{0x} \\ \to v_{0y} \end{cases}$

$\vec{a} \begin{cases} \to a_x \\ \to a_y \end{cases}$ $\quad \Delta\vec{r} \begin{cases} \to \Delta r \\ \to \Delta y \end{cases}$

t is the same.

Ex: $\boxed{4.1}$ / page: 83

A particle moves in xy plane, starting from the origion at $t=0$ ($x_i = y_i = 0$) with an initial velocity having an x component of $20\,m/s$ ($v_x = 20\,m/s$) and a y component of $-15\,m/s$ ($v_{0y} = -15\,m/s$). The particle experiences an acceleration in the x direction. given by $\boxed{a_x = 4}\,m/s^2$ $\boxed{a_y = 0}$

طالما ماذكرش
هنعتبرها صفر

A) Determine the total velocity vector at any time.

$\vec{v}_f(t)$ at any time $\boxed{t=t}$

$v_{fx} = v_{0x} + a_x t$ $\qquad v_{fy} = v_{0y} + \cancel{a_y}^{0} t$

$\boxed{v_{fx} = 20 + 4t}$ $\qquad \boxed{v_{fy} = -15}$

$\boxed{\vec{v}_f(t) = (20+4t)\hat{i} - 15\hat{j}}$

OR $\vec{v}_f = \vec{v}_i + \vec{a}t$

$\vec{v}_f = (20\hat{i} - 15\hat{j}) + 4t\hat{i}$

$\boxed{\vec{v}_f(t) = (20+4t)\hat{i} - 15\hat{j}}$

B) Calculate the velocity and speed of particle at $t=5\,s$ and the angle the velocity vector makes with the x-axis.

$\vec{v}(5) = (20+4(5))\hat{i} - 15\hat{j} = 40\hat{i} - 15\hat{j}$

→ angle the velocity vector makes with the x-axis:

$\theta = \tan^{-1}\left(\frac{v_{fy}}{v_{fx}}\right) = \tan^{-1}\left(\frac{-15}{40}\right) = -21$

→ speed $= |\vec{v}| = \sqrt{v_{xf}^2 + v_{yf}^2} = \sqrt{(40)^2 + (-15)^2}$

$|\vec{v}| = 43\,m/s$

c) Determine the x and y coordinate of the particle at any time t and its position vector at this time.

$\Delta x = v_{0x} t + \frac{1}{2} a_x t^2$

$x_f - \cancel{x_i}^{0} =$

$x_f = v_{0x} t + \frac{1}{2} a_x t^2$

$= 20t + \frac{1}{2}(4)t^2$

$\boxed{x_f = 20t + 2t^2}$

$\Delta y = v_{0y} t + \frac{1}{2} \cancel{a_y}^{0} t^2$ ($y_f - \cancel{y_i}^{0}$)

$\boxed{y_f = -15t}$

→ position vector at this time.

$\vec{r}_f = x_f \hat{i} + y_f \hat{j}$

$\boxed{\vec{r}_f = (20t + 2t^2)\hat{i} + (-15)\hat{j}}$

N O T E B O O K