No.

Date

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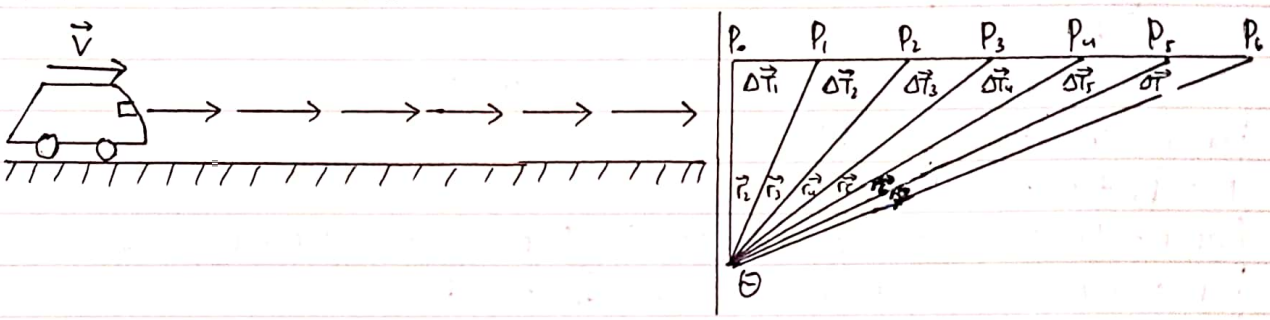
NPM : 2013022030
Prodi : Pendidikan Fisika
Kelas : B

Uji Pemahaman Konsep 1: Kinematika

① Gerak Lurus Beraturan.



$P_0, P_1, P_2, P_3, P_4, P_5$, dan P_6 merupakan posisi benda saat t_1, t_2, t_3, t_4, t_5, dan t_6 dengan vektor posisi terhadap Θ yaitu $\vec{r}_1, \vec{r}_2, \vec{r}_3, \ldots$ dan perpindahan $\Delta T_1, \Delta T_2, \Delta T_3, \ldots$.

ΔT_1 ditempuh dalam waktu $\Delta t_1 = t_1 - t$

ΔT_2 ditempuh dalam waktu $\Delta t_2 = t_2 - t_1$ dst.

Karena benda bergerak lurus beraturan, maka:

$\Delta T_1 = \Delta T_2 = \Delta T_3 = \ldots = \Delta T$ } konstan

$\Delta t_1 = \Delta t_2 = \Delta t_3 = \ldots = \Delta t$ }

Persamaan lintasan di titik P $\rightarrow \vec{r} = \vec{r}_0 + \Delta\vec{r} = \vec{r}_0 + \Delta\vec{r}\,\hat{e}r$

$\hat{e}r$ = vektor satuan perpindahan $\Delta\vec{r}$

$\Delta\vec{r}$ = tetap dalam selang waktu Δt yang sama

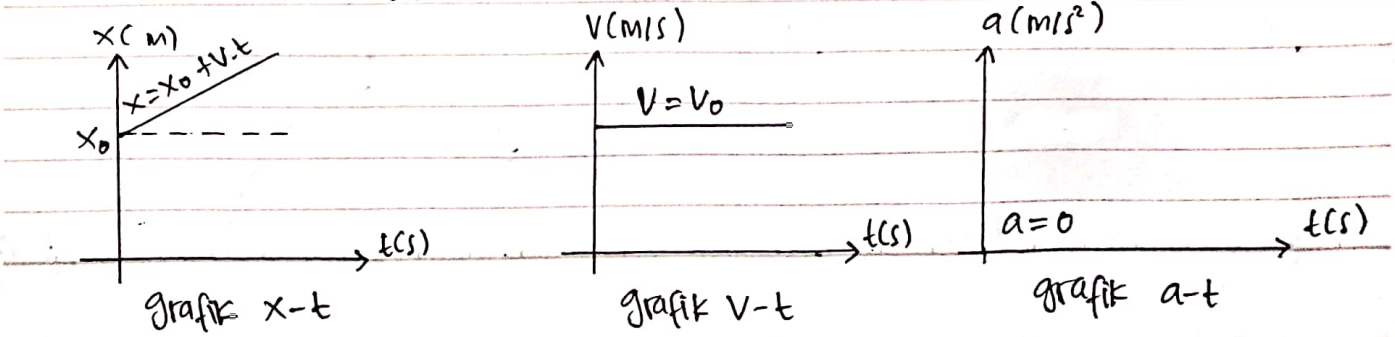
Kecepatan gerak dalam selang $\Delta t \rightarrow V = \frac{\Delta r}{\Delta t}$ = konstan, $\Delta r = V.\Delta t$

Sehingga vektor posisi menjadi $\vec{r} = \vec{r}_0 + Vt\hat{e}r$

$x(t) = V(x).t$ atau $y(t) = Vy.t$

$V(t) = \frac{dx(t)}{dt} = Vx = C$ = konstan

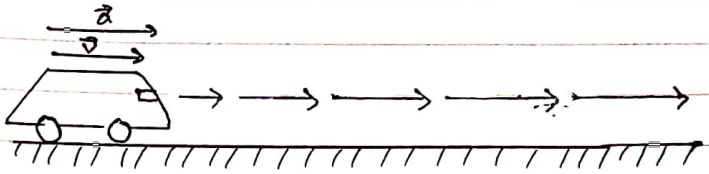
$at = \frac{dV(t)}{dt} = \frac{d(C)}{dt} = 0$

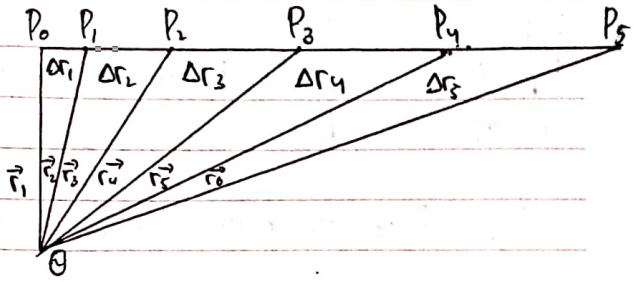


No.

Date

② Gerak Lurus Berubah Beraturan.





Jarak yang ditempuh berbanding lurus dengan kuadrat waktu, maka:

$x = c \cdot t^2$

c = konstanta tak bergantung pada waktu

Persamaan lintasan titik P

$\vec{r} = \vec{r_0} + \Delta\vec{r} = \vec{r_0} + ct^2\hat{i}$

Karena lintasan lurus, maka ditulis tanpa tanda vektor → $x_t = x_0 + ct^2$

Persamaan kecepatan benda $V_t = \frac{dx}{dt} = 2ct$

Persamaan percepatan benda $a_t = \frac{dV_t}{dt} = 2c$

Tetapi jika benda bergerak dengan kecepatan awal V_0, persamaannya menjadi :

$x = x_0 + V_0 t + \frac{1}{2}at^2$

$V_x = V_0 + at$

$V_x^2 = V_0^2 + 2a(x - x_0)$

$V_{(t)} = \frac{V_0 + V_x}{2}$

atau

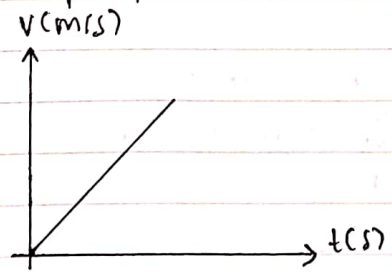
$s = s_0 + V_0 t + \frac{1}{2}at^2$

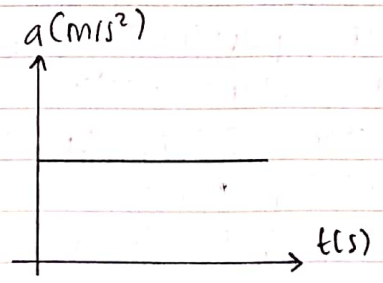
$V = V_0 + at$

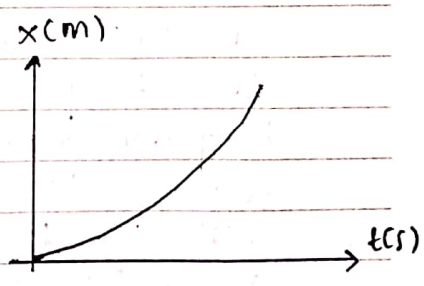
$V^2 = V_0^2 + 2a(s - s_0)$

$V_r = \frac{V_0 + V}{2}$

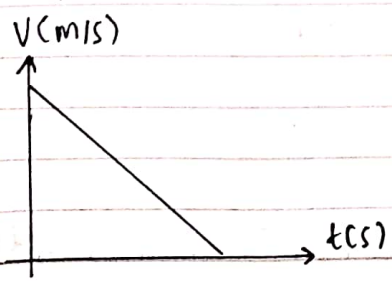
Dipercepat

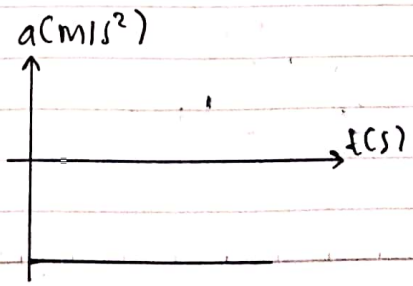


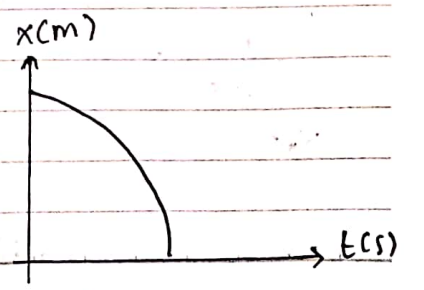




Diperlambat



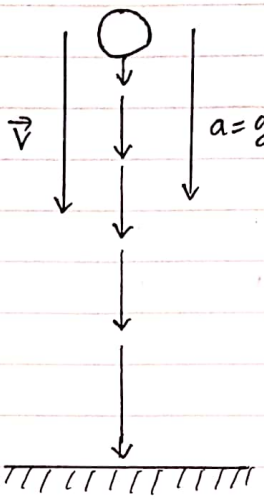




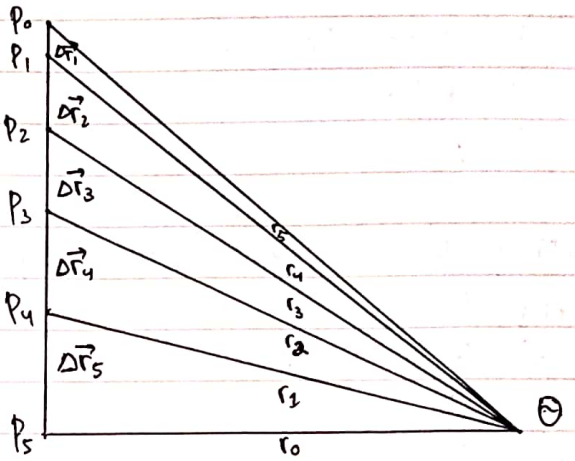
No.

Date

③ Gerak Vertikal ke bawah



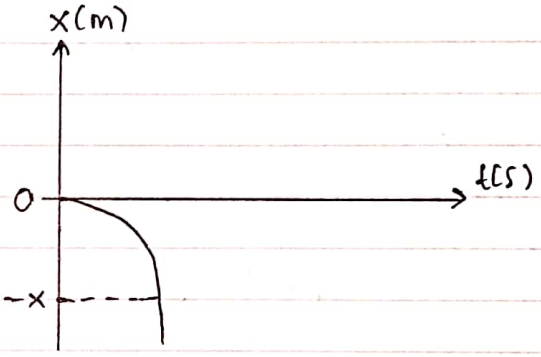
$V \neq 0$

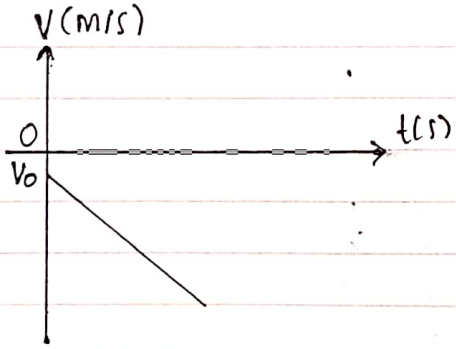


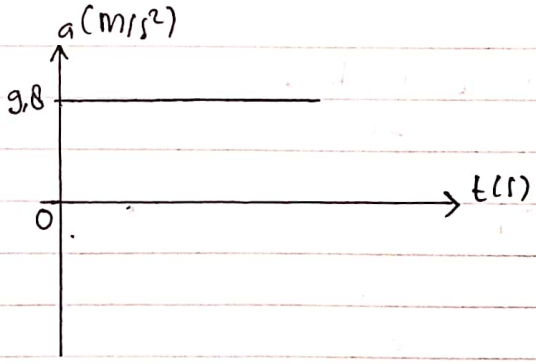
$V_t = V_0 + gt$

$V_t^2 = V_0^2 + 2gh$

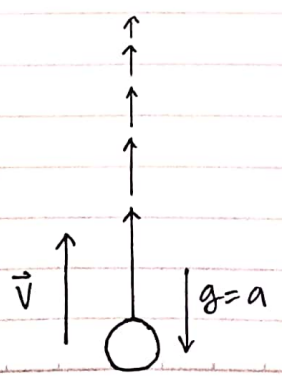
$h = V_0 t + \frac{1}{2} g t^2$

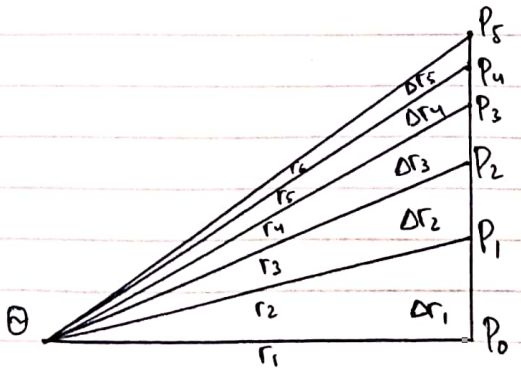






④ Gerak Vertikal ke atas





No.

Date

Ketika bergerak dengan kecepatan awal V_0, persamaan lintasannya:

$$x = x_0 + V_0 t + \frac{1}{2} a t^2$$

$$V_x = V_0 + a$$

$$V_x^2 = V_0^2 + 2a\,(x - x_0)$$

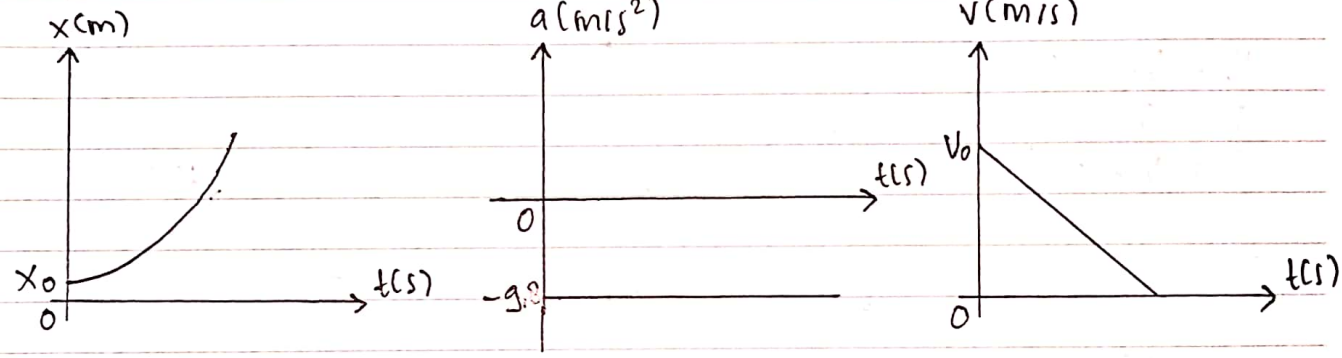
$$V_r = \frac{V_0 + V_x}{2}$$

Ketika benda bergerak tanpa kecepatan awal $V_0 = 0$ persamaannya menjadi:

$$x = x_0 + \frac{1}{2} a t^2$$

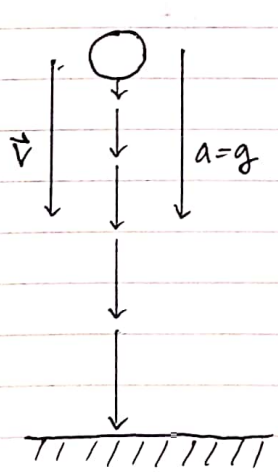
$$V_x = at$$

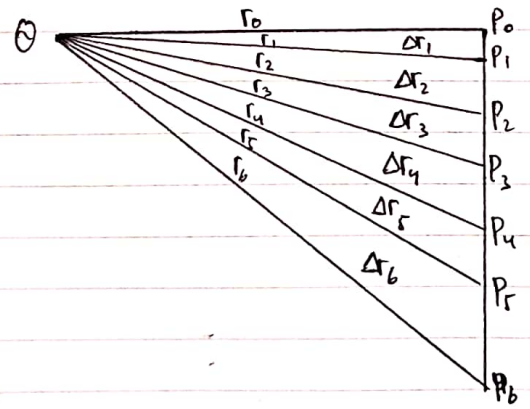
$$V_x^2 = 2a\,(x - x_0)$$



⑤ Gerak Jatuh Bebas

$V_0 = 0$





No.

Date

Jarak berbanding lurus dengan kuadrat waktu $y = ct^2$ (c = konstan)

Persamaan lintasan titik P

$\vec{r} = \vec{r}_0 + \Delta\vec{r} = \vec{r}_0 + ct^2\hat{j}$

Dapat ditulis tanpa tanda vektor

$y = y_0 + ct^2$

Persamaan kecepatan benda

$v_y = \frac{dy}{dt} = 2ct$

Persamaan percepatan benda

$a_y = \frac{dv_y}{dt} = 2c = g \longrightarrow c = \frac{1}{2}g$

Persamaan lintasan benda jatuh bebas menjadi

$y = y_0 + \frac{1}{2}gt^2$

$v_y = gt$

$a_y = g = 9{,}8\ m/s^2$

Jika ditinjau pada titik tinjau yang berimpit dengan P_0

$y = \frac{1}{2}gt^2$ dan $v_y = gt$

jadi, $t = \frac{v_y}{g}$, $v_y^2 = 2gy$ atau $v_y = \sqrt{2gy}$

Benda jatuh bebas ($v_0 = 0$)

$x = x_0 t + \frac{1}{2}at^2$ atau $s = s_0 + \frac{1}{2}at^2$

$v_x = at$ atau $v = at$

$v_x^2 = 2a(x - x_0)$ atau $v^2 = 2a(s - s_0)$

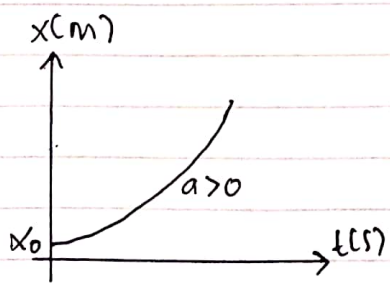
Benda jatuh bebas (v_0)

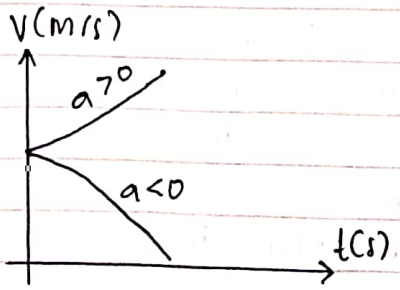
$x = x_0 + v_0 t + \frac{1}{2}at^2$ atau $s = s_0 + v_0 t + \frac{1}{2}at^2$

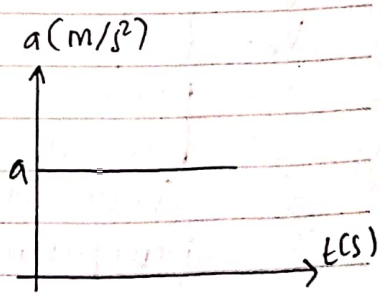
$v_x = v_0 + at$ atau $v = v_0 + at$

$v_x^2 = v_0^2 + 2a(x - x_0)$ atau $v^2 = v_0^2 + 2a(s - s_0)$

$v_r = \frac{v_0 + v_x}{2}$ atau $v_r = \frac{v_0 + v}{2}$



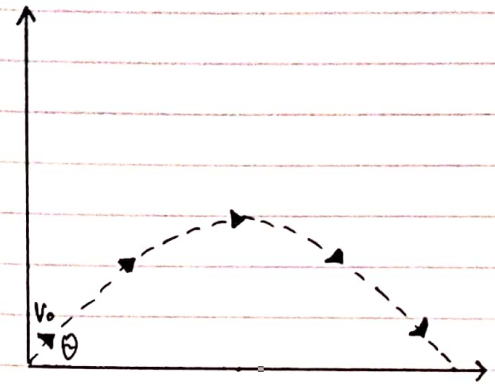




No.

Date

⑥ Gerak Parabola



Kecepatan di sembarang titik

$V = \sqrt{(V_x)^2 + (V_y)^2}$	Kecepatan (V_x, V_y)	
	Sumbu x	Sumbu y
Kondisi awal	$V_0 \cos\theta$	$V_0 \sin\theta$
Saat t sekon	$V_0 \cos\theta$	$V_0 \sin\theta - gt$

Kecepatan saat t sekon

	Kedudukan (x,y)		waktu yg dipakai
	Sumbu x	Sumbu y	
Kondisi awal	0	0	0
Saat t sekon	$x = V_0 \cos\theta\, t$	$y = V_0 \sin\theta - t - \frac{1}{2}gt^2$	t
Pada titik tertinggi	$x = \frac{V_0^2 \sin 2\theta}{g}$	$y_{max} = \frac{V_0^2 \sin^2\theta}{2g}$	$t = \frac{V_0 \sin\theta}{g}$
Pada titik terjauh	$x_{max} = \frac{V_0^2 \sin 2\theta}{g}$	0	$t = 2\frac{V_0 \sin\theta}{g}$

Keterangan :

V_0 = kecepatan awal (m/s)
V_x = kecepatan arah sumbu x (m/s)
V_y = kecepatan arah sumbu y (m/s)
x = posisi di sumbu x (m)
y = posisi di sumbu y (m)
θ = sudut elevasi
g = percepatan gravitasi (m/s^2)