KOÇ UNIVERSITY
College of Arts and Sciences
PHYS 101 General Physics 1

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Quiz 1.2:
On a distant planet where the gravitational acceleration is $4 m/s^2$, s ball is thrown upwards from the ground with initial velocity 10 *m/s*. Calculate the elapsed time between the two moments when the ball was 8*m* high from the ground. Is the speed of the particle the same at these two moments?

$$y - y_0 = V_0 t + \frac{1}{2} a t^2$$

$$8 = 10t - \frac{1}{2} 4 t^2 \Rightarrow 2t^2 - 10t + 8 = 0$$

$$\boxed{t_1 = 4s} \quad \boxed{t_2 = 1s}$$

At $t = 1s$ the ball is at the height of 8m for the first time, then it reaches to a maximum and fall to the same point at $t = 4s$. So the time difference is 3s.

Speeds are the same but velocities differ in direction.

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Quiz 1.3:
A driver driving his car with 20 m/s speed suddenly notices another car in front of him that is moving with a slower constant speed in the same direction. At that instant, the driver starts to brake with constant acceleration for 5 seconds, and reduces his speed to 10 m/s. The car at the front was moving with constant speed all the time. If the cars have barely avoided a collision, calculate the initial distance between the two cars. Plot the $v_x - t$ graphs for the both cars.

$a = \frac{V_f - V_i}{t} = \frac{10-20}{5}$

$\boxed{a = -2 m/s^2}$

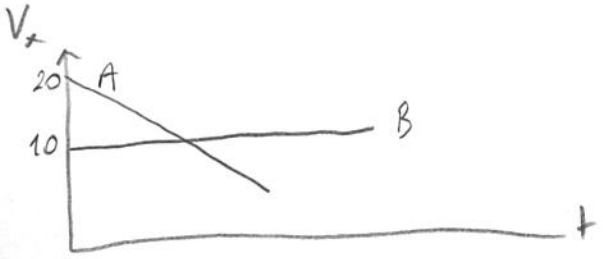
First car $X + Y = 20.5 - \frac{1}{2}.2.25$

$\boxed{X + Y = 75}$

Second car $Y = 5V$

So $\boxed{X = 75 - 5V}$

(if you assumed the velocity of the second car is $V = 10 m/s$ the result will be $\boxed{X = 25 m}$)



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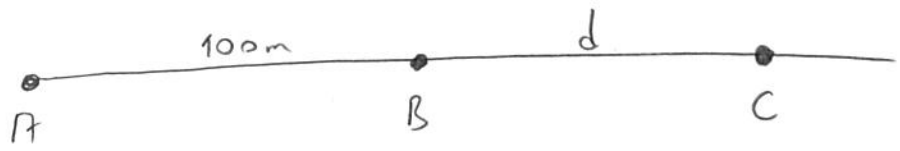
Quiz 1.4:
Two cars with a distance of 100m between them are moving in the same direction with the same speed. At t = 0 s, The cars start to apply constant acceleration with the same magnitude but in opposite directions, simultaneously. At the 5th second, the cars are at the same position, and one of the cars is stopping. Calculate the velocity of the moving car at the 5th second.



$100 + d = V_0 \cdot 5 + \frac{1}{2} a \cdot 25$

$-\quad d = V_0 5 - \frac{1}{2} a \cdot 25$

$100 = 25a \Rightarrow \boxed{a = 4 m/s^2}$

For the second car ; $V = V_0 - at = 0$

$V_0 = at = 5 \cdot 4 = 20 m/s$

For the first car ; $V = V_0 + at = 20 + 5 \cdot 4 = 40 m/s$

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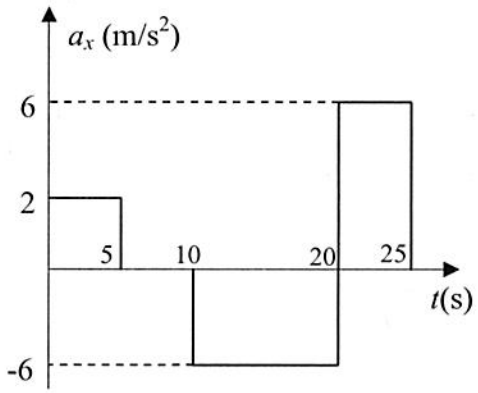
Quiz 1.5:
A car is initially at the origin and moving with initial velocity v_{0x} in the positive x direction. The acceleration of the car in time is given in the figure below. At the 25th second, the car is stopping at its initial position. Calculate the initial velocity of the car, and plot the v_x – t graph of the car. Calculate the *average speed* of the car.



$V = V_0 + at$

at $t=0$ $V = V_{0x}$

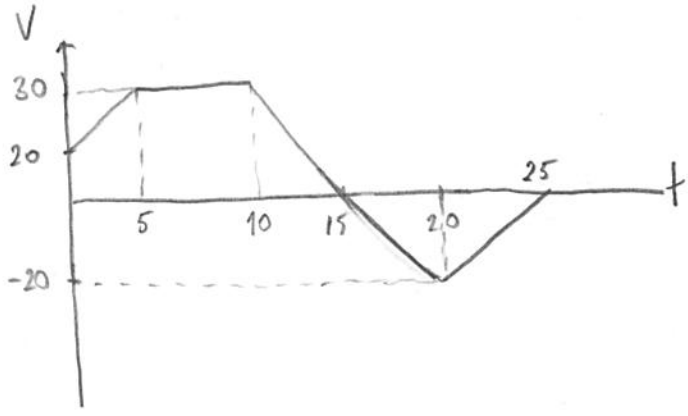
at $t=5s$ $V_1 = V_{0x} + 10$

at $t=10s$ $V_2 = V_{0x} + 10$

at $t=20s$ $V_3 = V_{0x} + 10 - 60 = V_{0x} - 50$

at $t=25s$ $V_4 = V_{0x} - 50 + 30 = V_{0x} - 20$

if $V_4 = 0 \Rightarrow V_{0x} - 20 = 0 \Rightarrow \underline{V_{0x} = 20 m/s}$



the total area under the graph is equal to the distance the car traveled

$V_{av} = \frac{X_t}{t} = \frac{500}{25} = \underline{20 m/s}$

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Quiz 1.1:
A particle at rest starts to free fall from an initial height of h from the ground. It bounces from the ground at an instant, goes up to a height $h/4$, and then falls again and comes to rest on the ground. Plot the $v_y - t$, and $y - t$ graphs as accurately as possible for the entire motion, where y is the vertical coordinate of the particle. In your graphs, determine and show the maximum, zero and minimum values of the velocity and the corresponding time and vertical coordinates of the particle in terms of h and gravitational acceleration, g.

V_1: the velocity of the particle when it reaches to the ground for the first time.

V_2: the velocity of the particle after it bounces from the ground

V_3: the velocity of the particle when it reaches to $\frac{h}{4}$ ($V_3 = 0$)

V_4: the velocity of the particle when it reaches to the ground for the second time

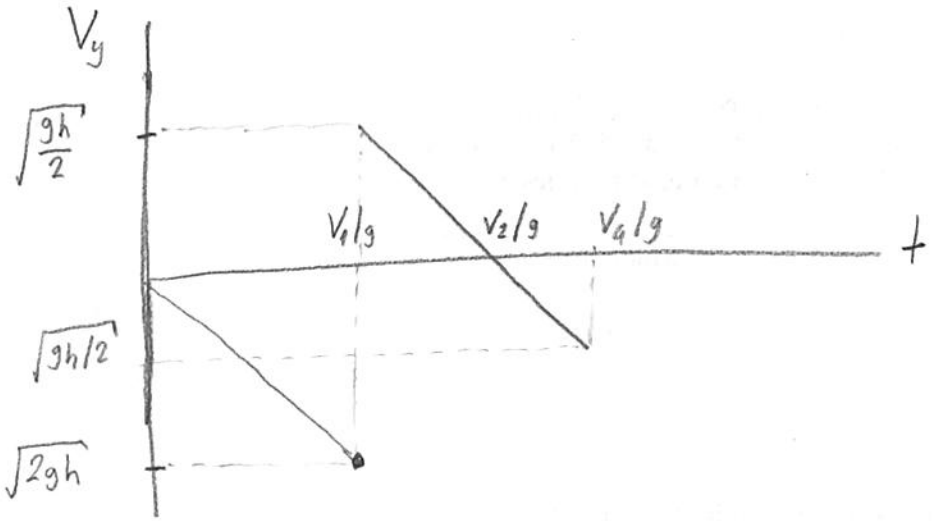
$V_1^2 = V_0^2 + 2gh \Rightarrow \boxed{V_1 = \sqrt{2gh}}$, $V_1 = V_0 + gt_1 \Rightarrow \boxed{t_1 = \frac{V_1}{g}}$

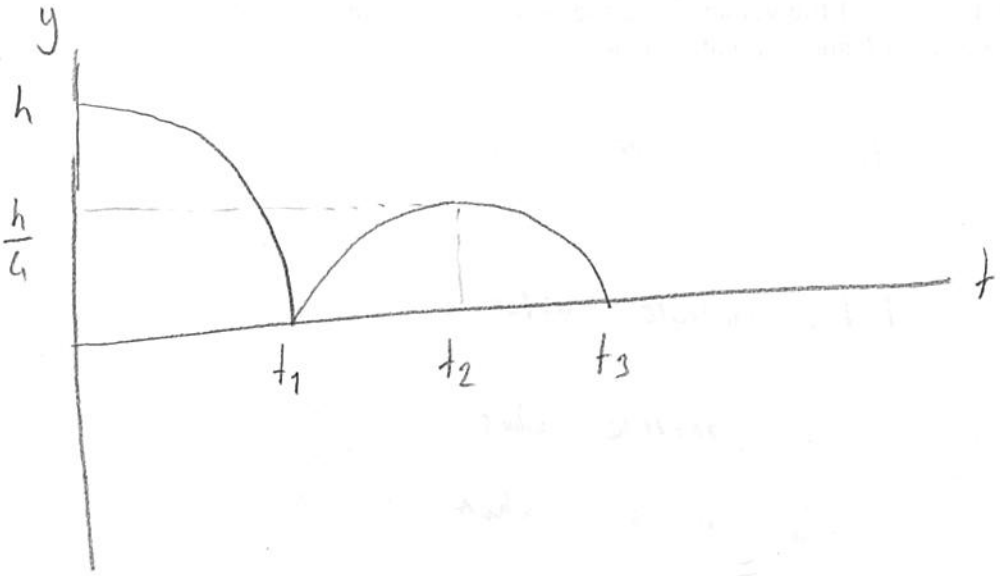
$V_3^2 = V_2^2 - 2g\frac{h}{4} = 0 \Rightarrow \boxed{V_2 = \sqrt{\frac{gh}{2}}}$ $\boxed{t_1 = \sqrt{\frac{2h}{g}}}$

$V_3 = V_2 - gt_2 = 0 \Rightarrow \boxed{t_2 = \frac{V_2}{g}}$, $\boxed{t_2 = \sqrt{\frac{h}{2g}}}$

$V_4^2 = V_3^2 + 2g\frac{h}{4} \Rightarrow \boxed{V_4 = \sqrt{\frac{gh}{2}}}$, $V_4 = V_3 + gt_3 \Rightarrow \boxed{t_3 = \frac{V_4}{g}}$

$\boxed{t_3 = \sqrt{\frac{h}{2g}}}$


V_y
$\sqrt{\frac{gh}{2}}$
V_1/g
V_2/g
V_4/g
t
$\sqrt{gh/2}$
$\sqrt{2gh}$


y
h
$\frac{h}{4}$
t
t_1
t_2
t_3