PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Fall Semester 2013**

College of Arts and Sciences

Section **Quiz 1** **3 October 2013**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

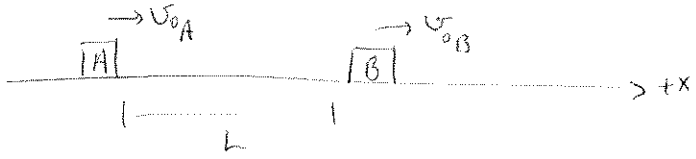
Name: **Student ID:** **Signature:**

Two cars, A and B, are moving in the $+\hat{x}$ direction with speeds v_{0A} and v_{0B}, where $v_{0A} > v_{0B}$. At t = 0s, the distance between the cars is L.

1. Determine the minimum acceleration of car A to avoid collision with car B, while car B continues to move with constant velocity. Express your answer in terms of given variables.
2. Plot the velocity of two cars as a function of time on the same graph qualitatively.

at $t=0$ s

$v_{0A} > v_{0B}$



$v_{relative\ initial}$ = vel. of car A wrt. car B

$= v_{0A} - v_{0B}$

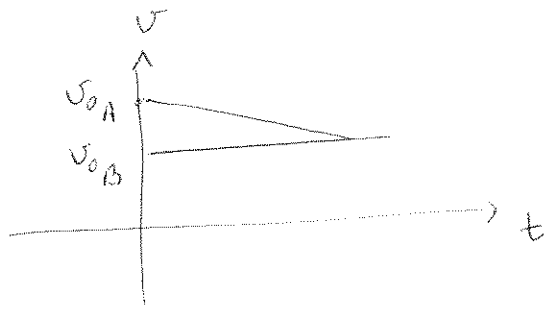
$v_{relative\ final} = 0$

$v_x^2 = v_{0x}^2 + 2a_x(x - x_0)$

$v_{relative\ final}^2 = v_{relative\ initial}^2 + 2a_x(x - x_0)$

$0 = (v_{0A} - v_{0B})^2 + 2aL$

$a = -\dfrac{(v_{0A} - v_{0B})^2}{2L}$



PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Fall Semester 2013**

College of Arts and Sciences

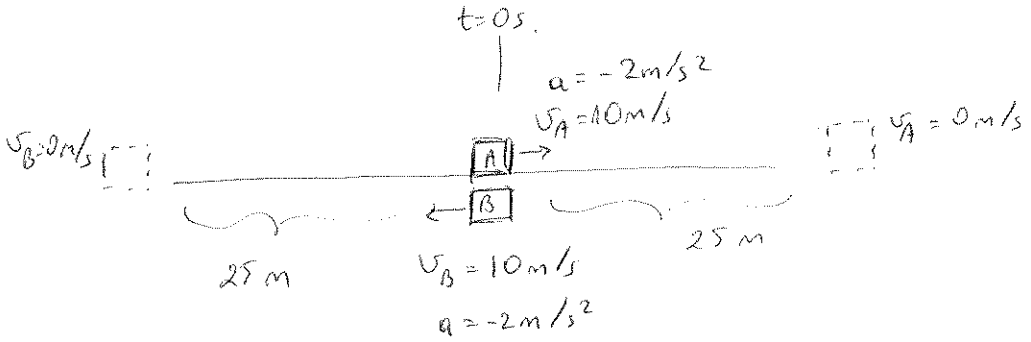
Section **Quiz 2** **3 October 2013**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

Two cars moving with same speed 10 m/s but in the opposite directions pass each other at t = 0. At that instant they both start to slow down with the same magnitude of acceleration 2 m/s^2.

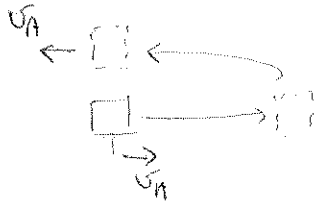
1. What is the maximum distance between the cars? How long does it take them to be at the same position again?
2. Plot the position vs. time graph of the cars qualitatively.



$$v_x^2 = v_{0x}^2 + 2a_x(x - x_0)$$

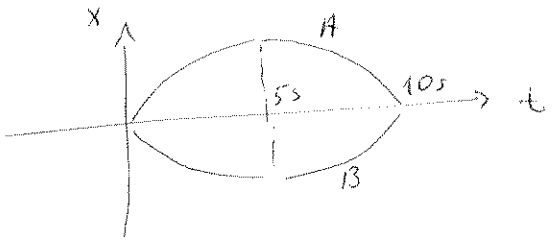
$$x - x_0 = \frac{v_x^2 - v_{0x}^2}{2a_x} = \frac{0 - (10\,m/s)^2}{2(-2\,m/s^2)} = 25\,m$$

max. distance btw cars → $25\,m + 25\,m = 50\,m$



$$v_x = v_{0x} + at$$

$$-10\,m/s = 10\,m/s - (2\,m/s^2)\,t \rightarrow t = 10\,s$$



PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Fall Semester 2013**

College of Arts and Sciences

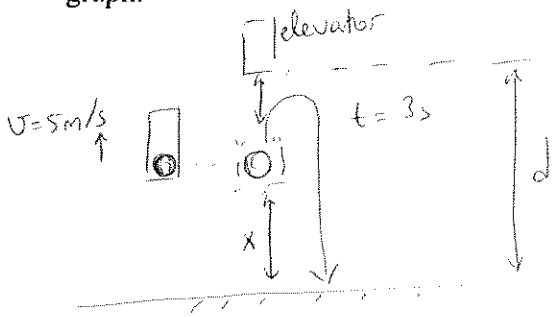
Section **Quiz 3** **3 October 2013**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

A ball hits the ground 3s after it was released from an elevator which is moving upward with constant speed 5 m/s.

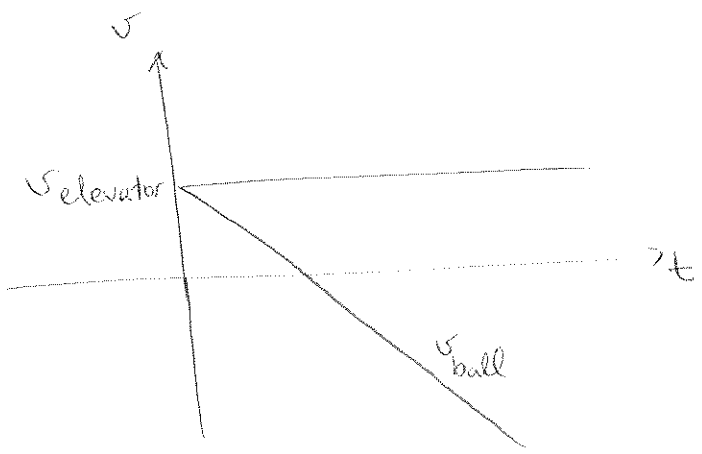
1. Find the distance between the ball and the elevator at the instant the ball hit the ground. ($g = 10\ m/s^2$).
2. Plot the velocity of the ball and the elevator as a function of time on the same graph.



$$y - y_0 = v_{elevator}\, t$$
$$= (5\ m/s)(3s)$$
$$= 15\ m.$$

ball:

$$y - y_0 = v_{0y} t + \frac{1}{2} a_y t^2$$
$$-x = (5\ m/s)(3s) + \frac{1}{2}(-10\ m/s^2)(3s)^2$$
$$= 15\ m - 45\ m$$
$$x = 30\ m.$$
$$d = 15\ m + 30\ m = 45\ m.$$



PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Fall Semester 2013**

College of Arts and Sciences

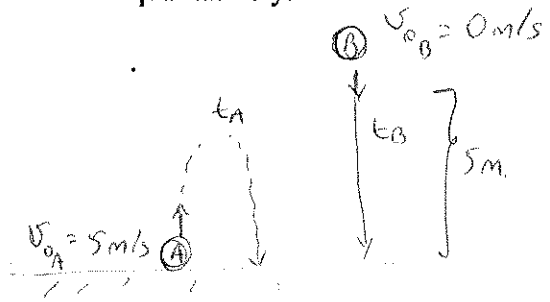
Section **Quiz 4** **3 October 2013**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

A ball "A "is thrown vertically from the ground with initial speed $v_0 = 5m/s$. At the same instant, another ball "B" is released from a height above the ball "A" to fall freely. Both balls reach to the ground at the same time. ($g = 10m/s^2$)

1. What is the distance between the balls when ball "A" reached to its maximum height?
2. On the same graph, plot the velocity of the balls as a function of time qualitatively.



$t_A = t_B = t$

$v_A = v_{0A} + at$

$-10 m/s = -10 m/s^2 \, t \rightarrow t = 1s/2$

$(y-y_0)_B = v_{0B} t + \frac{1}{2} a_B t^2$

$(y-y_0)_B = -5 t^2$

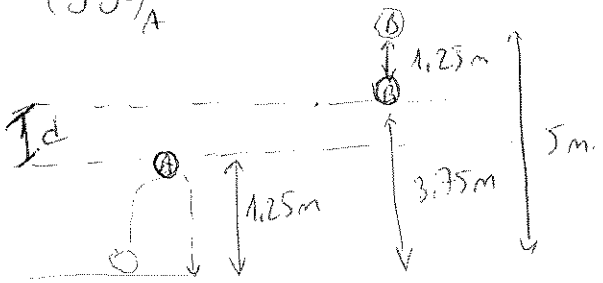
$(y-y_0)_B = -5 (0,5 s)^2$

$= 1,25 m.$

$v_{y_A}^2 = v_{0y_A}^2 + 2ay (y-y_0)_A$

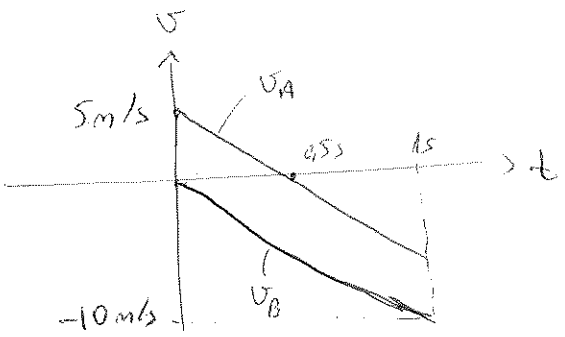
$-25 = 2(-10)(y-y_0)$

$(y-y_0)_A = 1,25 m$



distance btw them:

$d = 3,75m - 1,25m = 2,5 m$



PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Fall Semester 2013**

College of Arts and Sciences

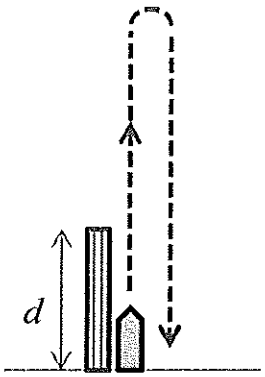
Section **Quiz 5** **3 October 2013**

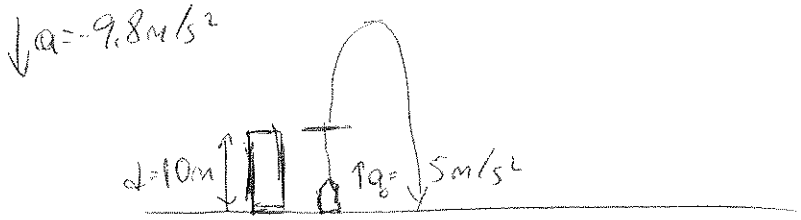
Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

A vertical launch ramp is $d = 10\ m$ long from the ground. During the launch, the ramp applies a constant vertical acceleration $a_0 = 5\ m/s^2$ to an object until it leaves the ramp. ($g = 10\ m/s^2$).

1. The launch starts at t = 0s with the object at rest on the base of the ramp at the ground. When does the object return to the ground?
2. Plot the velocity vs. time graph of the object during this motion qualitatively. Indicate the important data points on the graph.





During launch: $v_y^2 = v_{0y}^2 + 2a_y(y-y_0)$

$v_y^2 = 0 + 2(5\,m/s^2)(10\,m)$

$v_y^2 = 100\ m^2/s^2 \Rightarrow v_y = 10\ m/s$

$y - y_0 = v_{0y}t + \frac{1}{2}a_y t^2$

$10\,m = 0 + \frac{1}{2}5t^2$

$t^2 = 4 \rightarrow t = 2\,s$

After object leaves the ramp:

$y - y_0 = v_{0y}t + \frac{1}{2}a_y t^2$

$-10\,m = (10\,m/s)t + \frac{1}{2}(-10\,m/s^2)t^2$

$-5t^2 + 10t + 10 = 0$

$-t^2 + 2t + 2 = 0 \quad < \quad t_{1,2} = \frac{-2 \pm \sqrt{4+8}}{-2} = 1 \pm \sqrt{3}$

$t = 1 + \sqrt{3}$

$t_{total} = 2 + (1+\sqrt{3})$

$= \frac{3+\sqrt{3}}{5}\ s$