PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Fall Semester 2012**

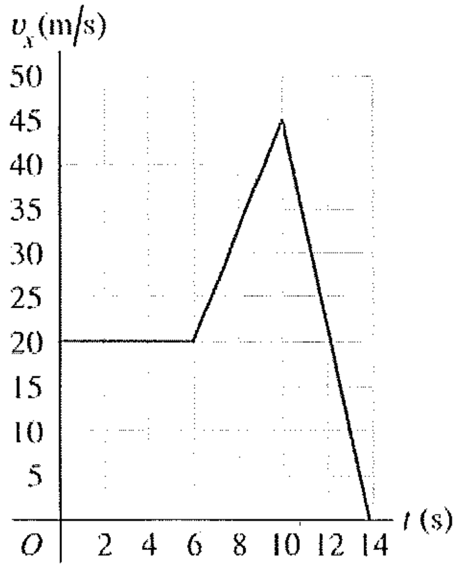
College of Arts and Sciences

Section 1 **Quiz 2** **4 October 2012**

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

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

The graph below shows the velocity of a motorcycle police officer plotted as a function of time. (a) Find the instantaneous acceleration at t=3 s, at t=7 s, and at t=11 s. (b) How far does the officer go in the first 6 s? The first 10 s? The first 14 s?



a) At t=3s, $v_x - t$ curve is a straight line, which has zero slope, so;

• At t=3 $a_x = 0$

• At t=7s, $a_{x-t} = \frac{\Delta v_x}{\Delta t} = \frac{45m/s - 20m/s}{(10s - 6s)} = 6.25m/s$

• At t=11s, $a_{x-t} = \frac{(0 - 45m/s)}{(14s - 10s)} = -11.25m/s^2$

b) • For t=0 to t=6s; $x - x_0 = v_{0x}\cdot t + \frac{1}{2}at^2$, but $a_x = 0$ in this interval.

$x - x_0 = v_{0x}\cdot t = (20m/s)(6s) = 120m.$

• For t=6s to t=10s; $x - x_0 = v_{0x}\cdot t + \frac{1}{2}at^2$, $a = 6.25m/s^2$, $v_{0x} = 20m/s$, $x_0 = 120m$

$x - 120m = (20m/s)\cdot 4s + \frac{1}{2}(6.25m/s^2)(4s)^2$

$x = 250m.$

• For t=10s to t=14s; $a = -11.25m/s^2$, $v_{0x} = 45m/s$, $x_0 = 230m.$

$x - 250m = (45m/s)\cdot 4s + \frac{1}{2}(-11.25m/s^2)(4s)^2$

$x - 250m = 180m - 90m$

$x = 340m.$

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Section 2 **Quiz 2** **4 October 2012**

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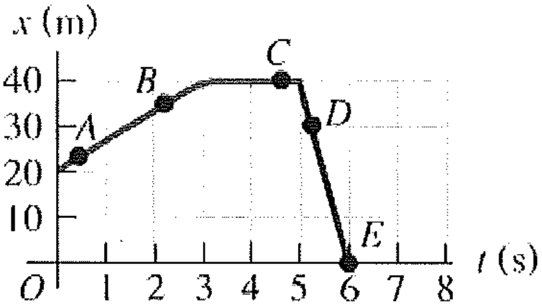
Quiz duration: 10 minutes

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

A test car travels in a straight line along the x-axis. The graph below shows the car's position as a function of time. (a) Find the car's instantaneous velocity at points A, B, C, D, and E. (b) Find the car's instantaneous acceleration at points A, B, C, D, and E.



a) Instantaneous velocity is given by the slope of the x versus t graph.

A: $v_x = \frac{\Delta x}{\Delta t} = \frac{(40m - 20m)}{3s} = 6.7 m/s$

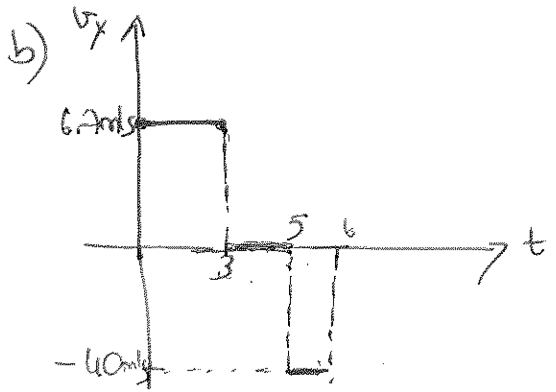
B: same as point A, $v_x = 6.7 m/s$.

C: $v_x = 0$ (straight line)

D: $v_x = \frac{(0 - 40m)}{1s} = -40 m/s$

E: same as point D, $v_x = -40 m/s$

b)



Since the v_x-t graph is straight line, slope is zero, so; acceleration is zero through all points.

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Section 3 **Quiz 2** **4 October 2012**

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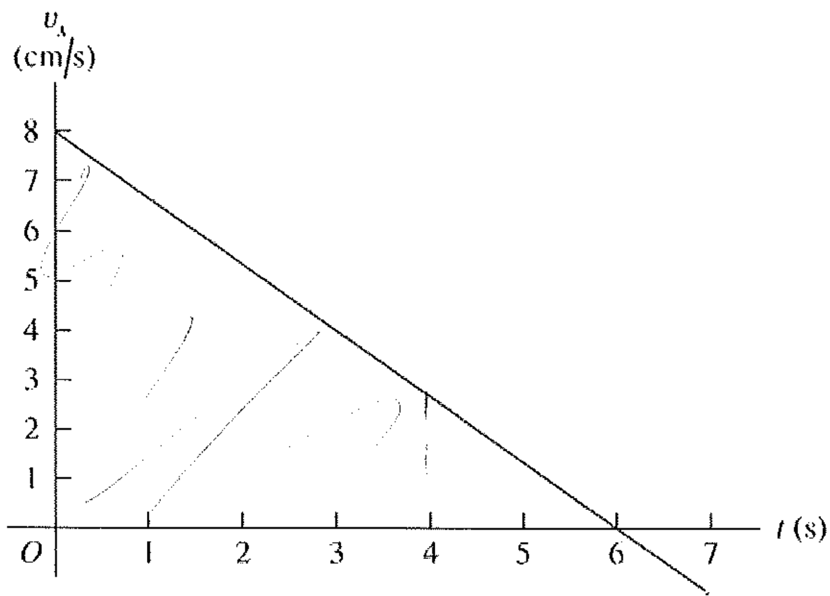
Quiz duration: 10 minutes

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

A cat walks in a straight line. The graph of its velocity as a function of time is given below. (a) Find the cat's velocity at t=4 s and t= 7 s. (b) What distance does the cat move during the first 4 s (between t=0 s and t=4 s)?



a) Use te formula $v_x = v_{0x} + a_x \cdot t$, to find te velocity.

let us first find te accelerotion: $a_x = \frac{-8 m/s}{6 s} = -1.4 m/s^2$

at t=4s $v_x = 8 m/s + (-1.4 m/s^2) \cdot 4$

$v_x = 2.4 m/s$

at t=7s $v_x = 8 m/s + (-1.4 m/s^2) \cdot 7 = -1.8 m/s$.

b) $x - x_0 = v_{0x} \cdot t + \frac{1}{2} a t^2$

$x = (8 m/s) \cdot 4s + \frac{1}{2} \cdot (-1.4 m/s^2) \cdot (4s)^2$

$x = 32 m - 11.2 m = 20.8 m$.

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Section 4 **Quiz 2** **4 October 2012**

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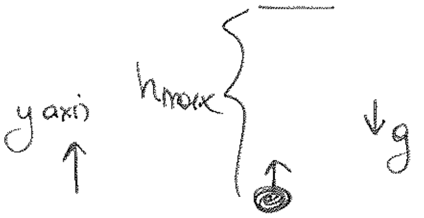
Quiz duration: 10 minutes

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

A ball is thrown vertically upward with an initial velocity v_0. Find an expression for the height of the ball at $t=t_{max}/2$ where t_{max} is the time it takes for the ball to reach the maximum height. You should consider the gravitational acceleration to be g. Your answer sould be a function of v_0 and g only.



At maximum height $v_y = 0$.

$v_y = v_{oy} + a_y \cdot t$, $v_{oy} = v_o$, $a_y = g$

$0 = v_o - g t_{max}$

$v_o = +g t_{max} \rightarrow t_{max} = + \frac{v_o}{g}$

$y - y_o = v_{oy} \cdot t + \frac{1}{2} a t^2$

At $\frac{t_{max}}{2} = + \frac{v_o}{2g} \rightarrow y - y_o = v_o \cdot \left(+\frac{v_o}{2g}\right) - \frac{1}{2} g \cdot \frac{v_o^2}{4g^2}$

$y - y_o = \frac{v_o^2}{2g} - \frac{v_o^2}{8g}$

$y - y_o = + \frac{3v_o^2}{8g}$

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Section 5 Quiz 2 4 October 2012

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Quiz duration: 10 minutes

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

The acceleration of a bus is given by $a_x(t) = \alpha t$ where $\alpha = 1.2\ m/s^3$.
(a) If the bus's velocity at $t=1\ s$ is $5\ m/s$ what is its velocity at $t=2\ s$?
(b) If the bus's position is $6\ m$ at $t=1\ s$ what is its position at $t=2\ s$?

a) Given at $t=1$, $v_x = 5 m/s$

$$v(t) = \int a(t)\,dt$$

$$= \int \alpha t\,dt$$

$$v(t) = 1{,}2\frac{t^2}{2} + c$$

At $t=1$ $\quad v(1) = 1{,}2 m/s^3\ \frac{1s^2}{2} + c = 5 m/s$

$0{,}6 m/s + c = 5 m/s$

$c = 4.4 m/s$

At $t=2$ $\quad v(2) = 1{,}2 m/s^3 \cdot \frac{2^2}{2} + 4{,}4 m/s$

$v(2) = 6{,}8 m/s$

b) $x = \int v\,dt$

$$= \int \left(\alpha\frac{t^2}{2} + 4{,}4 m/s\right) dt$$

$$x(t) = \alpha\frac{t^3}{6} + (4.4 m/s)\cdot t + c.$$

at $t=1 \Rightarrow x(1) = 1{,}2 m/s^3 \cdot \frac{1s^3}{6} + (4.4 m/s)\cdot 1s + c = 6m$

$4{,}6m + c = 6m$

$c = 1{,}4m$

at $t=2s$

$x(2) = 1{,}2 m/s^3 \cdot \frac{2^3 s^3}{6} + (4{,}4 m/s) 2 + 1{,}4m$

$x(2) = 11{,}8 m$