PHYS 101: General Physics 1 KOÇ UNIVERSITY Fall Semester 2010

College of Sciences

Section 1 Quiz 2 14 October 2010

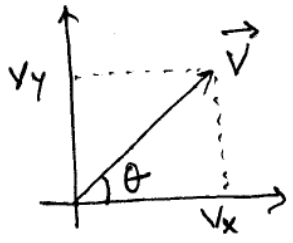
Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

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

If the position of an object is determined by $x = b\,t^2$ and $y = c\,t^3$, where b and c are positive constants, when does the velocity vector make an angle of 45 degrees with the x-axis?

$$V_x = \frac{dx}{dt} = 2bt$$

$$V_y = \frac{dy}{dt} = 3ct^2$$



$\theta = 45°$ when $V_x = V_y \rightarrow 2bt = 3ct^2$

$$\rightarrow t = \frac{2b}{3c}$$

PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Fall Semester 2010**

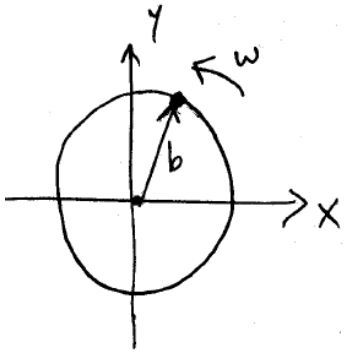
College of Sciences

Section 2 **Quiz 2** **14 October 2010**

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

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

If the position of an object is determined by x = b cos(w t) and y = b sin(w t), where b and w are positive constants, find the radial and tangential components of the accelaration.



The object is making uniform circular motion: with $R = b$.

So,

$a_{tan} = 0$ and $a_{rad} = \frac{v^2}{R}$

$v = Rw = bw \rightarrow a_{rad} = \frac{(bw)^2}{b} = bw^2.$

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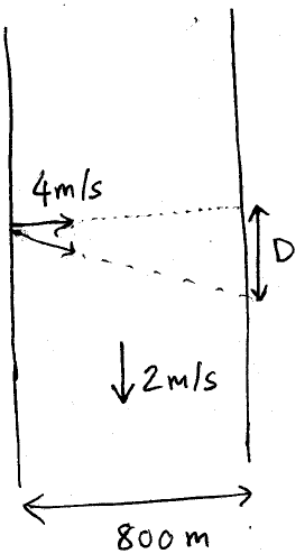
Section 3 **Quiz 2** **14 October 2010**

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

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

A man is rowing always directly towards the opposite shore across a river which is flowing due South with a speed 2m/s. The river is 800m wide. The speed of the boat with respect to the river is 4m/s. Calculate the distance the man would have drifted when he had reached to the opposite shore.



Time to reach the opposite shore $= \frac{(800\,m)}{(4\,m/s)} = 200\,s$

$\rightarrow D = (2\,m/s) \cdot (200\,s) = 400\,m$

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Section 4 **Quiz 2** **14 October 2010**

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Quiz duration: 10 minutes

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

An object that is initially at rest starts to rotate on a circular track with constant tangential acceleration a. The radius of the track is given by R. How much time will it take to complete one full turn for the object? What will be the speed of the particle at the time it has completed one full turn? Express your results in terms of R and a.

$$\frac{1}{2} a t^2 = 2\pi R$$

$$\rightarrow t = 2\sqrt{\frac{\pi R}{a}}$$

$$v(t) = at = 2\sqrt{\pi R a}$$

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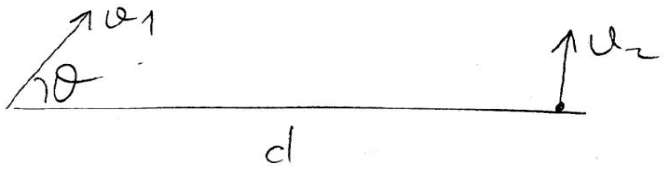
Section 5 **Quiz 2** **14 October 2010**

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

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

Consider two projectiles that are thrown at the same time with initial velocities as shown in the figure (v_2 is in the vertical direction). How should one choose the distance d and the angle θ so that these two projectiles will hit each other? Express your results for the distance and the angle in terms of the initial speeds of the projectiles.



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

$$\Rightarrow y_1 = 0 + v_1 \sin\theta\, t - \frac{1}{2}gt^2$$

$$y_2 = 0 + v_2 t - \frac{1}{2}gt^2$$

to hit: $y_1 = y_2$

$$\Rightarrow \boxed{v_1 \sin\theta = v_2}$$

$$d = v_1 \cos\theta\, t \Rightarrow t = \frac{d}{v_1 \cos\theta}$$

$$\Rightarrow y_2 = y_1 = v_1 \sin\theta\left(\frac{d}{v_1\cos\theta}\right) - \frac{1}{2}g\left(\frac{d}{v_1\cos\theta}\right)^2$$

hit will occur when $y_1 = y_2 > 0$

$$\Rightarrow v_1 \sin\theta\left(\frac{d}{v_1\cos\theta}\right) > \frac{1}{2}g\left(\frac{d}{v_1\cos\theta}\right)^2$$

$$\Rightarrow \boxed{d < \frac{2v_1^2 \sin\theta\cos\theta}{g}}$$