Name______________________________

Feb. 14, 2007

Quiz #1 — Spring 2007

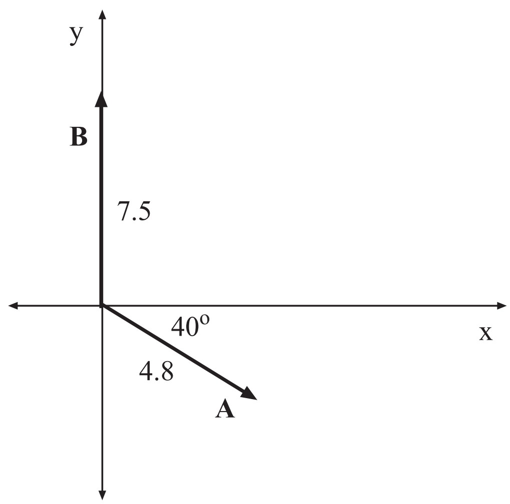
Phys 2010 – NSCC

1. Convert $5.5\,\frac{\text{g}}{\text{cm}^2}$ to units of $\frac{\text{kg}}{\text{m}^2}$

$$5.5\,\frac{\text{g}}{\text{cm}^2} = (5.5\,\frac{\text{g}}{\text{cm}^2})\left(\frac{1\ \text{kg}}{1000\ \text{g}}\right)\left(\frac{100\ \text{cm}}{1\ \text{m}}\right)^2 = 55\,\frac{\text{kg}}{\text{m}^2}$$

2. Vector **A** has a magnitude of 4.8 and is directed at 40° *below* the x axis. Vector **B** has a magnitude of 7.5 and points in the $+y$ direction.

Find the magnitude and direction of $\mathbf{A} + \mathbf{B}$.



The components of the vectors are:

$$A_x = 4.8\cos 40^\circ = 3.68 \qquad A_y = -4.8\sin 40^\circ = -3.09 \qquad B_x = 0 \qquad B_y = +7.5$$

If $\mathbf{C} = \mathbf{A} + \mathbf{B}$ then

$$C_x = A_x + B_x = 3.68 \qquad C_y = A_y + B_y = 4.41$$

The magnitude of $\mathbf{C}$ is

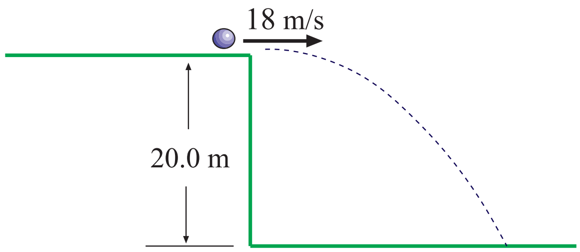
$$C = \sqrt{C_x^2 + C_y^2} = 5.74$$

and it points at and angle θ, where

$$\tan\theta = \frac{C_y}{C_x} = 1.20 \qquad \Longrightarrow \qquad \theta = 50.2^\circ$$

(That is the correct angle since both components of $\mathbf{C}$ are positive.)

3. A golf ball flies off the edge of a cliff (horizontally) with a speed of $18.0\frac{\mathrm{m}}{\mathrm{s}}$. The cliff has a height of 20.0 m.



a) How long does the ball spend in flight?

Here, $v_{0x} = 18.0\frac{\mathrm{m}}{\mathrm{s}}$, $v_{oy} = 0$, $a_x = 0$, $a_y = -9.8\frac{\mathrm{m}}{\mathrm{s}^2}$. Find the time at which $y = -20.0\ \mathrm{m}$. The y equation of motion gives

$$y = -20.0\ \mathrm{m} = 0 + \tfrac{1}{2}(-9.8\tfrac{\mathrm{m}}{\mathrm{s}^2})t^2 \qquad \Longrightarrow \qquad t^2 = \frac{2(20.0\ \mathrm{m})}{(9.8\frac{\mathrm{m}}{\mathrm{s}^2})} = 4.08\ \mathrm{s}^2$$

Then:

$$t = 2.02\ \mathrm{s}$$

b) How far does the ball land from the base of the cliff?

Find the value of x at the time found in part (a). The x equation of motion gives:

$$x = (18.0\tfrac{\mathrm{m}}{\mathrm{s}})t + 0 = (18.0\tfrac{\mathrm{m}}{\mathrm{s}})(2.02\ \mathrm{s}) = 36.4\ \mathrm{m}$$

You must show all your work and include the right units with your answers!

$$A_x = A\cos\theta \qquad A_y = A\sin\theta \qquad A = \sqrt{A_x^2 + A_y^2} \qquad \tan\theta = A_y/A_x$$

$$v_x = v_{0x} + a_x t \qquad x = v_{0x}\Delta t + \tfrac{1}{2}a_x t^2 \qquad v_x^2 = v_{0x}^2 + 2a_x x \qquad x = \tfrac{1}{2}(v_{0x} + v_x)t$$

$$v_y = v_{0y} + a_y t \qquad y = v_{0y}\Delta t + \tfrac{1}{2}a_y t^2 \qquad v_y^2 = v_{0y}^2 + 2a_y y \qquad y = \tfrac{1}{2}(v_{0y} + v_y)t$$

$$g = 9.80\tfrac{\mathrm{m}}{\mathrm{s}^2} \qquad \mathbf{F}_{\mathrm{net}} = m\mathbf{a}$$