Name_____

Sept. 20, 2010

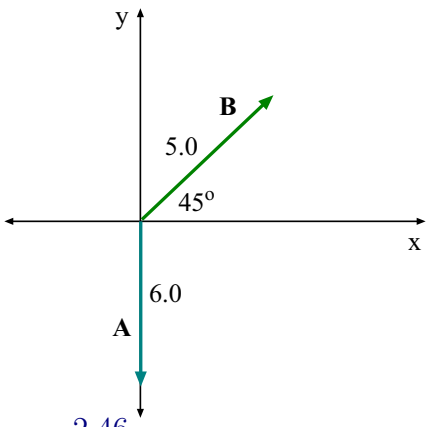
Quiz #1 — Fall 2010

Phys 2110 – Sec 3

1. Convert $256\frac{\text{cm}^3}{\text{s}}$ to units of $\frac{\text{m}^3}{\text{h}}$. ("h" means hour, as in 60 minutes).

$$256\frac{\text{cm}^3}{\text{s}} = 256\frac{\text{cm}^3}{\text{s}}\left(\frac{3600\text{ s}}{1\text{ h}}\right)\left(\frac{1\text{ m}}{100\text{ cm}}\right)^3 = 0.922\frac{\text{m}^3}{\text{h}}$$

2. Vector **A** has magnitude 6.00 and points in the $-y$ direction and vector **B** has magnitude 5.00 and points at an angle of 45.0° above the x axis.



If $\mathbf{C} = \mathbf{A} + \mathbf{B}$, find the magnitude and direction of **C**.

Find the components of the vectors:

$$A_x = 0 \qquad A_y = -6$$

$$B_x = 5.0\cos 45^\circ = 3.53 \qquad B_y = 5.0\sin 45^\circ = 3.53$$

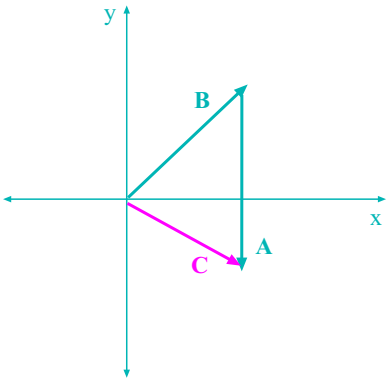
$$C_x = A_x + B_x = 3.53 \qquad C_y = A_y + B_y = -2.46$$

$$C = \sqrt{C_x^2 + C_y^2} = 4.3 \qquad \tan\theta = \frac{C_y}{C_x} = \frac{-2.46}{3.53} = -0.748$$

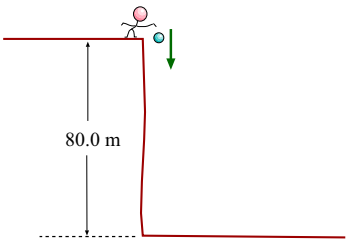
This gives

$$\theta = -34.6^\circ$$

which is plausible as **C** must lie in the 4^{th} quadrant (as seen from a simple picture).



3. a) A man stands at the edge of a 80.0−m high cliff and throws a rock straight down; at what speed does he need to throw it so that it reaches the ground below 3.00 s later?



Here with origin at starting point, $x_0 = 0$, $x = -80$ m, $a = -g$. We don't know v_0 so the x equation gives

$$-80 \text{ m} = 0 + v_0(3.0 \text{ s}) - \tfrac{1}{2}(9.80\tfrac{\text{m}}{\text{s}^2})(3.0 \text{ s})^2$$

Solve for v_0:

$$v_0(3.0 \text{ s}) = -80 \text{ m} + 44.1 \text{ m} = -35.9 \text{ m} \qquad \Longrightarrow \qquad v_0 = -12.0\tfrac{\text{m}}{\text{s}}$$

so the rock was thrown down with a *speed* of $\boxed{12.0\tfrac{\text{m}}{\text{s}}}$.

b) What is the speed of the rock at impact?

Use $v = v_0 + at$ to find the velocity of the rock at $t = 3.0$ s:

$$v = -12.0\tfrac{\text{m}}{\text{s}} + (-9.8\tfrac{\text{m}}{\text{s}^2})(3.0 \text{ s}) = -41.4\tfrac{\text{m}}{\text{s}}$$

So the speed of the rock at impact was $\boxed{41.4\tfrac{\text{m}}{\text{s}}}$.

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

$v = v_0 + at$ $\quad x = x_0 + v_0 t + \frac{1}{2}at^2$ $\quad v^2 = v_0^2 + 2a(x - x_0)$ $\quad x - x_0 = \frac{1}{2}(v_0 + v)t$

$g = 9.80\frac{\text{m}}{\text{s}^2}$ $\quad 1 \text{ kg} = 10^3 \text{ g}$ $\quad$ Ignore air resistance.