Name_____

Sept. 17, 2012

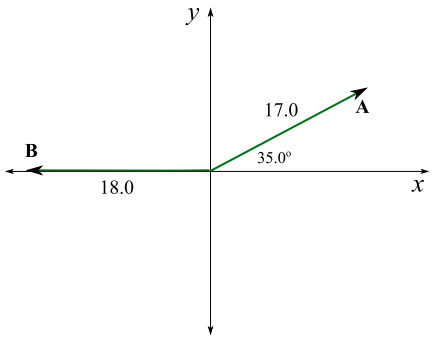
Quiz #1 — Fall 2012

Phys 2110 – Sec 5

1. Change 0.331 $\frac{\text{g}}{\text{cm}^2}$ to units of $\frac{\text{kg}}{\text{m}^2}$

$$0.331\ \tfrac{\text{g}}{\text{cm}^2} = (0.331\ \tfrac{\text{g}}{\text{cm}^2})\left(\frac{1\ \text{kg}}{10^3\ \text{g}}\right)\left(\frac{100\ \text{cm}}{1\ \text{m}}\right)^2 = \boxed{3.31\ \tfrac{\text{kg}}{\text{m}^2}}$$

2. Vector **A** has magnitude 17.0 and points at an angle of 35.0° above the $+x$ axis. Vector **B** has magnitude 18.0 and points in the $-x$ direction.



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

Get the components of the vectors:

$$A_x = A\cos\theta = (17.0)\cos(35.0^\circ) = 13.93$$

$$A_y = A\sin\theta = (17.0)\sin(35.0^\circ) = 9.75$$

$$B_x = -18.0 \qquad B_y = 0$$

Then if $\mathbf{C} = \mathbf{A} + \mathbf{B}$ then

$$C_x = A_x + B_x = -4.07 \qquad C_y = A_y + B_y = 9.75$$

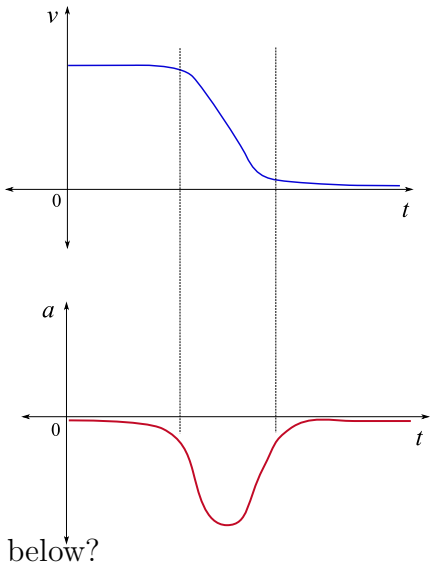
so that $\mathbf{C}$ is a vector in the 2nd quadrant. Then the magnitude and direction of $\mathbf{C}$ are

$$C = \sqrt{C_x^2 + C_y^2} = \boxed{10.6} \qquad \tan\theta = \frac{9.75}{-4.07} = -2.40$$

A calculator then gives $\theta = -67.3^\circ$, but as $\mathbf{C}$ is in the 2nd quadrant, its angle must be

$$\theta = -67.3^\circ + 180^\circ = \boxed{113^\circ}$$

3. A particle moves along the x axis and the graph of v vs. t for the motion has the appearance shown here.



On the graph below it, sketch what the curve of a vs. t should look like. (Only the general *appearance* of the graph is important.)

The derivative of the velocity curve is nearly zero except for the middle part where it decreases to some bigger negative value and then returns to (nearly) zero. This gives the curve for a shown here.

4. A thin man stands at the edge of a 60.0–m cliff and hurls a rock straight down with a speed of $10.0\frac{\text{m}}{\text{s}}$.

a) What is the speed of the rock when it strikes the ground below?

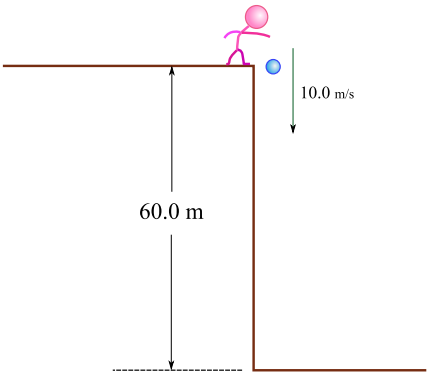
Using a y axis which points *up* and the origin at the starting point, we have $v_0 = -10.0\frac{\text{m}}{\text{s}}$ and with $a = -g$ and $y - y_0 = -60.0$ m, we can solve for v with:

$$v^2 = v_0^2 + 2a(y - y_0) = (-10.0\tfrac{\text{m}}{\text{s}})^2 + 2(-9.8\tfrac{\text{m}}{\text{s}^2})(-60.0\text{ m}) = 1276\ \tfrac{\text{m}^2}{\text{s}^2}$$

This gives $v = -35.7\frac{\text{m}}{\text{s}}$ (minus; it's going *down*) but the question asks for the speed, so

$$|v| = \boxed{35.7\tfrac{\text{m}}{\text{s}}}$$

b) How long is the rock in flight?



Use $v = v_0 + at$ and our answer from part (a) so that

$$t = \frac{v - v_0}{a} = \frac{-35.7 - (-10.0\frac{\text{m}}{\text{s}})}{(-9.8\frac{\text{m}}{\text{s}^2})} = \boxed{2.62\text{ s}}$$

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

$$A_x = A\cos\theta \qquad A_y = A\sin\theta$$

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

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