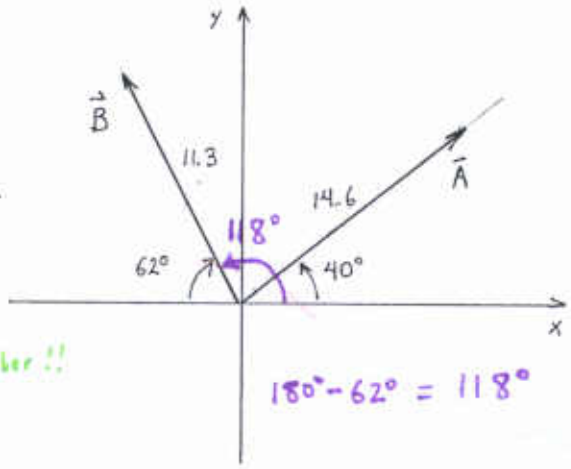
Name_____ Units? Units?

Phys 121
Quiz #1 — Spring 2001

1. Express $85.4\,\mathrm{g \cdot cm^2}$ in units of $\mathrm{kg \cdot m^2}$.

$$85.4\ \mathrm{g \cdot cm^2} = (85.4\ \mathrm{g \cdot cm^2})\left(\frac{1\ \mathrm{kg}}{1000\ \mathrm{g}}\right)\left(\frac{1\ \mathrm{m}}{100\ \mathrm{cm}}\right)^2 = \boxed{8.54 \times 10^{-6}\ \mathrm{kg \cdot m^2}}$$

2. Vector **A** has magnitude 14.6 and points at 40.0° above the x axis; vector **B** has magnitude 11.3 and points at 62° above the $-x$ axis. (See picture.)



a) Find the $x-$ and $y-$ components of the vectors **A** and **B**.

$A_x = (14.6)\cos 40° = 11.2$
$A_y = (14.6)\sin 40° = 9.38$
$B_x = (11.3)\cos(118°) = -5.31$
$B_y = (11.3)\sin(118°) = 9.98$

B_x is a negative number!!

b) Find the magnitude and direction of **A** + **B**.

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

$C_x = A_x + B_x = 11.2 - 5.31 = 5.88$
$C_y = A_y + B_y = 9.38 + 9.98 = 19.4$

Magnitude of $\vec{C}$ is

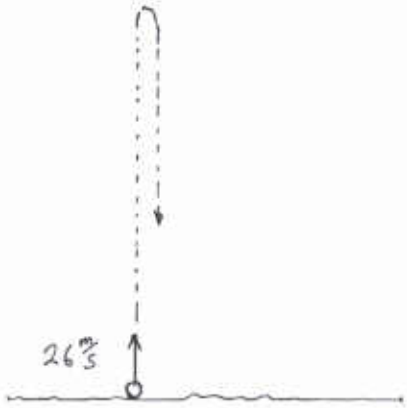
$$C = \sqrt{C_x^2 + C_y^2} = \boxed{20.2}$$

Direction of $\vec{C}$ is

$$\theta = \tan^{-1}\left(\frac{C_y}{C_x}\right) = \boxed{73.1°}$$

And this choice of θ is OK since $\vec{C}$ must lie in the first quadrant.

3. A rock is thrown straight *up* from ground level with an initial speed of $26.0 \frac{m}{s}$.



a) How long does it take the rock to attain maximum height?

$v_0 = +26.0 \frac{m}{s}$ $\quad a = -9.80 \frac{m}{s^2}$

When does v equal zero?

$v = v_0 + at \rightarrow 0 = 26 \frac{m}{s} + (-9.8 \frac{m}{s^2})t$

$\rightarrow t = \frac{26 \frac{m}{s}}{9.8 \frac{m}{s^2}} =$ **2.65 s**

b) What is the maximum height attained by the rock?

Use $v^2 = v_0^2 + 2ax$, with $v = 0$ (max. ht.)

$x = \frac{v^2 - v_0^2}{2a} = \frac{0 - (26 \frac{m}{s})^2}{2(-9.80 \frac{m}{s^2})} =$ **34.5 m** $=$ value of y when $v=0$ $=$ Max ht.

c) 4.0 s after being thrown, what is the *velocity* of the rock?

Use $v = v_0 + at$

At $t = 4.0$ s,

$v = (26 \frac{m}{s}) + (-9.80 \frac{m}{s^2})(4.0 s) =$ **$-13.2 \frac{m}{s}$**

i.e. rock has a speed of $13.2 \frac{m}{s}$ and is moving downward

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

$$A_x = A\cos\theta \qquad A_y = A\sin\theta \qquad A = \sqrt{A_x^2 + A_y^2} \qquad \theta = \tan^{-1}\left(\frac{A_y}{A_x}\right)$$

$$g = 9.8 \frac{m}{s^2} \qquad 1 \text{ m} = 100 \text{ cm} \qquad 1 \text{ kg} = 1000 \text{ g}$$

$$v = v_0 + at \qquad x = v_0 t + \frac{1}{2}at^2 \qquad v^2 = v_0^2 + 2ax \qquad x = \frac{1}{2}(v_0 + v)t$$