Name______________________

Feb. 8, 2013

Quiz #1 — Spring 2013

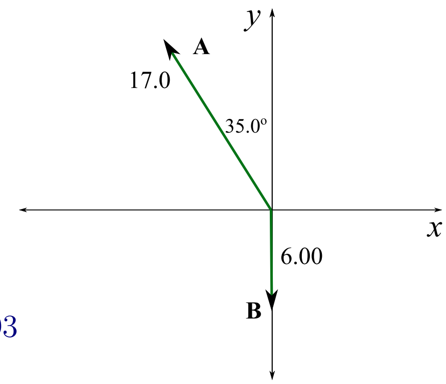
Phys 2110 – Sec 4

1. Change $6.6 \times 10^{-34}\,\frac{\text{kg}\cdot\text{m}^2}{\text{s}}$ to units of $\frac{\text{g}\cdot\text{cm}^2}{\text{s}}$.

$$6.6 \times 10^{-34}\,\frac{\text{kg}\cdot\text{m}^2}{\text{s}} = \left(6.6 \times 10^{-34}\,\frac{\text{kg}\cdot\text{m}^2}{\text{s}}\right)\left(\frac{1000\ \text{g}}{1\ \text{kg}}\right)\left(\frac{100\ \text{cm}}{1\ \text{m}}\right)^2 = \boxed{6.6 \times 10^{-27}\,\frac{\text{g}\cdot\text{cm}^2}{\text{s}}}$$

2. Vector **A** has magnitude 17.0 and points at an angle of 35.0° (counterclockwise) from the $+y$ axis. Vector **B** has magnitude 6.00 and points in the $-y$ direction.

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



The angle of vector $\mathbf{A}$ from the $+x$ axis is $35.0° + 90.0° = 125.0°$ so

$$A_x = (17.0)\cos 125° = -9.75 \qquad A_y = (17.0)\sin 125° = 13.93$$

and

$$B_x = 0.0 \qquad B_y = -6.0$$

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

$$C_x = A_x + B_x = -9.75 \qquad C_y = A_y + B_y = 7.93$$

$$C = \sqrt{C_x^2 + C_y^2} = \boxed{12.6} \qquad \tan\theta = \frac{C_y}{C_x} = -0.8347$$

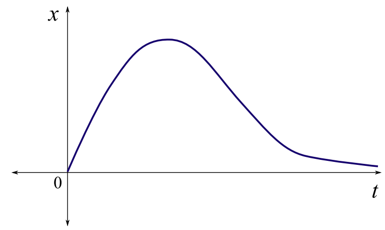
While a cheep calculator gives

$$\tan^{-1}(-0.8347) = -39.9°$$

we know that the vector $\mathbf{C}$ must lie in the second quadrant and so we add 180° to this angle. Then the direction of $\mathbf{C}$ is

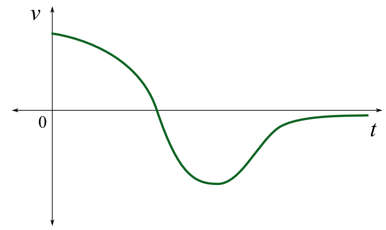
$$\theta = -39.9° + 180.0° = \boxed{141°}$$

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



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

The curve for v vs. t is roughly as shown. v is zero where x is a maximum; the slope of the x curve is negative for bit and then it gets close to zero (i.e. decreases in magnitude).



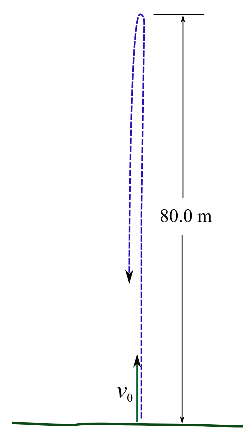
4. A projectile is fired straight upward from ground level; it attains a maximum height of 80.0 m.

a) What was the initial speed of the projectile?

Use $v^2 = v_0^2 + 2a(y - y_0)$ for the trip up; with $v = 0$ and $a = -g$ we get

$$v_0^2 = 0 - 2a(y - y_0) = (-2)(-9.80\tfrac{\text{m}}{\text{s}^2})(80.0\ \text{m}) = 1.57 \times 10^3\ \tfrac{\text{m}^2}{\text{s}^2} \qquad \Longrightarrow \qquad v_0 = \boxed{39.6\tfrac{\text{m}}{\text{s}}}$$

b) What was the total time in flight (from firing to landing back on the ground)?



Solve for t when $y = 0$:

$$y = 0 = 0 + (39.6\tfrac{\text{m}}{\text{s}})t - \tfrac{1}{2}(9.80\tfrac{\text{m}}{\text{s}^2})t^2 = t(39.6\tfrac{\text{m}}{\text{s}} - (4.90\tfrac{\text{m}}{\text{s}^2})t)$$

$$t = \frac{(39.6\frac{\text{m}}{\text{s}})}{(4.90\frac{\text{m}}{\text{s}^2})} = \boxed{8.08\ \text{s}}$$

c) What is the speed of the projectile when it lands? (Along with your answer, you need to show *why it's true*.)

Find the velocity at $t = 8.08$ s:

$$v = v_0 + at = (39.6\tfrac{\text{m}}{\text{s}}) - (9.80\tfrac{\text{m}}{\text{s}^2})(8.08\ \text{s}) = -39.6\tfrac{\text{m}}{\text{s}}$$

so that the *speed* at impact is $\boxed{39.6\frac{\text{m}}{\text{s}}}$.

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

$A_x = A\cos\theta \qquad A_y = A\sin\theta \qquad g = 9.80\frac{\text{m}}{\text{s}^2} \qquad 1\ \text{m} = 10^2\ \text{cm} \qquad 1\ \text{kg} = 10^3\ \text{g}$ Ignore air res.

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