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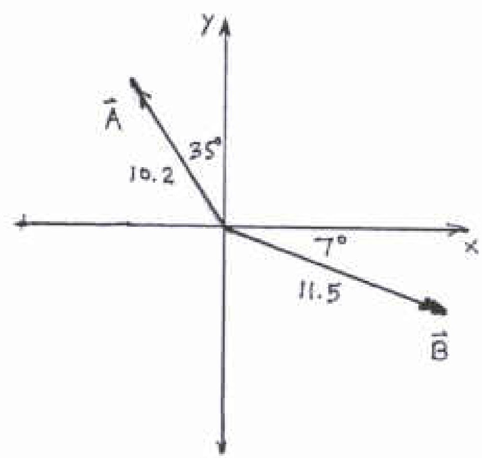
**Phys 2110, Section 5**
**Quiz #1 — Fall 2001**

**1.** Change $2.53\frac{\text{m}}{\text{s}^2}$ to units of $\frac{\text{km}}{\text{hr}\cdot\text{s}}$.

$$2.53\,\text{m/s}^2 = (2.53\,\text{m/s}^2)\left(\frac{1\,\text{km}}{1000\,\text{m}}\right)\left(\frac{60\,\text{s}}{1\,\text{min}}\right)\left(\frac{60\,\text{min}}{1\,\text{hr}}\right) = \boxed{9.11\,\frac{\text{km}}{\text{hr}\cdot\text{s}}}$$

**2.** The vectors **A** and **B** lie in the $xy$ plane and have directions and magnitudes as shown in this diagram.




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

Using the given angles carefully & including the appropriate signs,

$$A_x = -10.2\sin 35° = \boxed{-5.85}$$
$$A_y = +10.2\cos 35° = \boxed{+8.36}$$
$$B_x = +11.5\cos 7° = \boxed{+11.41}$$
$$B_y = -11.5\sin 7° = \boxed{-1.401}$$

b) If the vector **C** is such that

$$\mathbf{A} + \mathbf{B} + \mathbf{C} = \mathbf{0}\ ,$$

find **C**. Give the *magnitude* and *direction* of vector **C**.

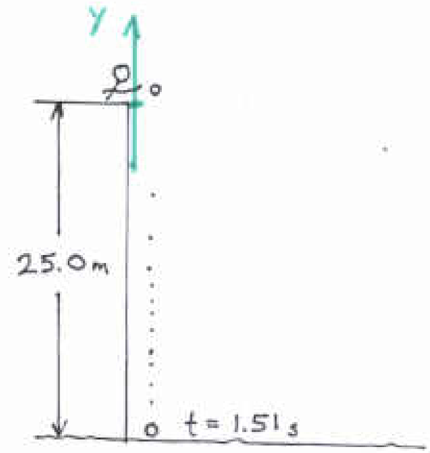
This gives $\vec{C} = -\vec{A} - \vec{B}$ , so

$$C_x = -A_x - B_x = -5.56$$
$$C_y = -A_y - B_y = -6.95$$
$$|\vec{C}| = C = \sqrt{C_x^2 + C_y^2} = \boxed{8.91}$$

$$\tan\theta = \frac{C_y}{C_x} = 1.25\ , \text{ so } \theta \overset{?}{=} \tan^{-1}(1.25) = 51.3°\ ?$$

No, must be in III$^{rd}$ quadr, so $\theta = 51.3° + 180° = \boxed{231.3°}$
or $51.3° - 180° = \boxed{-128.7°}$

3. You stand at the edge of the roof of a 25.0 m–high building and give a ball some initial velocity. The ball hits the ground below 1.51 seconds later.




a) What was the initial velocity given to the ball?

Put the origin ($y = 0$) at the release point, then using $y = y_0 + v_0 t + \frac{1}{2} a t^2$ for time $t = 1.51$ s, get:

$$-25.0\text{ m} = 0 + v_0 (1.51\text{ s}) - \frac{1}{2}(9.8\,\tfrac{\text{m}}{\text{s}^2})(1.51\text{ s})^2$$

Solve for $v_0$:

$v_0 (1.51\text{ s}) = -13.8$ m $\Longrightarrow$ $\boxed{v_0 = -9.18\ \tfrac{\text{m}}{\text{s}}}$

(Initial velocity is downward)

b) What is the speed of the ball just before it reaches the ground?

We have $v_0$ and the time, so using $v = v_0 + at$,

$$v = (-9.18\,\tfrac{\text{m}}{\text{s}}) + (-9.80\,\tfrac{\text{m}}{\text{s}^2})(1.51\text{ s})$$

$$= -23.96\ \tfrac{\text{m}}{\text{s}}$$

So the final speed is $\boxed{|v| = 23.96\ \tfrac{\text{m}}{\text{s}}}$

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

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

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

For free-fall problems ignore air resistance.

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

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