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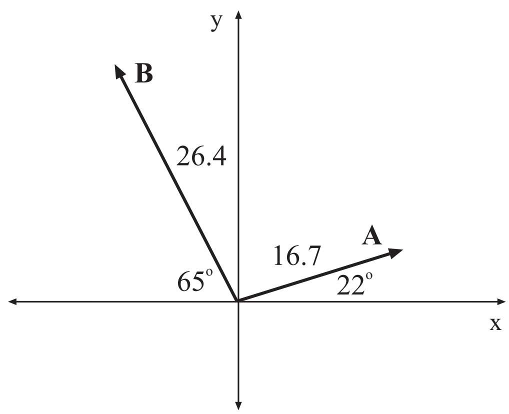
Phys 2010, NSCC
Quiz #1 — Fall 2005

1. Change $0.055\,\frac{\mathrm{g}}{\mathrm{cm}}$ to units of $\frac{\mathrm{kg}}{\mathrm{m}}$.

$$0.055\,\tfrac{\mathrm{g}}{\mathrm{cm}} = \left(0.055\,\tfrac{\mathrm{g}}{\mathrm{cm}}\right)\left(\frac{100\ \mathrm{cm}}{1\ \mathrm{m}}\right)\left(\frac{1\ \mathrm{kg}}{1000\ \mathrm{g}}\right) = 0.0055\,\tfrac{\mathrm{kg}}{\mathrm{m}} = 5.5\times 10^{-3}\,\tfrac{\mathrm{kg}}{\mathrm{m}}$$

2. Vector $\mathbf{A}$ has magnitude 16.7 and is directed at 22° above the $+x$ axis. Vector $\mathbf{B}$ has magnitude 26.4 and is directed at 65° above the $-x$ axis, as shown at the right.



a) Find the x and y components of $\mathbf{A}$ and $\mathbf{B}$.

For $\mathbf{A}$ we can use the usual formula:

$$A_x = A\cos\theta = (16.7)\cos 22^\circ = 15.48$$

$$A_y = A\sin\theta = (16.7)\sin 22^\circ = 6.26$$

but for $\mathbf{B}$ we need to watch how the direction is given in the problem; this vector points at 65° above the $-x$ axis, so we can find the components from

$$B_x = -(26.4)\cos 65^\circ = -11.16$$

and

$$B_y = +(26.4)\sin 65^\circ = 23.93$$

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

If $\mathbf{A}+\mathbf{B}=\mathbf{C}$, then the components of $\mathbf{C}$ are given by:

$$C_x = A_x + B_x = 4.33 \qquad C_y = A_y + B_y = 30.19$$

so the magnitude of $\mathbf{C}$ is

$$C = \sqrt{C_x^2 + C_y^2} = 30.5$$

and the direction of $\mathbf{C}$ (given as an angle measured from the $+x$ axis) is

$$\tan\theta = C_y/C_x = 7.72 \qquad \Longrightarrow \qquad \theta = 81.8^\circ$$

(Since both components of $\mathbf{C}$ are positive this angle is the correct choice.)

3. Suppose we stand on top of a large building and throw an object straight *downward* with a speed of $12\frac{\text{m}}{\text{s}}$.

a) After 3 seconds what is the speed of the object?

Here the initial velocity is $v_0 = -12.0\frac{\text{m}}{\text{s}}$ (it was thrown *downward*) and since $a = -g = -9.8\frac{\text{m}}{\text{s}^2}$, the velocity at $t = 3.0\,\text{s}$ is

$$v = v_0 + at = (-12.0\tfrac{\text{m}}{\text{s}}) + (-9.8\tfrac{\text{m}}{\text{s}^2})(3.0\ \text{s}) = -41.4\tfrac{\text{m}}{\text{s}}$$

so the *speed* at that time was

$$\text{Speed} = |v| = 41.4\tfrac{\text{m}}{\text{s}}$$

b) After 3 seconds, how far has the object fallen?

At $t = 3.0\,\text{s}$ the y coordinate is given by

$$y = v_0 t + \tfrac{1}{2}at^2 = (-12.0\tfrac{\text{m}}{\text{s}})(3.0\ \text{s}) + \tfrac{1}{2}(-9.8\tfrac{\text{m}}{\text{s}^2})(3.0\ \text{s})^2 = -80.1\ \text{m}$$

So at $t = 3.0$ s the object has fallen 80.1 m.

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

$$A_x = A\cos\theta \qquad A_y = A\sin\theta \qquad A = \sqrt{A_x^2 + A_y^2} \qquad \tan\theta = A_y/A_x$$

$$v = v_0 + at \qquad x = v_0 t + \tfrac{1}{2}at^2 \qquad v^2 = v_0^2 + 2ax \qquad x = \tfrac{1}{2}(v_0 + v)t \qquad g = 9.80\tfrac{\text{m}}{\text{s}^2}$$