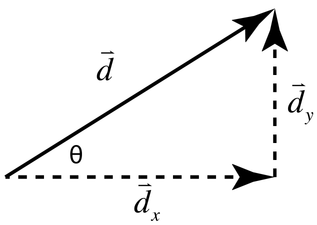
Flipping Physics Lecture Notes:
Introduction to Vector Components

Starting with the displacement vector for our Slow Velocity Racer, $\vec{d} = 90.0cm \ @\ 32° \ N\ of\ E$, we can determine the components, or pieces, of displacement $\vec{d}$ in the x and y directions.



We can use SOH to find the displacement in the y direction:

$$\sin\theta = \frac{O}{H} = \frac{\vec{d}_y}{\vec{d}} \Rightarrow \vec{d}_y = \vec{d}\sin\theta = 90\sin 32 = 47.693 \approx 48cm$$

And we can use CAH to find the displacement in the x direction:

$$\cos\theta = \frac{A}{H} = \frac{\vec{d}_x}{\vec{d}} \Rightarrow \vec{d}_x = \vec{d}\cos\theta = 90\cos(32) = 76.324 \approx 76cm$$

So have broken our displacement vector $\vec{d}$ in to its components in the x and y direction:

$$\boxed{\vec{d}_y \approx 48cm \ \&\ \vec{d}_x \approx 76cm}$$

You can also say "resolve" vectors in to components. I prefer "break" vectors in to components, it has that hard "k" sound, which makes it more fun to say.

$\vec{d}_y \approx 48cm \ \&\ \vec{d}_x$ are the components of $\vec{d}$ because they add up to the vector $\vec{d}$. [$\vec{d}_y + \vec{d}_x = \vec{d}$] We can show this by working this problem now in reverse. First we find the magnitude of $\vec{d}$ by using the Pythagorean theorem.

$$a^2 + b^2 = c^2 \Rightarrow d^2 = d_x^2 + d_y^2 \Rightarrow d = \sqrt{d_x^2 + d_y^2} = \sqrt{(76.324)^2 + (47.493)^2} = 89.894cm$$

And then we can find the direction by using TOA:

$$\tan\theta = \frac{O}{A} = \frac{\vec{d}_y}{\vec{d}_x} \Rightarrow \theta = \tan^{-1}\left(\frac{\vec{d}_y}{\vec{d}_x}\right) = \tan^{-1}\left(\frac{47.493}{76.324}\right) = 31.892°$$

Therefore, rounded to 2 sig figs, we get:

$$\vec{d} \approx 9.0x10^1 cm \ @\ 32° \ N\ of\ E$$

Which is the displacement vector we started with.

Also notice that $\vec{d}_y \approx 48cm \ \&\ \vec{d}_x \approx 76cm$ are vectors because they do have both magnitude and direction. The subscripts of y & x illustrate the direction and both numbers are positive. This means that $\vec{d}_y \approx 48cm$ is 48 cm in the positive y direction and $\vec{d}_x \approx 76cm$ is 76 cm in the positive x direction.