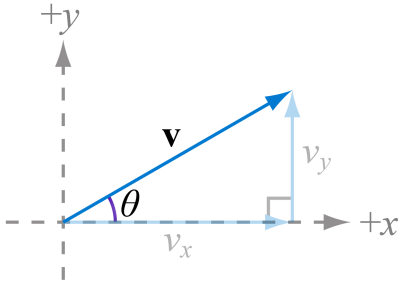
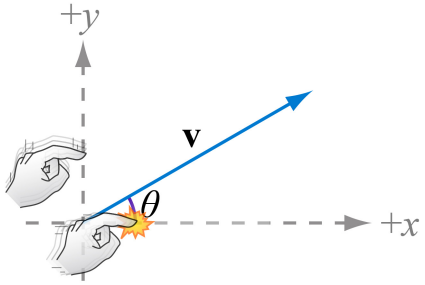
Resolve components for “slanted” vectors using trigonometry

Slower method: Draw and analyze a right triangle



1. Draw and label the vector of interest (in this example $\vec{\mathbf{v}}$)
2. Draw an axis system.
3. Draw an acute or right angle θ between the direction of $\vec{\mathbf{v}}$ and one of the axes.



4. Draw a right triangle with $\vec{\mathbf{v}}$ as the hypotenuse and legs parallel to the axes. **For now,** use v_x and v_y to label the **lengths** of the legs parallel to the x-axis and y-axis, respectively.
5. Apply mnemonic SOH-CAH-TOA to form leg-hypotenuse ratios. In this example, the ratios are

$$\cos\theta = \frac{v_x}{v} \qquad \sin\theta = \frac{v_y}{v}$$

6. Solve for the component lengths

$$v_x = v\cos\theta \qquad v_y = v\sin\theta$$

7. Assuming that the symbols v_x and v_y represented non-negative **lengths** might have resulted in failing to capture one or two negative signs that should have been part of the expressions for the **scalar** components v_x and v_y. Determine whether a + or – should lead each expression for each component by identifying the direction of each component on the drawing of the right triangle.

$$v_x = \pm v\cos\theta \qquad v_y = \pm v\sin\theta$$

Faster method: Swipe the axes

4. Determine the sign of the x-component of $\vec{\mathbf{v}}$:

💬	“$\vec{\mathbf{v}}$ is more in the $+x$ direction than in the $-x$ direction.”	“$\vec{\mathbf{v}}$ is more in the $-x$ direction than in the $+x$ direction.”
✏️	$v_x = +$	$v_x = -$

5. Write the symbol for the magnitude of the vector:

✏️	$v_x = +v$	$v_x = -v$

6. Determine which trigonometric function to use:
   a. Swipe your finger back-and-forth along the x-axis.

💬	“My finger bumps into the arc labeling the angle θ.”	“My finger misses the arc labeling the angle θ.”
💭	Bumping into Near Adjacent cosine	Missing Far Opposite sine
✏️	$v_x = \pm v\cos\theta$	$v_x = \pm v\sin\theta$

7. Repeat steps 4-6 for the y-component of $\vec{\mathbf{v}}$.