6.3B Vectors in the plane

Recap

$\mathbf{v} = \langle v_1, v_2 \rangle$ component vector form

$||\mathbf{v}||$ magnitude

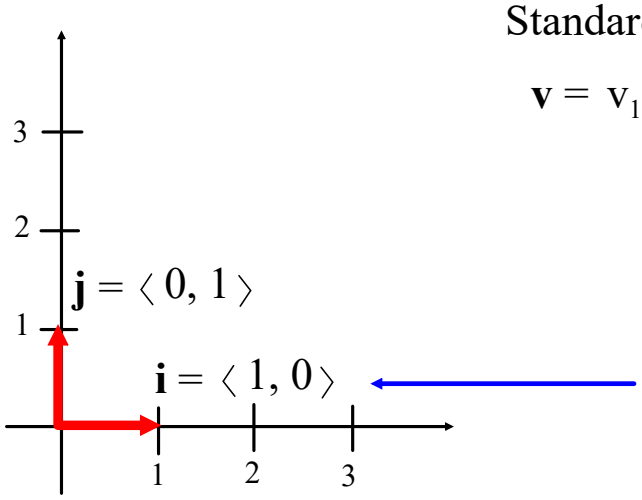
$\mathbf{u}$ = unit vector = $\dfrac{\mathbf{v}}{||\mathbf{v}||}$

Unit vector has a magnitude of 1

New Notation: $\mathbf{v} = \langle v_1, v_2 \rangle$ component vector form

Standard unit vector form:

$\mathbf{v} = v_1\mathbf{i} + v_2\mathbf{j}$



Bold **i**, not to be confused with italicized $i = \sqrt{-1}$ for imaginary numbers

Let **u** be the vector with initial point (2, -5) and terminal point (-1, 3). Write the standard unit vector.

Let **u** be the vector with initial point (-2, 6) and terminal point (-8, 3). Write the standard unit vector.

Vector Operations:

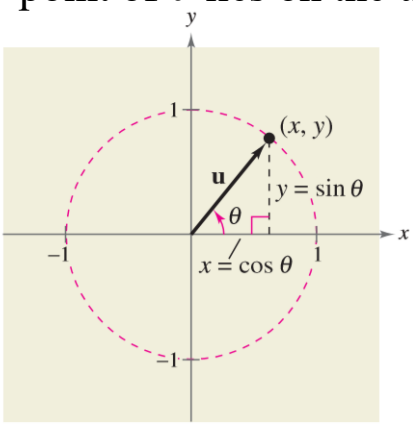
$\mathbf{u} = -3\mathbf{i} + 8\mathbf{j}$ and $\mathbf{v} = 2\mathbf{i} - \mathbf{j}$

Try both component and standard form

Find: $2\mathbf{u} - 3\mathbf{v}$

Find: $-5\mathbf{u} + 2\mathbf{v}$

If **u** is a unit vector such that θ is the angle (measured counterclockwise) from the positive x-axis to **u**, the terminal point of **u** lies on the unit circle and you have:



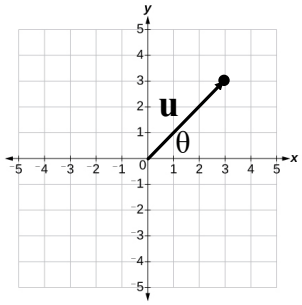
$\|\mathbf{u}\| = 1$

$$\mathbf{u} = \langle x, y \rangle$$
$$= \langle \cos\theta, \sin\theta \rangle$$
$$= (\cos\theta)\mathbf{i} + (\sin\theta)\mathbf{j}$$

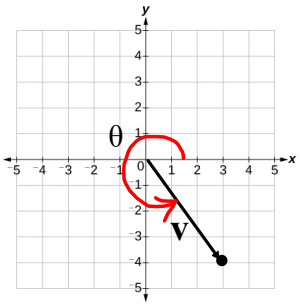
θ can be found using right triangle trig.

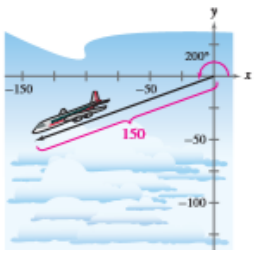
Find the direction angle of each vector.

$\mathbf{u} = 3\mathbf{i} + 3\mathbf{j}$

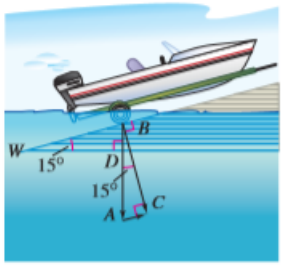


$\mathbf{v} = 3\mathbf{i} - 4\mathbf{j}$

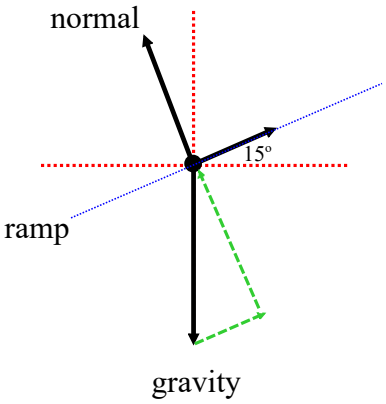




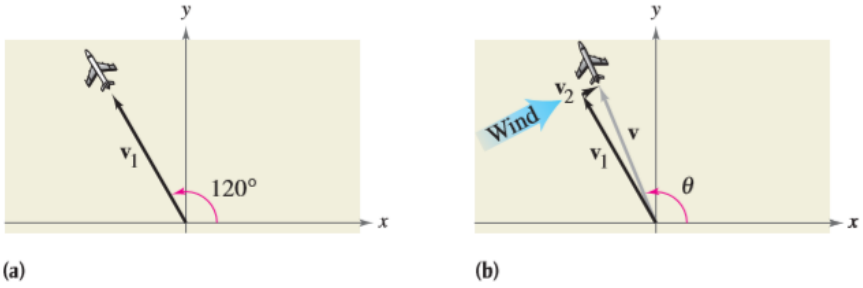
Find the component form of the vector that represents the velocity of an airplane descending at a speed of 150 miles per hour and an angle 20º below the horizontal.



A force of 600 pounds is required to pull a boat and trailer up a ramp inclined at 15º from the horizontal. Find the combined weight of the boat and trailer.



An airplane traveling at a speed of 500 miles per hour with a bearing of 330° at a fixed altitude with a negligible wind velocity as shown in figure (a). When the airplane reaches a certain point, it encounters a wind with a velocity of 70 miles per hour in the direction N 45° E, as shown in figure (b). What are the resultant speed and direction of the airplane?



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