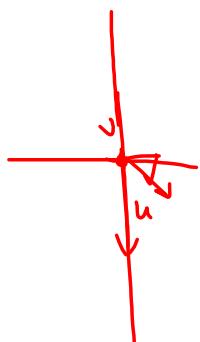


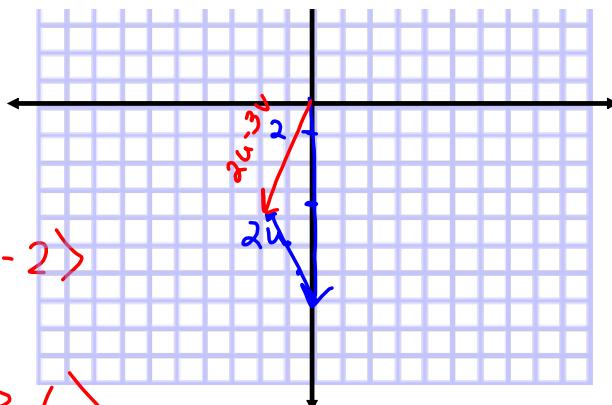
35) c) $2u - 3v$

$$u = \langle 0, -7 \rangle \quad v = \langle 1, -2 \rangle$$

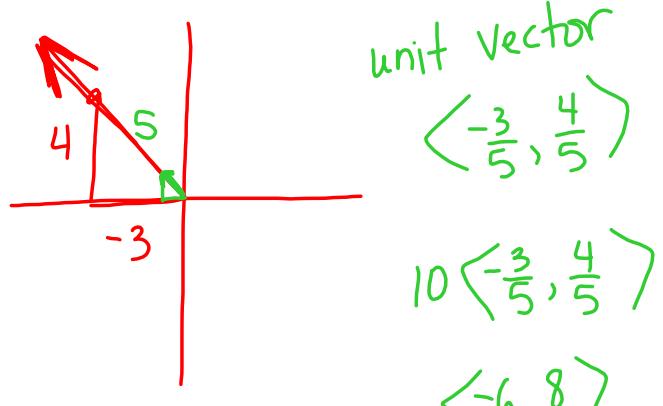


$$\langle 0, -14 \rangle + \langle -3, 6 \rangle$$

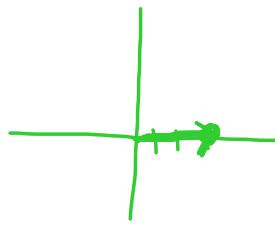
$$\langle -3, -8 \rangle$$



47) $\|v\|=10 \quad u = \langle -3, 4 \rangle$



$$4) \langle 3, 0 \rangle$$



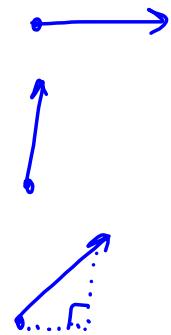
unit vector $\left\langle \frac{3}{3}, \frac{0}{3} \right\rangle$

$$\frac{\mathbf{v}}{\|\mathbf{v}\|}$$

$$\langle 1, 0 \rangle = \mathbf{u}$$

$$\sqrt{1^2 + 0^2} = \|\mathbf{u}\|$$

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



6.3B Vectors in the plane

Recap

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

component vector form

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

$$\mathbf{u} = \text{unit vector} = \frac{\mathbf{v}}{\|\mathbf{v}\|}$$

Unit vector has a magnitude of 1

New Notation:

$$\mathbf{v} = \begin{pmatrix} v_1, v_2 \end{pmatrix}$$

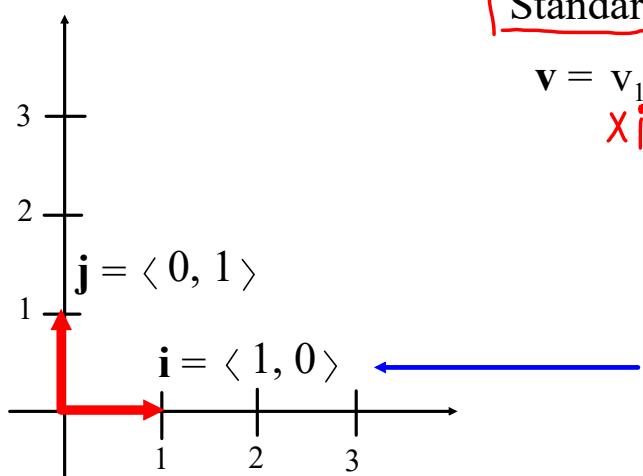
x
y

component vector form

Standard unit vector form:

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

x \mathbf{i} + *y* \mathbf{j}



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

Let \mathbf{u} be the vector with initial point $(2, -5)$ and
terminal point $(-1, 3)$. Write the standard unit vector.

$$\begin{aligned} & \langle -3, 8 \rangle \\ & \mathbf{u} = -3\mathbf{i} + 8\mathbf{j} \end{aligned}$$

Let \mathbf{u} be the vector with initial point $(-2, 6)$ and
terminal point $(-8, 3)$. Write the standard unit vector.

$$\mathbf{u} = -6\mathbf{i} - 3\mathbf{j}$$

Vector Operations:

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

Try both component and standard form

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

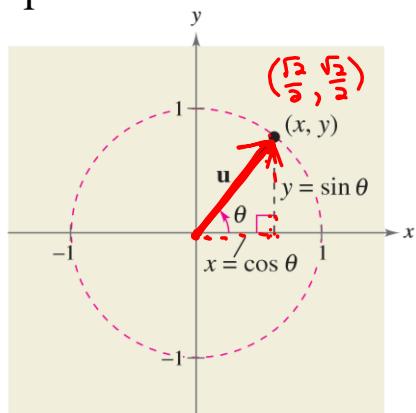
$$\text{Find: } -5\mathbf{u} + 2\mathbf{v}$$

$$\begin{aligned} & 2(-3\mathbf{i} + 8\mathbf{j}) - 3(2\mathbf{i} - \mathbf{j}) \\ & -6\mathbf{i} + 16\mathbf{j} - 6\mathbf{i} + 3\mathbf{j} \\ & = -12\mathbf{i} + 19\mathbf{j} \end{aligned}$$

$$\begin{aligned} & 2\langle -3, 8 \rangle - 3\langle 2, -1 \rangle \\ & \langle -6, 16 \rangle + \langle -6, 3 \rangle \\ & \langle -12, 19 \rangle \end{aligned}$$

$$19\mathbf{i} - 42\mathbf{j}$$

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



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

$$\begin{aligned} (x, y) & \\ (\cos\theta, \sin\theta) & \end{aligned}$$

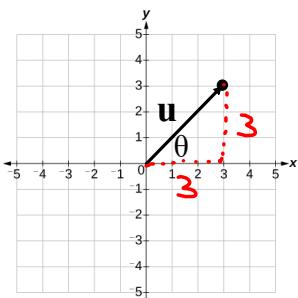
θ can be found using right triangle trig.

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

$$\begin{aligned} \theta &= 45^\circ = \frac{\sqrt{2}}{2}\mathbf{i} + \frac{\sqrt{2}}{2}\mathbf{j} \\ &= \left\langle \frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \right\rangle \end{aligned}$$

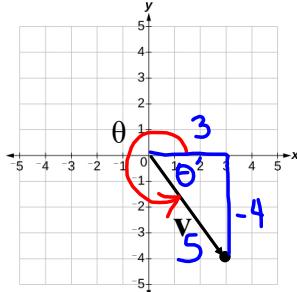
Find the direction angle of each vector.

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



$$\theta = 45^\circ$$

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



$$360^\circ - 53.1^\circ = \theta$$

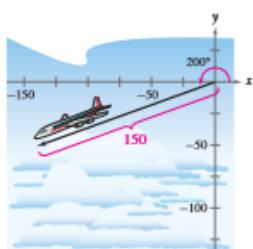
$$\theta = 306.9^\circ$$

$$\tan \theta' = -\frac{3}{4}$$

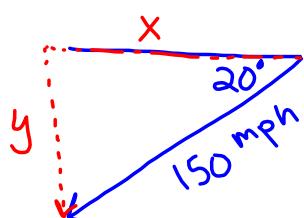
$$\tan^{-1}\left(\frac{3}{-4}\right) = \theta'$$

$$\theta' = -53.1^\circ$$

$$\text{ref } \angle = 53.1^\circ$$



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 20° below the horizontal.



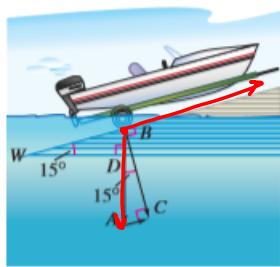
$$\cos 20^\circ = \frac{x}{150}$$

$$\sin 20^\circ = \frac{y}{150}$$

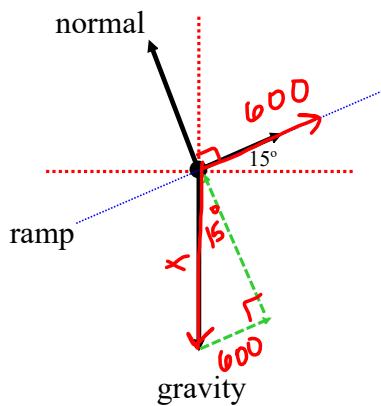
$$x = 150 \cos 20^\circ \quad 150 \sin 20^\circ$$

$$\langle 150 \cos 20^\circ, 150 \sin 20^\circ \rangle$$

$$\langle 140.95, -51.3 \rangle$$



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



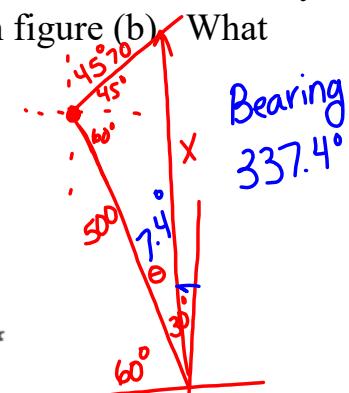
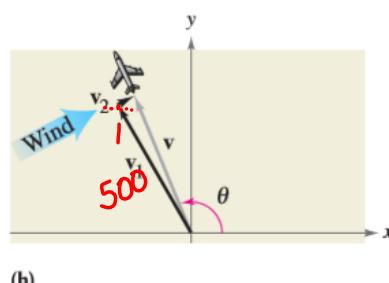
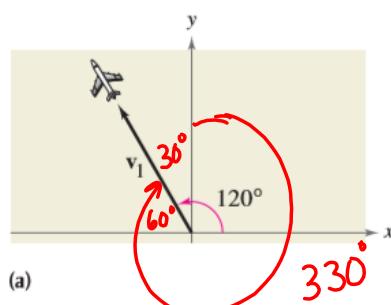
$$\sin 15^\circ = \frac{600}{X}$$

$$X = \frac{600}{\sin 15^\circ}$$

$$X = 2318.22 \text{ lbs}$$

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?



$$X^2 = 70^2 + 500^2 - 2(70)(500)\cos 105^\circ$$

$$X = 522.5$$

$$\frac{\sin \theta}{70} = \frac{\sin 105^\circ}{522.5}$$

Section 6.3B Pgs. 425-428

#51 - 69, 71 - 74, 77-80, 85, 87, 106