Applications of Vectors

Throwing a discus/javelin

hockey puck shot off the boards

soccer dynamics

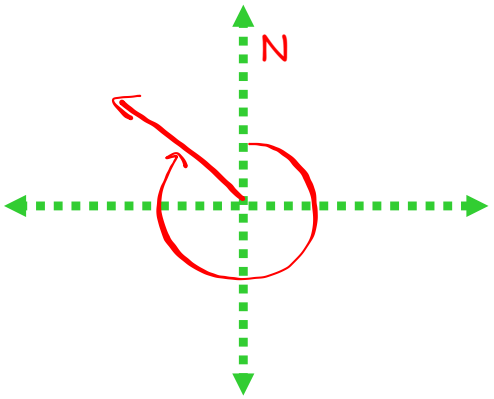
Airplane course

Playing pool

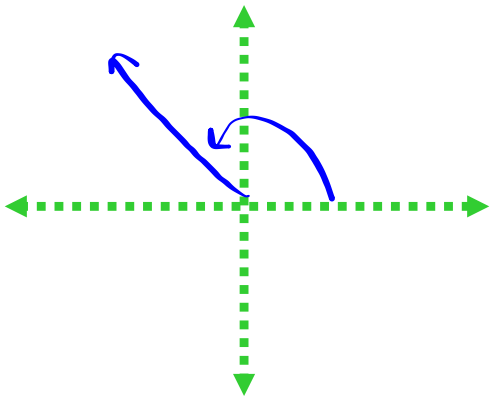
Speed a baseball player must go to intercept the fly ball

Bearings vs. Direction Angles

Bearing is an **angle** that is measured clockwise from the north direction

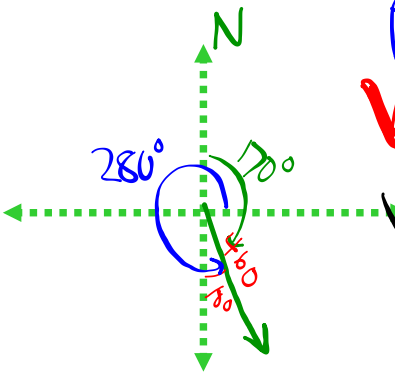


A direction **angle** is measured from t positive x-axis.



You have to convert from bearings to direction angles 1st!! Speed = Magnitude of Velocity Vector

An airplane is flying at a bearing of 170° at 460 mph. Find the component form of the velocity of the plane.



Directed angle: 280°

$\mathbf{v} = \langle |v|\cos\theta, |v|\sin\theta \rangle$

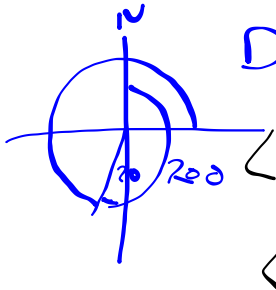
$v = \langle 460\cos 280°, 460\sin 280° \rangle$

$v = \langle 79.9 \text{ mph}, -453.0 \text{ mph} \rangle$

Eastward motion

Southward direction

The wind is blowing with the bearing of 200° at 80 mph. Find the component form of the velocity of the wind.



Direct = 250°

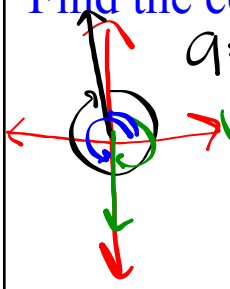
$\langle |v|\cos 250, |v|\sin 250 \rangle$

$\langle -27.4, -75.2 \rangle$

Calculating the effect of Wind velocity

An airplane is flying at a bearing of 350° at 420 mph.
A wind is blowing with a bearing of 180° at 75 mph.

Find the component form of the airplane and wind.



$a: \theta = 100^\circ$ $\quad a: \langle 420\cos 100^\circ, 420\sin 100^\circ \rangle$

$w: \theta = 270^\circ$ $\quad w: \langle 75\cos 270^\circ, 75\sin 270^\circ \rangle$

$a: \langle -72.9, 413.6 \rangle$

$w: \langle 0, -75 \rangle$

Find the actual direction and speed of the airplane.

$a: \langle -72.9, 413.6 \rangle$

$w: \langle 0, -75 \rangle$

$a + w = \langle -72.9, 413.6 \rangle + \langle 0, -75 \rangle$

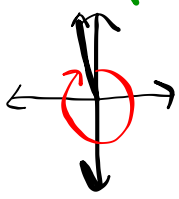
$a + w = \langle -72.9, 338.6 \rangle$

$|a+w| = \sqrt{(-72.9)^2 + (338.6)^2} =$ **346.36 mph**

$x = |a+w|\cos\theta$

$-72.9 = 346.36\cos\theta$

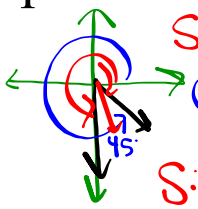
$\cos^{-1}\left(\frac{-72.9}{346.36}\right) = 102.2^\circ$



$360^\circ - 12.2^\circ = 347.8^\circ$

Bearings

A ship is heading due south at 15mph. A current is flowing southeast at 3 mph. Find the actual direction and speed of the ship.



S: θ 270° $\langle 15\cos 270°, 15\sin 270° \rangle$

C: θ 315° $\langle 3\cos 315, 3\sin 315 \rangle$

S: $\langle 0,-15 \rangle + \langle 2.12,-2.12 \rangle = \langle 2.12,-17.12 \rangle$

Speed: $\sqrt{(2.12)^2+(-17.12)^2} = 17.25$ mph

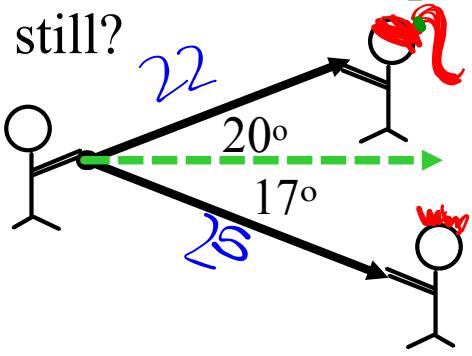
$\cos^{-1}\left(\frac{2.12}{17.25}\right) = 82.94°$

$360° - 82.94° = 277.06°$

Bearing

$180° - 7.06° = 172.93°$

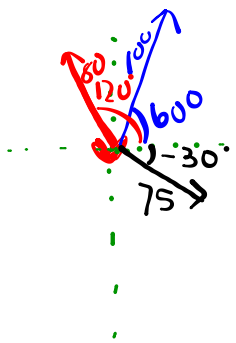
Kaitlyn and her brother Kaedon are playing tug of war with their dad. If each child pulls with a force of 22 lbs and 25 lbs at the angles shown, how hard is their dad pulling to hold them still?



Ka: $\langle 22\cos 20°, 22\sin 70° \rangle +$

Ke: $\langle 25\cos(-17)°, 25\sin(-17°) \rangle$

Three forces with magnitudes of 100 lb., 80 lbs., and 75 lbs. act on an object at angles of 60^o, 120^o, and -30^o respectively. Find the resultant.



$\langle 100\cos 60°, 100\sin 60° \rangle +$

$\langle 80\cos 120°, 80\sin 120° \rangle +$

$\langle 75\cos -30, 75\sin -30° \rangle$