$$\text{Direction} \angle = 450° - \text{Bearing}$$

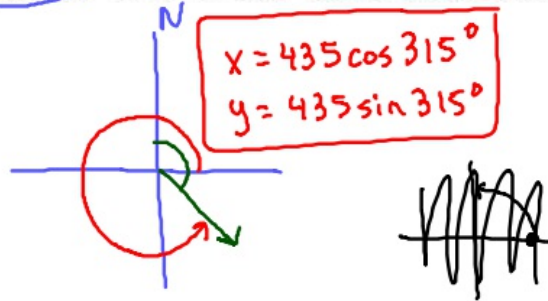Navigation

A) An airplane is flying on a bearing of 135° at 435 mph. Find the component form of the velocity of the airplane.

$x = 435\cos 135°$
$y = 435\sin 135°$

direction angle

N

$x = 435\cos 315°$
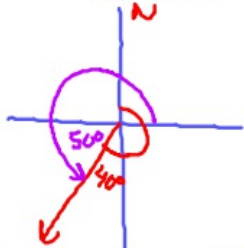$y = 435\sin 315°$

315° from North
Direction angle 135°

B) An airplane is flying on a compass heading(bearing) of 315° at 300 mph. A wind is blowing with the bearing 220° at 30 mph.
- Find the component form of the velocity of the airpane.

$x = 300\cos 135° = -212.132 \rightarrow A$
$y = 300\sin 135° = 212.132 \rightarrow B$

Bearing 220° from North
N

500°
40°

$\theta = \text{direction angle} = 230°$

- Find the component form of the velocity of the wind.

$x = 30\cos 230° \rightarrow -19.283 \rightarrow C$
$y = 30\sin 230° \rightarrow -22.981 \rightarrow D$

N

39°

- Find the actual ground speed and direction of the airplane

$\text{plane} + \text{wind} = \langle -231.415 \quad 189.15 \rangle$
$\qquad\qquad\qquad\qquad A+C=E \quad\; B+D=F$

$\text{Ground Speed} = |\text{plane} + \text{wind}| = \sqrt{E^2 + F^2} = 298.88 \text{ mph}$

$\text{Direction} = \text{Bearing from North} = 270 + 39.261 = 309.261° \text{ From North}$

$\text{reference} \angle = \tan^{-1}\left(\dfrac{F}{E}\right) = -39.261$
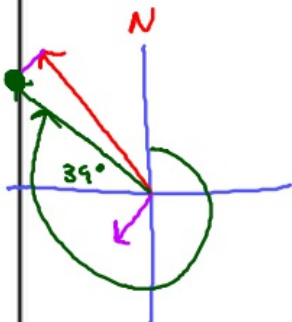
θ = direction angle
  - from positive x-axis

$\theta = \tan^{-1}\left(\dfrac{y}{x}\right)$

$x = |v|\cos\theta$

$y = |v|\sin\theta$

$180 + (90 - 80.648)$

Actual Bearing
  - Clockwise from North

$\theta = \tan^{-1}\left(\dfrac{-12.879}{-2.121}\right)$

$\theta = 80.648°$

Direction / Reference angle

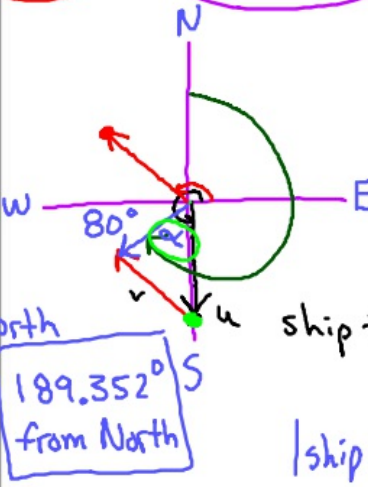
direction angle = 270°

→ speed = mag

direction angle 135°

C) A ship is heading due south at 15 mph. The current is flowing northwest at 3 mph. Find the actual bearing and speed of the ship.

N

W ———— E

80°

189.352° S from North

ship: $x = 15\cos 270° = 0$
  $y = 15\sin 270° = -15$

current: $x = 3\cos 135° = -2.121$
  $y = 3\sin 135° = 2.121$

ship + current $= \langle 0 + -2.121, -15 + 2.121\rangle$
  $= \langle -2.121, -12.879\rangle$

$|ship + current| = \sqrt{(-2.121)^2 + (-12.879)^2} = 13.05$ mph

Shooting a basketball: A basketball is shot at an angle 65° with an initial speed of 12m/sec.

a. Find the component form of the initial velocity.

b. Give an interpretation of the horizontal and vertical components of the velocity.

Combining Forces: A force of 40 lbs acts on an object at angle of 20°. A second force of 65 pounds acts on the object at an angle if $-25°$. Find the direction and magnitude of the resultant force.