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

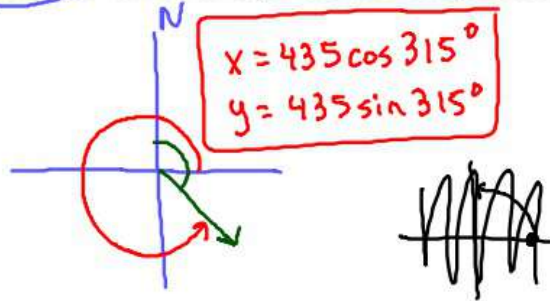135° From North → Direction angle 315°

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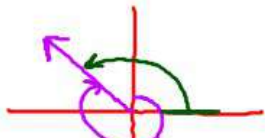
A) An airplane is flying on a bearing of 135° at 435 mph. Find the component form of the velocity of the airplane.

$x = 435 \cos 135°$
$y = 435 \sin 135°$

direction angle

N

$\boxed{\begin{array}{l} x = 435 \cos 315° \\ y = 435 \sin 315° \end{array}}$
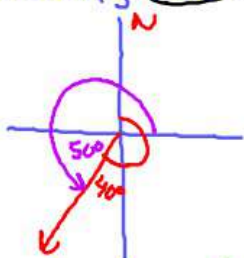
315° from North
Direction angle 135°

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

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

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

50°
40°

$\theta = $ direction angle $= 230°$

N

39°

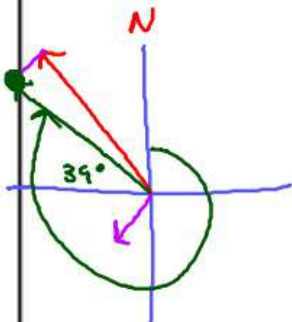- Find the actual ground speed and direction of the airplane

plane + wind = $\left\langle \begin{array}{cc} -231.415 & 189.15 \\ A+C=E & B+D=F \end{array} \right\rangle$

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

Direction = Bearing from North $= 270 + 39.261 = 309.261°$ From North

reference $\angle = \tan^{-1}\left(\dfrac{E}{E}\right) = -39.261$

$\theta$ = direction angle
  – from positive x-axis

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

$x = |v|\cos\theta$

$y = |v|\sin\theta$

$180 + (90 - 80.648)$

**Actual Bearing**
  – Clockwise from North

$\theta = \tan^{-1}\left(\frac{-12.879}{-2.121}\right)$
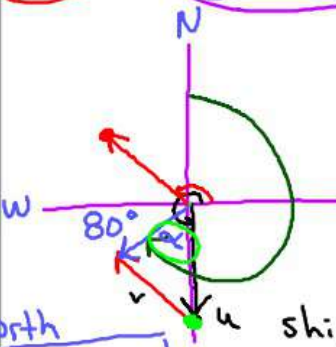
$\theta = 80.648°$

Direction / Reference angle

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.

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

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

N
W    80°    E
S

$189.352°$ S from North

**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.