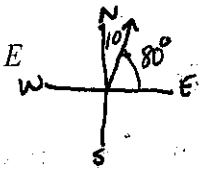
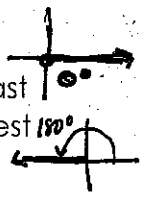
GSE Pre-calculus
Application Vector - notes

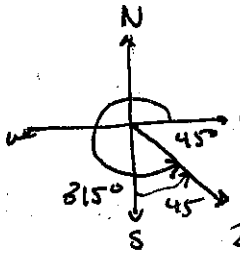
Vector applications - Vector addition and trig can be used to solve vector problems involving triangles.

Understanding direction

Draw the following from the standard position

1. $N10^\circ E$ 

2. Traveling due east / Traveling due west 

3. Southeast - $S45^\circ E$ 

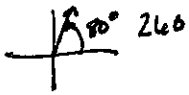
270 + 45 = 315°

In navigation, a heading is the direction in which a vessel, such as an airplane or boat, is steered to overcome other forces, such as wind or current.

4. An airplane is heading $N10^\circ E$ at 260 mph. A 16 mph wind blows from the west. Find the plane's resultant velocity. - (speed and direction)

|v| θ

Remember what we have learned (on back).

① Airplane: 

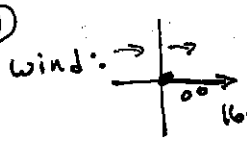
So, if we have magnitude and direction we can find the vector component

$\langle 260\cos 80^\circ, 260\sin 80^\circ \rangle$

$\langle 45, 256.1 \rangle$

④ |v| - speed $= \sqrt{61^2 + (256.1)^2}$ $= \boxed{263.3 \text{ mph}}$

θ - direction $\tan^{-1}\left(\frac{256.1}{61}\right) = \boxed{76.6^\circ}$

② Wind: 

$\langle 16\cos 0, 16\sin 0 \rangle$

$\langle 16, 0 \rangle$

③ So, the resultant vector (add together)

$\langle 45, 256.1 \rangle + \langle 16, 0 \rangle =$

$\langle 61, 256.1 \rangle$ now find |v| and θ

5. A boat is traveling 9 knots per hour(KPH) at an angle of 110°. The current is flowing due east at 4 KPH. Find the resulting velocity.

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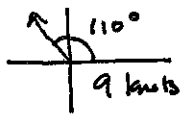
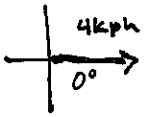
Boat: 

$\langle 9\cos 110^\circ, 9\sin 110^\circ \rangle$

$\langle -3.1, 8.5 \rangle$

Current: 

$\langle 4\cos 0, 4\sin 0 \rangle$

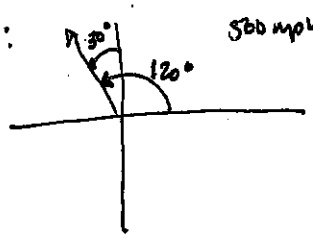
$\langle 4, 0 \rangle$

$\langle -3.1, 8.5 \rangle$
$+ \langle 4, 0 \rangle$
$\langle -.92, 8.46 \rangle$ Resultant vector

$|v| = \sqrt{(-.92)^2 + (8.46)^2}$
$= \boxed{8.51 \text{ KPH}}$

$\theta = \tan^{-1}\left(\frac{8.46}{-.92}\right)$
$= \boxed{83.79^\circ}$

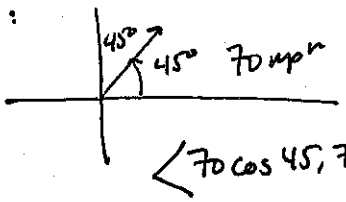
6. A plane is traveling 500 MPH and headed N30°W. It encounters a wind blowing 70 MPH at N45°E. What is the resulting velocity?

Plane: 

90 + 30

$\langle 500\cos 120, 500\sin 120 \rangle$

$\langle -250, 433.01 \rangle$

Wind: 

$\langle 70\cos 45, 70\sin 45 \rangle$

$\langle 49.5, 49.5 \rangle$

$\langle -250, 433.01 \rangle$
$+ \langle 49.5, 49.5 \rangle$
$\langle -200.5, 482.51 \rangle$ Resultant vector

$|v| = \sqrt{(-200.5)^2 + (482.51)^2}$
$= \boxed{522.51 \text{ mph}}$

$\theta = \tan^{-1}\left(\frac{482.51}{-200.5}\right) + 180$
$= \boxed{112.6^\circ}$