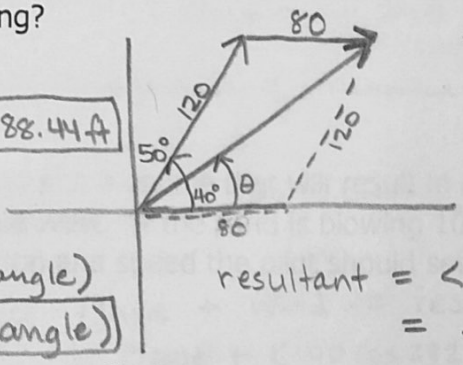
Accel. PreCalculus
Vector Applications Practice

Name Key
Date _____ Per _____

1. Suppose a person walks 120 ft. on a true bearing of 50°. They then turn and walk 80 ft. due east. How far from their starting position have they walked and at what bearing?



$\langle 120\cos 40°, 120\sin 40° \rangle$
$\langle 91.93, 77.13 \rangle$

$\langle 80\cos 0°, 80\sin 0° \rangle$
$\langle 80, 0 \rangle$

resultant = $\langle 91.93, 77.13 \rangle + \langle 80, 0 \rangle$
$= \langle 171.93, 77.13 \rangle$

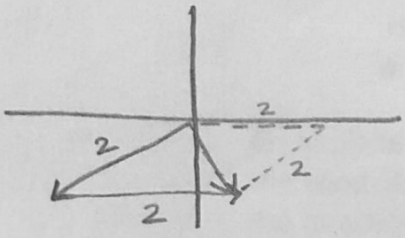
mag. of resultant = $\sqrt{(171.93)^2 + (77.13)^2} = \boxed{188.44 \text{ ft}}$

$\tan\theta = \frac{77.13}{171.93}$

$\theta = 24.16°$ (direction angle)

$\boxed{65.84°}$ (bearing angle)

2. Suppose a person walks 2 km. at a true bearing of 240° and then walks 2 km directly east. How far and at what bearing is the person from their starting position? Direction angle = 210°



$\langle 2\cos 210°, 2\sin 210° \rangle$
$\langle -1.73, -1 \rangle$

$\langle 2\cos 0, 2\sin 0 \rangle$
$\langle 2, 0 \rangle$

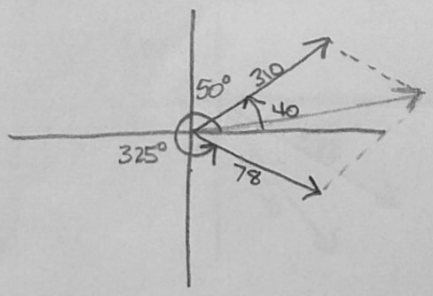
resultant = $\langle -1.73, -1 \rangle + \langle 2, 0 \rangle$
$= \langle 0.268, -1 \rangle$

mag. of resultant = $\sqrt{(.268)^2 + (-1)^2}$
$= \boxed{1.035 \text{ Km}}$

$\tan\theta = -1/0.268 = -74.997°$

$\boxed{\text{Bearing angle} = 165°}$

3. An airplane is flying with an airspeed of 310 knots on a true bearing of 50°. If a 78 knot wind is blowing ~~from~~ at a true bearing of 125°, determine the speed and direction of the plane relative to the ground.



Plane: $\langle 310\cos 40, 310\sin 40 \rangle$
$\langle 237.47, 199.26 \rangle$

Wind: $\langle 78\cos 325, 78\sin 325 \rangle$
$\langle 63.89, -44.74 \rangle$

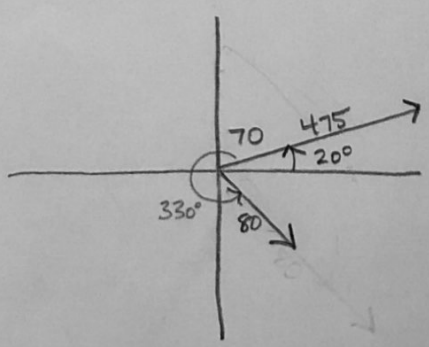
resultant: Plane + wind
$\langle 301.36, 154.52 \rangle$

mag. of resultant = $\sqrt{301.36^2 + 154.52^2}$
$= \boxed{338.67 \text{ knots}}$

$\theta = \tan^{-1}\left(\frac{154.52}{301.36}\right) = 27.15$

$90 - 27.15 = \boxed{62.85°}$

4. An airplane is flying with an airspeed of 475 mph on a bearing of 70°. If an 80 mph wind is blowing ~~from~~ at a bearing of 120°, determine the velocity and direction of the plane relative to the ground.



Plane: $\langle 475\cos 20, 475\sin 20 \rangle$
$\langle 446.35, 162.46 \rangle$

Wind: $\langle 80\cos 330, 80\sin 330 \rangle$
$\langle 69.28, -40 \rangle$

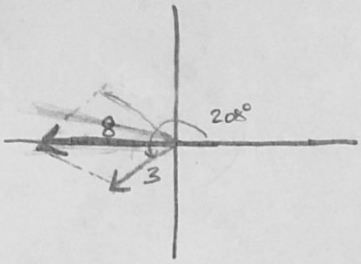
Resultant: Plane + wind
$\langle 515.63, 122.46 \rangle$

mag of resultant = $\sqrt{515.63^2 + 122.46^2}$
$= \boxed{529.97 \text{ Knots}}$

$\theta = \tan^{-1}\left(\frac{122.46}{515.63}\right) = 13.36°$

$90 - 13.36 = \boxed{76.64°}$

5. A runner's resultant velocity is 8 mph due west running with a wind of 3 mph at a bearing of 242°. What is the runner's speed without the effect of the wind?



Runner + wind = resultant

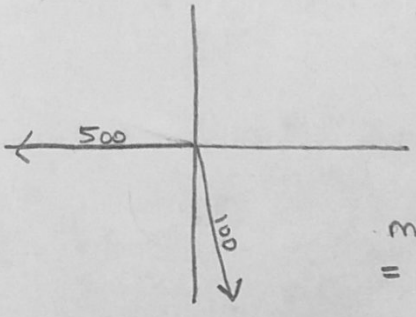
$\langle |v|\cos\theta, |v|\sin\theta\rangle + \langle 3\cos 208, 3\sin 208\rangle = \langle 8\cos 180, 8\sin 180\rangle$

$\langle |v|\cos\theta, |v|\sin\theta\rangle + \langle -2.65, -1.41\rangle = \langle -8, 0\rangle$

$\langle |v|\cos\theta, |v|\sin\theta\rangle = \langle -5.35, 1.41\rangle$ runner

magnitude of runner $= \sqrt{-5.35^2 + 1.41^2} =$ **5.53 mph**

6. A pilot needs to plot a course that will result in a velocity of 500 mph in a direction of due west. If the wind is blowing 100 mph ~~from~~ off the bearing of 168°, find the direction and speed the pilot should set to achieve this resultant.



Plane + wind = resultant

Plane + $\langle 100\cos 282, 100\sin 282\rangle = \langle -500, 0\rangle$

Plane + $\langle 20.79, -97.81\rangle = \langle -500, 0\rangle$

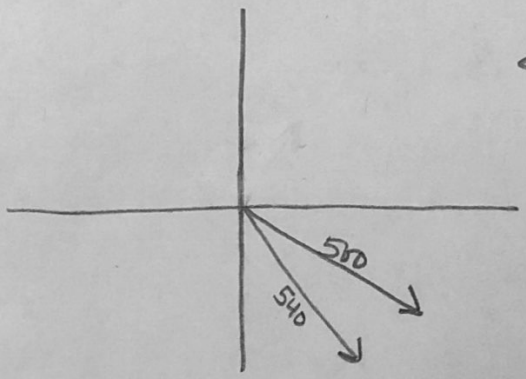
Plane = $\langle -520.79, 97.81\rangle$

mag. of plane $= \sqrt{-520.79^2 + 97.81^2} =$ **529.9 mph**

$\theta = \tan^{-1}\left(\frac{97.81}{-520.79}\right) = -10.64°$

$-10.64 + 180 =$ **169.36°**

7. An airplane flying on a bearing of 148° with an airspeed of 540 mph. Because of the wind, its groundspeed and direction are 500 mph at a bearing of 140°. Find the direction and speed of the wind.



Plane + wind = resultant

$\langle 540\cos 302, 540\sin 302\rangle$ + wind $= \langle 500\cos 310, 500\sin 310\rangle$

$\langle 286.16, -457.95\rangle$ + wind $= \langle 321.39, -383.02\rangle$

wind = $\langle 35.23, 74.93\rangle$

mag. of wind $= \sqrt{(35.23)^2 + (74.93)^2}$

$=$ **82.8 mph**

$\theta = \tan^{-1}\left(\frac{74.93}{35.23}\right) =$ **64.82°**