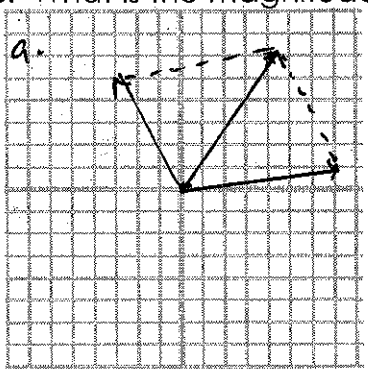
GSE PreCalculus
WS 7.3 – Apps Law of Vectors

Name Key
Date _____ Day ____

1. a. Draw a diagram of the vectors $\langle -3,5 \rangle$ and $\langle 7,1 \rangle$ in standard position
   b. Use the tip-to-tail or parallelogram method to draw the resultant vector.
   c. What is the magnitude and direction of the resultant?



b. $\langle -3,5 \rangle + \langle 7,1 \rangle = \langle 4,6 \rangle$ Resultant Vector

c. $\|v\| = \sqrt{a^2+b^2}$
$= \sqrt{(4)^2+(6)^2}$
$= 7.21$

$\theta = \tan^{-1}\left(\frac{b}{a}\right)$
$\tan^{-1}\left(\frac{6}{4}\right)$
$= 56.31°$

2. Find the resultant vector for each. Also, find the magnitude and direction.
   a. $\langle -16,32 \rangle + \langle 22,11 \rangle = \langle 6, 43 \rangle$ $\sqrt{6^2+43^2} = 43.4$ $\theta = \tan^{-1}\left(\frac{43}{6}\right)$ $\theta = 82.1°$
   b. $\langle 4,72 \rangle + \langle 37,-127 \rangle + \langle 43,43 \rangle = \langle 84, -12 \rangle$ $\sqrt{(84)^2+(-12)^2} = 84.9$ $\theta = \tan^{-1}\left(\frac{-12}{84}\right)$ $\theta = -8.1°$

3. The speed of a powerboat in still water is 47 knots per hour (KPH). The powerboat heads directly west across the Messina River. The river flows north at 3.5 KPH. Find the resulting velocity (i.e. speed and direction) of the powerboat.

① Powerboat: 47kph, Directly west is 180° $\langle 47\cos 180, 47\sin 180 \rangle$ $\langle -47, 0 \rangle$
$\theta = \tan^{-1}\left(\frac{3.5}{-47}\right) + 180$
$\theta = 175.7$

② River: 3.5kph, North = 90° $\langle 3.5\cos 90, 3.5\sin 90 \rangle$ $\langle 0, 3.5 \rangle$

③ $\langle -47, 0 \rangle + \langle 0, 3.5 \rangle$
$\langle -47, 3.5 \rangle$

④ $|v| = \sqrt{(-47)^2+(3.5)^2} = 47.1$

4. A ship near the coast is going 5 KPH at an angle of 130°. The water current is flowing directly due east at 3 KPH. What is the ships resultant velocity with respect to the current?

① Ship: 130° 5kph $\langle 5\cos 130, 5\sin 130 \rangle$ $\langle -3.2, 3.8 \rangle$

② water current: 3kph, 0° $\langle 3\cos 0, 3\sin 0 \rangle$ $\langle 3, 0 \rangle$

③ $\langle -3.2, 3.8 \rangle + \langle 3, 0 \rangle$
$\langle -.2, 3.8 \rangle$

④ $\sqrt{(-.2)^2+(3.8)^2}$
$= 3.8$ kph

$\theta = \tan^{-1}\left(\frac{3.8}{-.2}\right) + 180$
$\theta = 93°$

5. A Lear Jet has a speed of 420 MPH in still air. Suppose the plane travels east and encounters a 50 MPH wind blowing due North. Find the resulting velocity (speed and direction) of the jet.

① Lear Jet: still air = 0°, 420mph $\langle 420\cos 0, 420\sin 0 \rangle$ $\langle 420, 0 \rangle$

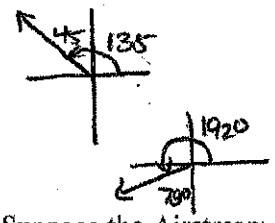
② wind due North 90°, 50mph $\langle 50\cos 90, 50\sin 90 \rangle$ $\langle 0, 50 \rangle$

③ $\langle 420, 0 \rangle + \langle 0, 50 \rangle$
$\langle 420, 50 \rangle$

④ $\sqrt{(420)^2+(50)^2}$
$= 422.97$

$\theta = \tan^{-1}\left(\frac{50}{420}\right)$
$\theta = 6.8$

6. An Airstream jet flies 640 MPH in still air. Suppose the jet is traveling $N45°W$ and encounters a 78 MPH wind blowing $S45°W$. Find the resulting velocity (speed and direction) of the jet.



$\langle 640\cos 135, 640\sin 135\rangle$

$\langle 78\cos 192, 78\sin 192\rangle$

? 150 + 45 = 195 should be!

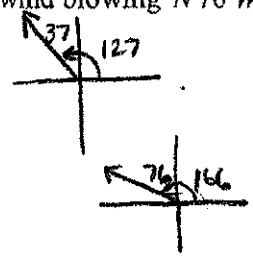
$\langle -528.84, 436.33\rangle$

speed = 685.61

direction = 140.47°

$-39.5 + 180$

7. Suppose the Airstream jet above (630 MPH in still air) is traveling $N37°W$ and encounters a 140 MPH wind blowing $N76°W$. Find the resulting velocity (speed and direction) of the jet.



$\langle 630\cos 127, 630\sin 127\rangle$

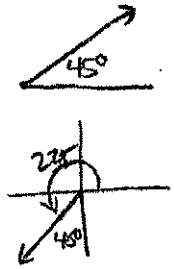
$\langle 140\cos 166, 140\sin 166\rangle$

$\langle -514.99, 537.01\rangle$

Speed = 744.04 MPH

direction = 133.8°

8. Miss Dalton is a tri-athlete and is swimming in the Cape Cod Canal. She swims 45° at 2.5 MPH. The current is flowing $S45°W$ at 0.8 MPH. Find Miss Dalton's resulting velocity (speed and direction).



$\langle 2.5\cos 45, 2.5\sin 45\rangle$

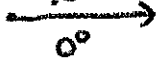
$\langle 0.8\cos 225, 0.8\sin 225\rangle$

$\langle 1.2, 1.2\rangle$

Speed = 1.7 MPH

direction = 45°

9. Suppose in question #8, that Miss Dalton also has to contend with a 0.5 MPH wind blowing directly east. Find Miss Dalton's resulting velocity (speed and direction).



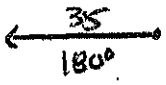
$\langle .5\cos 0, .5\sin 0\rangle$

$\langle 1.7, 1.2\rangle$

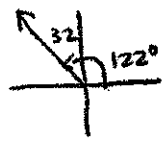
Speed = 2.1 MPH

direction = 35.21°

10. Mr. Johnson is traveling in his powerboat at 35 MPH traveling directly west. The current is flowing at 8 MPH in the direction of $N32°W$. There is also a tailwind of 12 MPH blowing in the direction of $N11°W$. Find the resulting velocity (speed and direction).

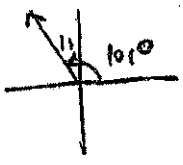


$\langle 35\cos 180, 35\sin 180\rangle$



90 + 32

$\langle 8\cos 122, 8\sin 122\rangle$



90 + 11

$\langle 12\cos 101, 12\sin 101\rangle$

$\langle -41.53, 18.56\rangle$

Speed = 45.5 MPH

direction = 155.9°