Name_____

Vectors: Review

1.)

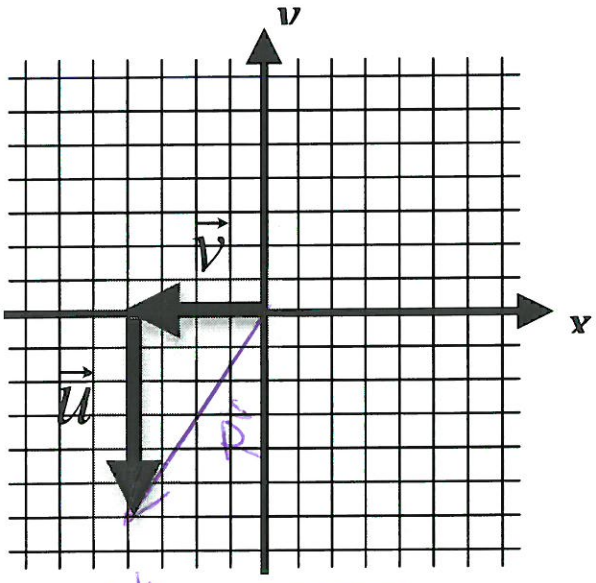
a) A vector is a quantity that involves both magnitude and direction.

b) The heading (bearing is ok) of a vector is measured clockwise from due north.

c) The resultant is the sum of two vectors.

Graph the resultant vector. Then determine its magnitude and direction.

2.)



$\|\vec{R}\| = \sqrt{4^2+6^2}$

$= \sqrt{52}$

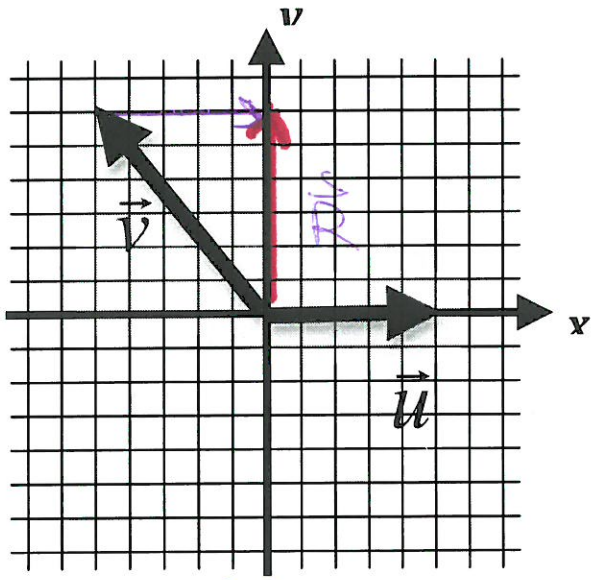
$= 7.21$

$\theta = 56.31°$ S of W

or W $56.31°$ S

S $33.69°$ W

3.)



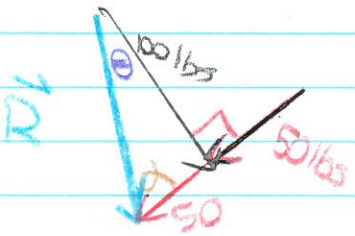
$\|\vec{R}\| = 6$

θ = Due North

or $0°$ heading

or $90°$ N of E

4)



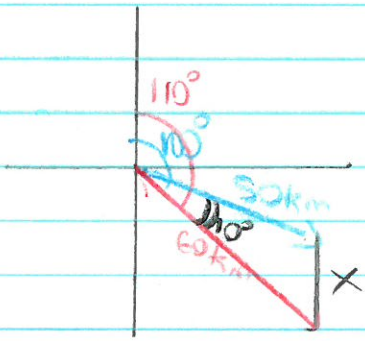
$$\|\vec{R}\| = \sqrt{50^2 + 100^2} = \boxed{111.8 \text{ lbs} = \|\vec{R}\|}$$

$$\frac{\sin\theta}{50} = \frac{\sin 90}{111.8} \qquad \theta = \boxed{26.57}$$

$$\alpha = 90 - 26.57 = \boxed{63.43^\circ = \alpha}$$

or $\frac{\sin\alpha}{100} = \frac{\sin 90}{111.8}$ 63.44° just a rounding difference

5)

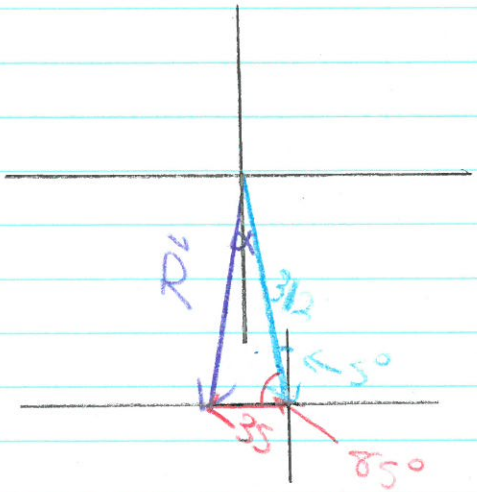


We do not need to add the vectors to find the distance between planes. Just use law of cosines

$$x = \sqrt{30^2 + 60^2 - 2(30)(60)\cos 110}$$

$$\boxed{x = 73.63 \text{ km apart}}$$

6)



$$\|\vec{R}\| = \sqrt{35^2 + 312^2 - 2(35)(312)\cos 85}$$

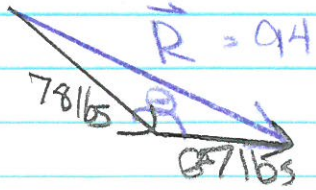
$$\boxed{\|\vec{R}\| = 310.91 \text{ mph}} \leftarrow \text{Ground Speed}$$

$$\frac{\sin\alpha}{35} = \frac{\sin 85}{310.95} \qquad \boxed{\alpha = 6.44^\circ} \leftarrow \text{Drift Angle}$$

The New Course is $175^\circ + 6.44^\circ = \boxed{181.44^\circ}$

- 175°: original heading
- 6.44°: Drift angle
- 181.44°: Course

7)



$94^2 = 78^2 + 67^2 - 2(78)(67)\cos\theta$

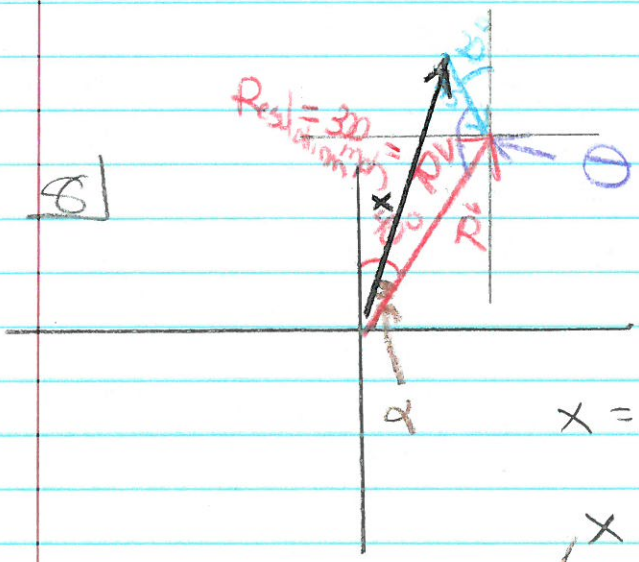
$\theta = 80.43^\circ$

$\approx 80^\circ$

The angle between the forces when we are adding them is 80°

The angle between the forces when they are acting on an object is 100° $(180-80)$

8)



$x = \sqrt{45^2 + 300^2 - 2(45)(300)\cos 120}$

$x = 324.85$ mph

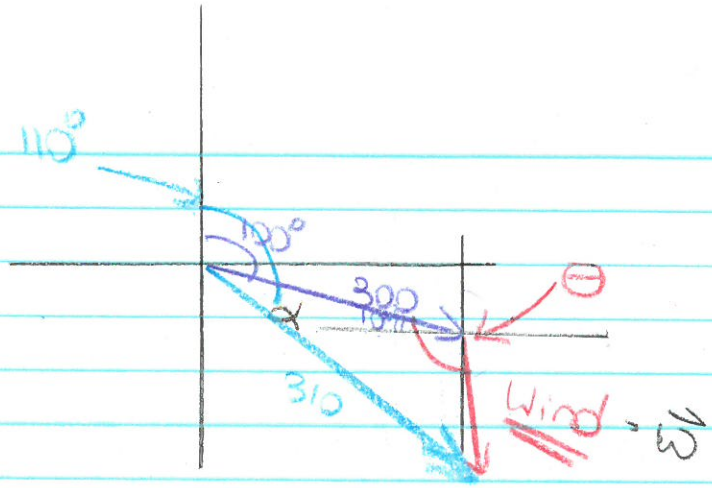
$\frac{\sin\alpha}{45} = \frac{\sin 120}{324.85}$ (about 7°)

$\alpha = 6.69^\circ$ ← Drift angle

Heading $40^\circ - 7^\circ = 33^\circ$

The pilot should have a heading of 33° at a speed of 324.85 mph.

9)



α = acute angle = 10°

$\|\vec{w}\| = \sqrt{300^2 + 310^2 - 2(300)(310)\cos 10}$

$\|\vec{w}\| = 54.09$ mph $\approx$ 54.1 mph = wind speed

$\frac{\sin\theta}{310} = \frac{\sin 10}{54.1}$ $\quad \theta = 84.26° \approx 84.3$

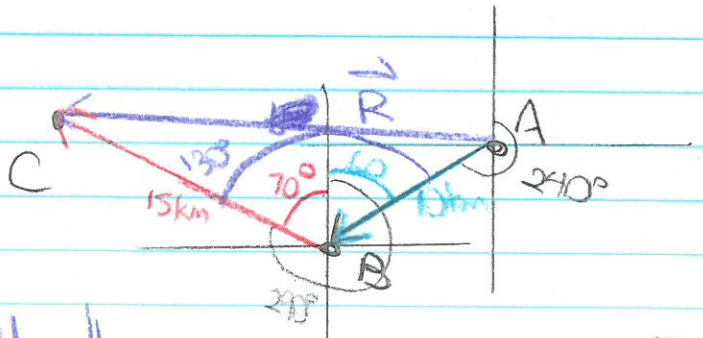
This is an accute angle when it clearly should be obtuse

so $\theta = 180 - 84.3 = 95.7°$

(direction)

So the heading of the wind is $260 - 95.7° = 164.3°$

10)



$\|\vec{R}\| = \sqrt{10^2 + 15^2 - 2(10)(15)\cos 130}$ $\quad = 22.78$km $= \|\vec{R}\|$