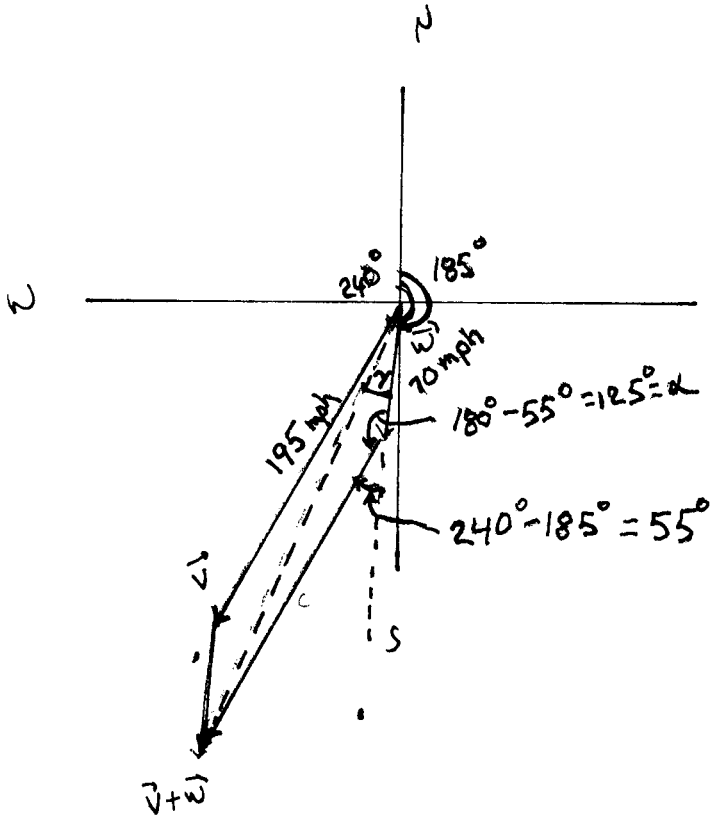
5.5 Applications of Vectors

20) Heading of helicopter = 240°

70 mph wind with bearing = 185°

Air speed of helicopter = 195 mph



$\vec{v}$ = velocity of helicopter

$\vec{w}$ = velocity of wind

Now solve the triangle, SAS case, so use Law of Cosines

Sides: $|\vec{w}| = 70$ mph $= b$

$|\vec{v}| = 195$ mph $= c$

$\alpha = 125°$

$a = |\vec{v}+\vec{w}|$

$a^2 = b^2 + c^2 - 2bc\cos\alpha$

$= 70^2 + 195^2 - 2(70)(195)\cos 125°$

$= 58583.6$

$a = |\vec{v}+\vec{w}| = \sqrt{58\,583.6} = \boxed{242.0 \text{ mph}}$

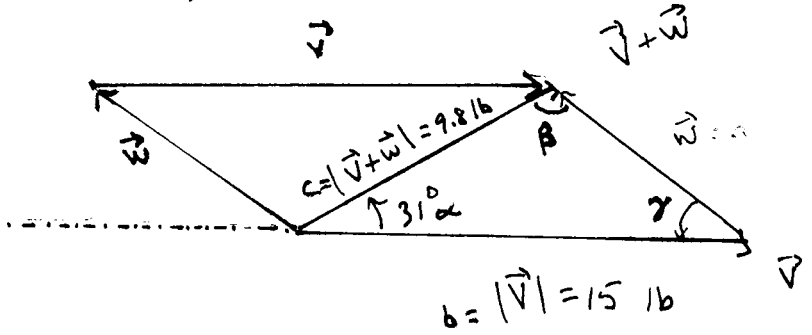
$\frac{\sin\gamma}{c} = \frac{\sin\alpha}{a} \Rightarrow \sin\gamma = \frac{c\sin\alpha}{a}$

$\sin\gamma = \frac{195\sin 125°}{242.0} = 0.659994$

$\gamma = \sin^{-1} 0.659994 = 41.3°$

Course of helicopter $= 185° + 41.3° = \boxed{226.3°}$

5.5 6)



Apply Law of Cosines: $a^2 = b^2 + c^2 - 2bc\cos\alpha$

$= 15^2 + 9.8^2 - 2(15)(9.8)\cos 31^\circ = 69.03$ lb^2

$a = \sqrt{69.03} = \boxed{8.3 \text{ lb}} = |\vec{w}|$

Apply law of Sines: $\frac{\sin\gamma}{c} = \frac{\sin\alpha}{a} \Rightarrow \sin\gamma = \frac{c\sin\alpha}{a} = \frac{9.8\sin 31^\circ}{8.3} = .6075$

So $\gamma = \boxed{37.4^\circ}$

The angle between the "other force" (i.e $\vec{w}$) and the resultant (i.e. $\vec{v}+\vec{w}$) is then

$\beta = 180^\circ - 37.4^\circ - 31^\circ = \boxed{111.6^\circ}$