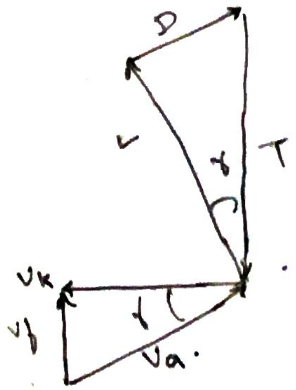
Case 1: Cross-current.



$T \perp v_k$

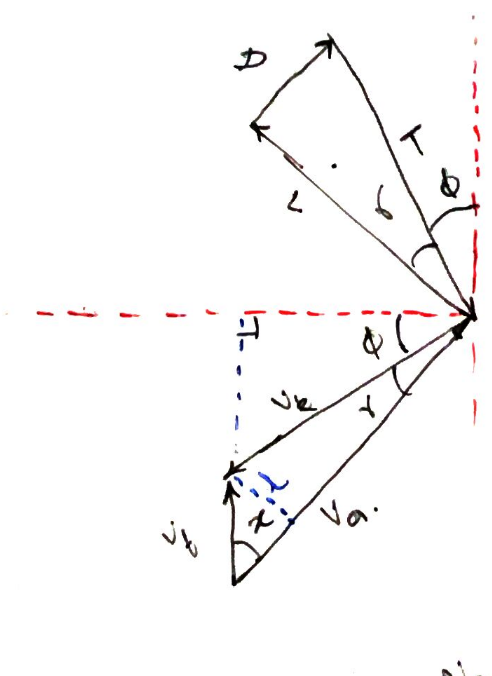
$L \perp v_a$.

Let angle b/w L & D be γ.

$\tan \gamma = \frac{D}{L}$

$\gamma = \operatorname{atan}(1/40)$

Case 2: flying at azimuth ϕ. (Upwind)



Again, $T \perp v_k$

$L \perp v_a$

extend v_f to meet with horizontal

Now, $x + \frac{\pi}{2} + \phi + \gamma = \pi$

$x = \frac{\pi}{2} - \phi - \gamma$

Drop perdicular from itersection of v_f & v_k at v_a.

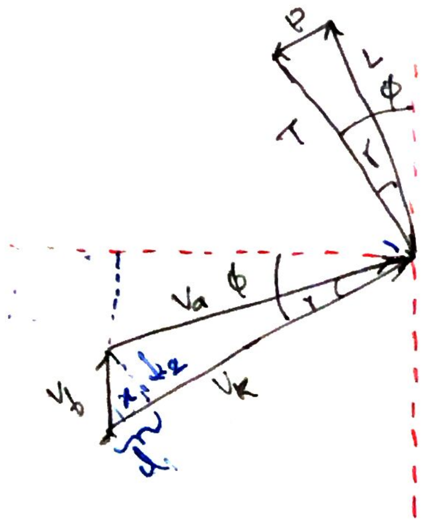
Now, $\sin x = d/v_f$

$d = v_f \sin x$.

Also, $\sin \gamma = \frac{d}{v_k}$

$\therefore v_k = \frac{d}{\sin \gamma} = \frac{v_f \sin(\pi/2 - \phi - \gamma)}{\sin \gamma}$

Case 3: Flying at azimuth ϕ (downwind)



Again, $T \perp v_K$

$L \perp v_a$

Now, v_K is pointing away from v_f.

Extend v_f to be perpendicular to horizontal

Now, $\phi + \frac{\pi}{2} + x = \pi$

$$x = \frac{\pi}{2} - \phi$$

$$\cos x = \frac{d_1}{v_f}$$

$$d_1 = v_f \cos x.$$

$$d_2 = v_f \sin x.$$

$$\tan \gamma = \frac{d_2}{v_K - d_1}$$

$$v_K - d_1 = \frac{d_2}{\tan \gamma}.$$

$$v_K = \frac{v_f \sin(\pi/2 - \phi)}{\tan \gamma} + v_f \cos(\pi/2 - \phi).$$

$$= v_f \left(\frac{\cos(\phi)}{\tan \gamma} + \sin(\phi) \right)$$