

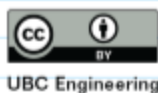
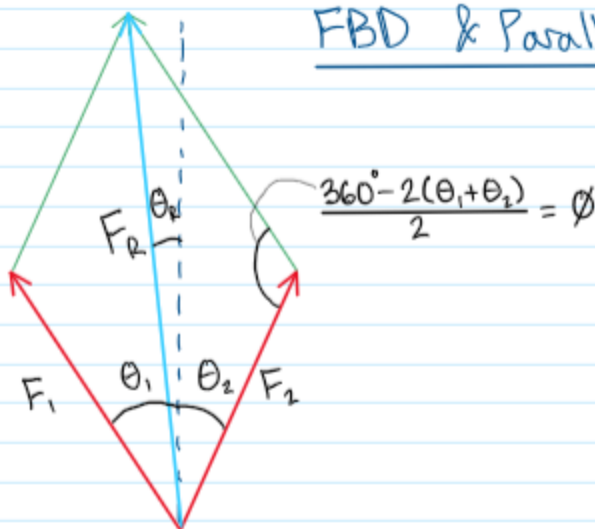
The muscles contracting and pulling on the achilles tendon can be modelled by two forces ( $F_1$  and  $F_2$ ) acting at some angle ( $\theta_1$  and  $\theta_2$ ) from the achilles tendon.

If  $F_1$  and  $F_2$  have magnitudes of  $F_1$  N and  $F_2$  N respectively and they act at angles of  $\theta_1$  degrees and  $\theta_2$  degrees respectively, what is the magnitude and direction of the resultant force?

(Assume CCW direction is positive  $\theta$ )

given  $F_1, \theta_1, F_2, \theta_2$   
 Find  $F_R, \theta_R$

FBD & Parallelogram Law



Trigonometry

Using law of Cosines

$$F_R = \sqrt{F_1^2 + F_2^2 - 2F_1F_2 \cos \phi}$$

Using law of Sines

$$\frac{\sin \psi}{F_2} = \frac{\sin \phi}{F_R}$$

$$\psi = \sin^{-1}\left(\frac{F_2}{F_R} \sin \phi\right)$$

$$\theta_R = \theta_1 - \psi$$

