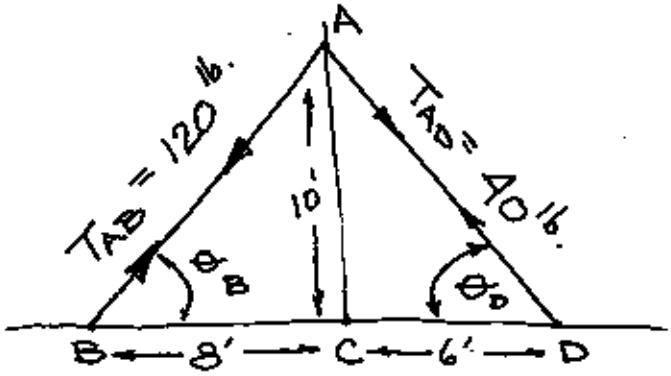
p. 25 – Prob. 2.4

MECH 234 - H.W.
MILANO

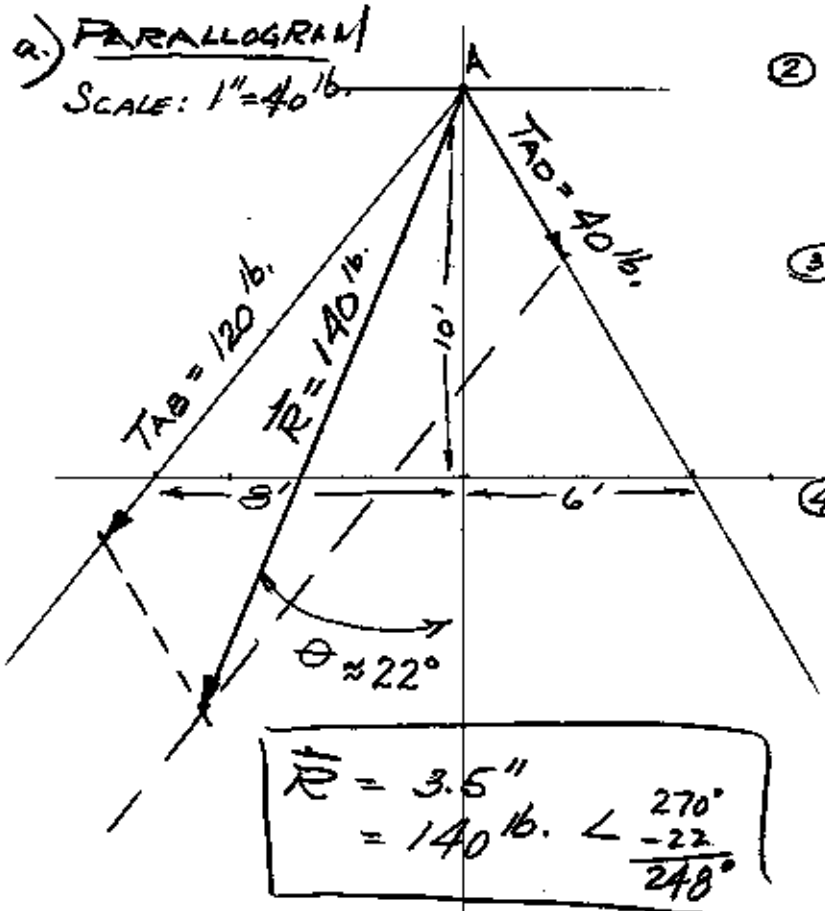


DETERMINE RESULTANT FORCE AT Pt. A

a.) PARALLOGRAM
b) TRIANGLE

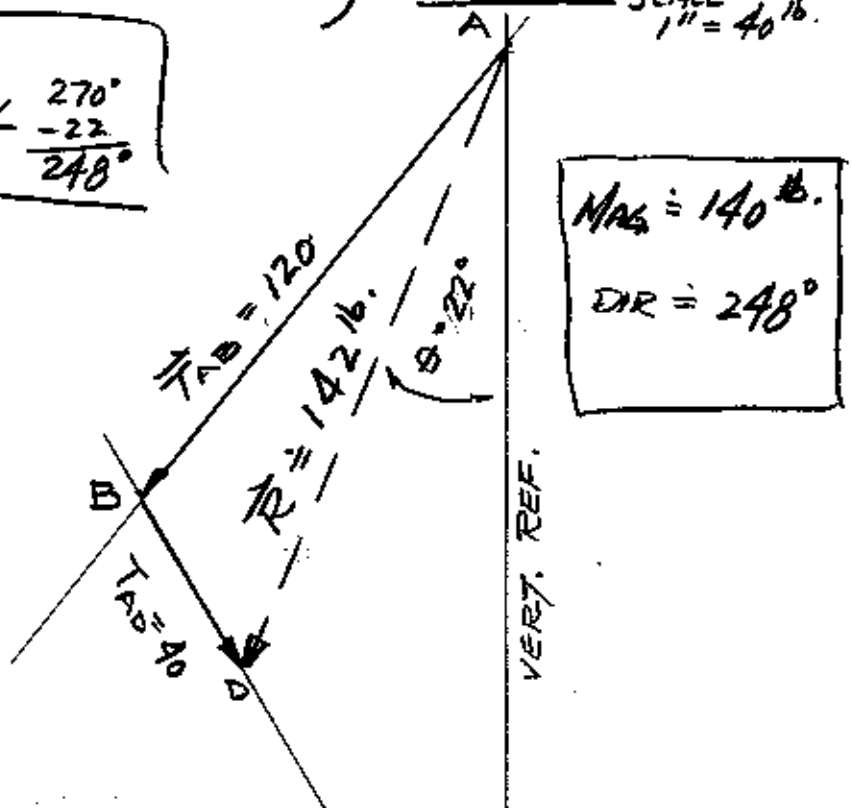
STEP
① Use distances given to scale off direction of force vectors.
② Choose a scale and scale off magnitudes of force vectors from pt. A., tail to head.
③ Using 2 Δ's, transpose another vector T_{AD} from head of T_{AB}. Transpose T_{AB} to head of T_{AD}.
④ Polygon closes. Draw $\vec{R}$ vector from pt. A. to opp. vertex, measure.

a.) PARALLOGRAM
SCALE: 1" = 40 lb.



$\vec{R} = 3.5"$
$= 140$ lb. $\angle \begin{matrix} 270° \\ -22 \\ \hline 248° \end{matrix}$

b.) TRIANGLE SCALE 1" = 40 lb.



MAG = 140 lb.
DIR = 248°

TO CHECK ANALYTICALLY, NEED ANGLES θ_B & θ_D.

$\tan \theta_B = \frac{OPP}{ADJ} = \frac{10'}{8'}$

$\therefore \theta_B = \arctan 1.25 =$

$\theta_B = 51.340°$

$\tan \theta_D = \frac{OPP}{ADJ} = \frac{10'}{6'}$

$\therefore \theta_D = \arctan 1.6667$

$\theta_D = 59.036°$

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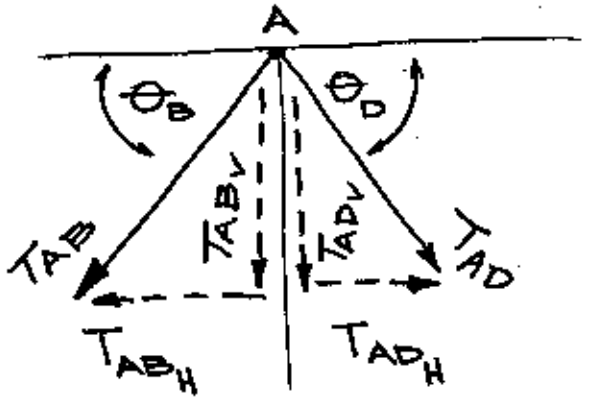
REDO ANALYTICALLY



① DETERMINE THE X & Y COMPONENT OF EACH VECTOR.

② ADD HORIZ. COMP.'S ADD VERT. COMP.'S.

③ DETERMINE RESULTANT VECTOR

$$\Sigma \vec{F}_A = \Sigma F_H \hat{i} + \Sigma F_V \hat{j}$$

$$\Sigma F_H = -T_{AB_H} + T_{AD_H}$$

$$T_{AB_H} = T_{AB} \cos\theta_B = 120^{lb} \cos 51.34^\circ = 74.964^{lb}.$$

$$T_{AD_H} = T_{AD} \cos\theta_D = 40^{lb.} \cos .59^\circ = 20.60^{lb.}$$

$$\therefore \Sigma F_H = -74.964 + 20.60 = -54.36^{lb.}$$

$$\Sigma F_V = -T_{AD_V} - T_{AD_V}$$

$$T_{AB_V} = 120^{lb.} \sin 51.34^\circ = 93.704^{lb.}$$

$$T_{AD_V} = 40^{lb.} \sin 59^\circ = 34.287^{lb.}$$

$$\Sigma F_V = -127.991^{lb.}$$

RESULTANT $\vec{F}_A = -54.36\hat{i} - 128\hat{j}$.

MAGNITUDE $= \sqrt{(-54.36)^2 + (-128)^2} = 139.065^{lb.}$

DIRECTION $= \theta = \arctan \frac{OPP}{ADJ} = \arctan \frac{F_V}{F_H}$

$$\theta = \arctan \frac{-128}{-54.36} = 66.989 + 180. = 247^\circ$$