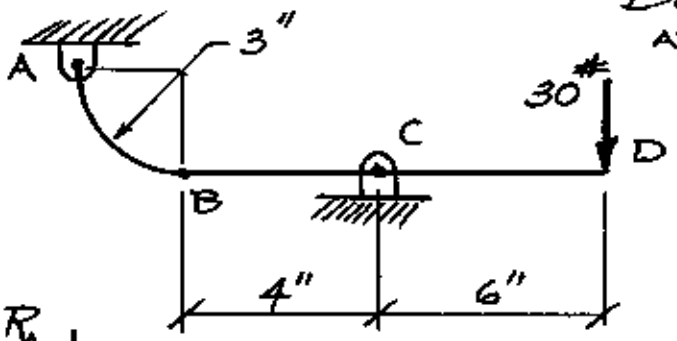
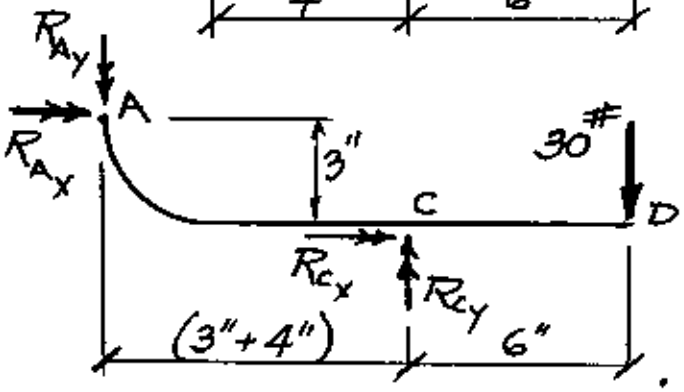
MILANO MECH 234 + 235 PROB. 4.67

p. 181

DETERMINE REACTIONS AT A AND C



30 lb. force applied at D produces a moment at C and A



Assume DIRECTIONS for HOR. & VERT. components of REACTIONS at A and C.

① $\Sigma M_A = 0$ (+)

$R_{Cx}(3") + R_{Cy}(7") - 30^{\#}(13") = 0$

$\therefore \underline{3R_{Cx} + 7R_{Cy} = 390 \text{ in. lb.}}$ (1)

② $\Sigma M_C = 0 = R_{Ay}(7") - R_{Ax}(3") - 30^{\#}(6")$

$\therefore \underline{7R_{Ay} - 3R_{Ax} = 180 \text{ in. lb.}}$ (2)

③ $\Sigma F_x = 0 = R_{Ax} + R_{Cx}$ R_{Ax} → must be equal + opp. R_{Cx} (3)

④ $\Sigma F_y = 0 = -R_{Ay} + R_{Cy} - 30^{\#}$ $\underline{R_{Cy} - R_{Ay} = 30^{\#}}$ (4)

SUB. (3) + (4) INTO (1) + (2) IN TERMS OF R_A, SOLVE SIMULTANEOUSLY.

(1) $3R_{Ax} + 7[30^{\#} + R_{Ay}] = 390 \Rightarrow -3R_{Ax} + 7R_{Ay} = 180$

(2) $7R_{Ay} - 3R_{Ax} = 180 \Rightarrow \underline{-3R_{Ax} + 7R_{Ay} = 180}$

?

INDETERMINANT !

READ p. 166, 3.6.

Then REVIEW p. 180 + SAMPLE 4.6

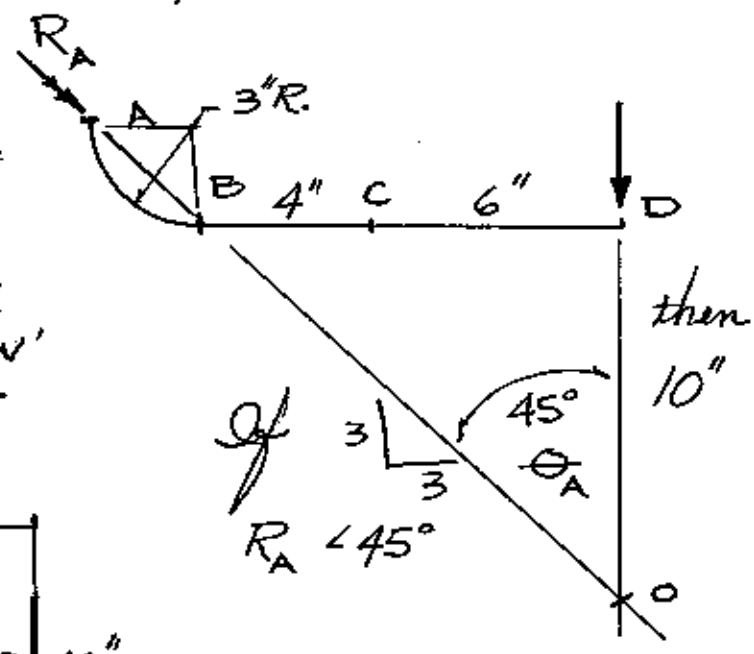
... continue

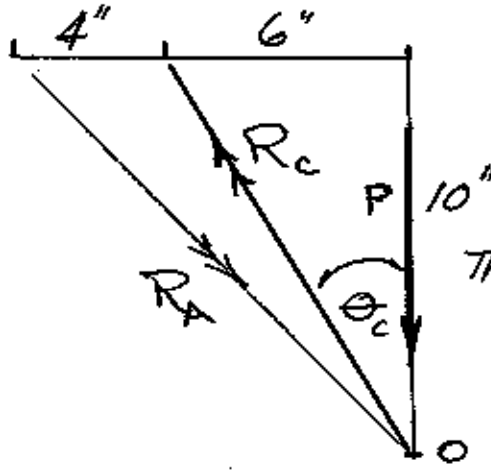
PROB. 4.67 continued

ABCD IS A 3-FORCE MEMBER
- REACTION at A
- REACTION at C
- APPLIED at D

NOTE: REACTIVE FORCE at A WILL PASS THROUGH pt. B.

and INTERSECT with the 'LINE of ACTION' for APPLIED FORCE.



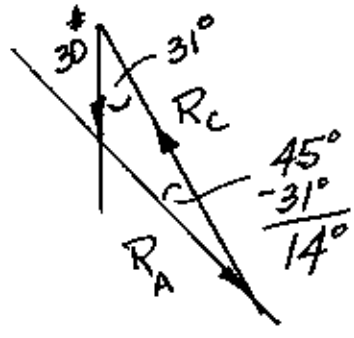


then $\theta_c = \tan^{-1}\frac{6}{10} = 30.96°$ for R_c

and $\Sigma F = 0$

$= \overrightarrow{R_A} + \overrightarrow{R_C} + \overrightarrow{P}$

SKETCH FORCE POLYGON, HEAD-TO-TAIL.



LAW of SINES

$$\frac{30^{\#}}{\sin 14°} = \frac{R_A}{\sin 31°} = \frac{R_C}{\sin(180°-14°-31°)}$$

$$\therefore R_A = \frac{30^{\#}}{\sin 14°}\sin 31° = 63.87^{\#}$$

$$R_C = \frac{30^{\#}}{\sin 14°}\sin 135° = 87.69^{\#}$$

$$\therefore \boxed{\overrightarrow{R_A} = 63.87^{\#} \angle 45°, \quad \overrightarrow{R_C} = 87.7^{\#} \angle 121°}$$

CHECK:

$\Sigma F_x = 63.87\cos 45° - 87.7\sin 31° = 0$ ✓

$\Sigma F_y = -63.87\sin 45° + 87.7\cos 31° - 30^{\#} = 0.010 \approx 0$ ✓