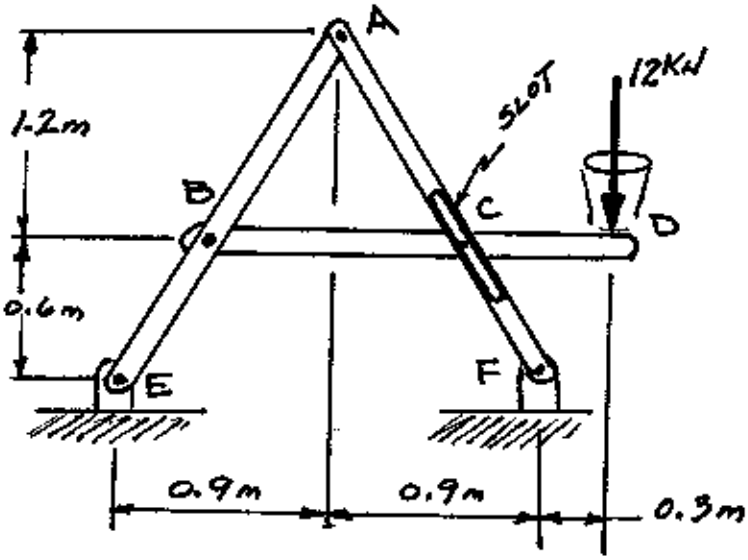
MECH 234 + 235
FRAMES

PROB. 6.99
1 of 3



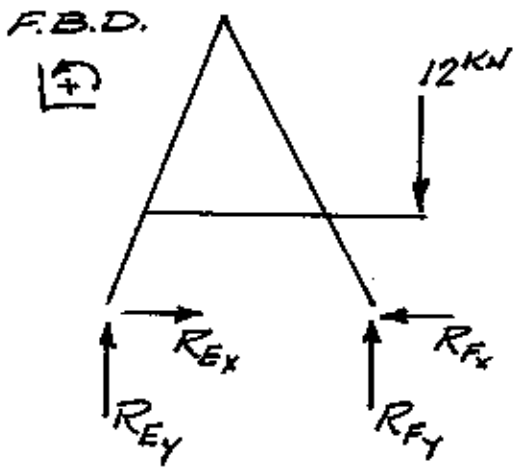
DETERMINE COMPONENTS OF ALL FORCES ON MEMBER ABE.

STEP. 1
- EXTERNAL FORCES.
- SOLVE FOR REACTIONS AT SUPPORTS.

STEP. 2
- INTERNAL FORCES IN MEMBERS ACTING AT PINNED LOCATIONS
- FORCES OF MEMBERS AGAINST EACH OTHER.

F.B.D.

(+)



$$\Sigma F_x = 0 = R_{Ex} - R_{Fx}$$

$$\Sigma F_y = 0 = R_{Ey} + R_{Fy} - 12^{KN}$$

$$\Sigma M_E = 0 = -12^{KN}(2.1\,m) + R_{Fy}(1.8\,m)$$

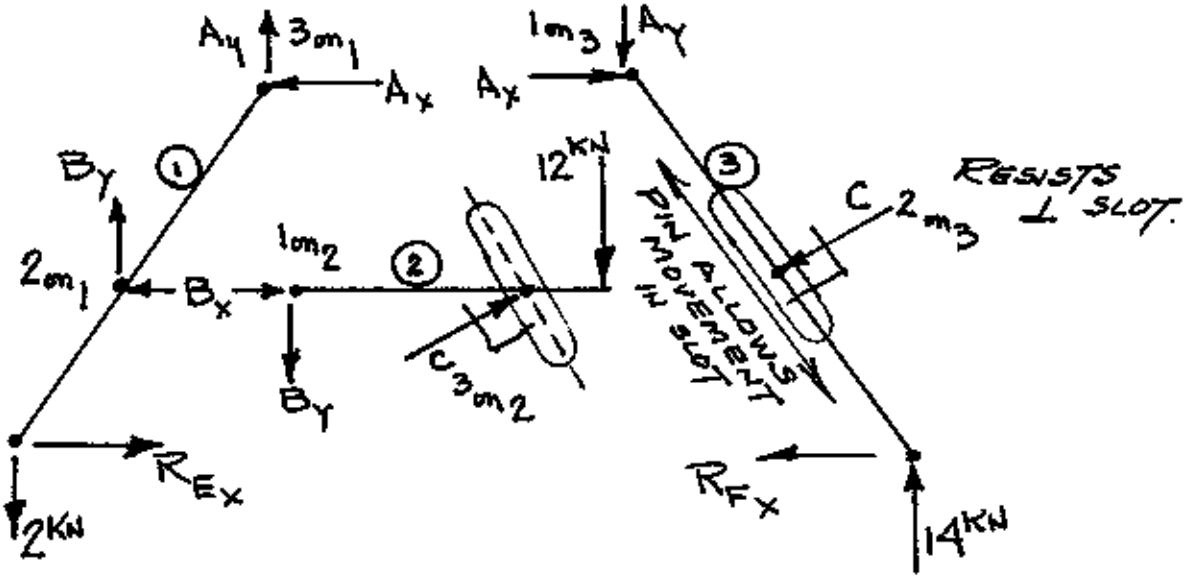
$$R_{Fy} = \frac{12(2.1)}{1.8} = 14^{KN} \uparrow = R_{Fy}$$

$$\therefore R_{Ey} = 12^{KN} - 14^{KN} = -2^{KN}$$

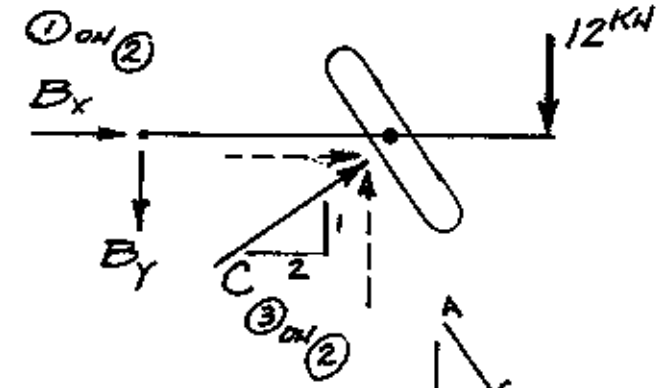
$$= 2^{KN} \downarrow = R_{Ey}$$

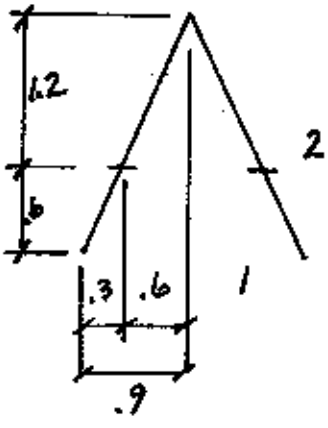
ANALYZE EACH MEMBER WITH FORCES AT PINS.

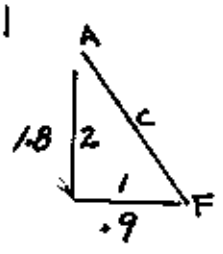
HERE'S WHAT YOU NEED TO CONSIDER:



- CONSIDER THE MEMBER WITH THE APPLIED LOAD
- DETERMINE ANGLE OF FORCE NORMAL TO SLOT







$\Sigma F_x = 0 = B_x + C_x$

$\Sigma F_y = 0 = -B_y + C_y - 12^{KN}$

and $\frac{C_x}{C_y} = \frac{2}{1}$

$\Sigma M_B = 0 = -12^{KN}(1.8m) + C_y(1.2m)$

$C_y = \frac{12(1.8)}{1.2} = 18^{KN} \uparrow$

$\therefore C_x = 2\,C_y = 36^{KN} \rightarrow$

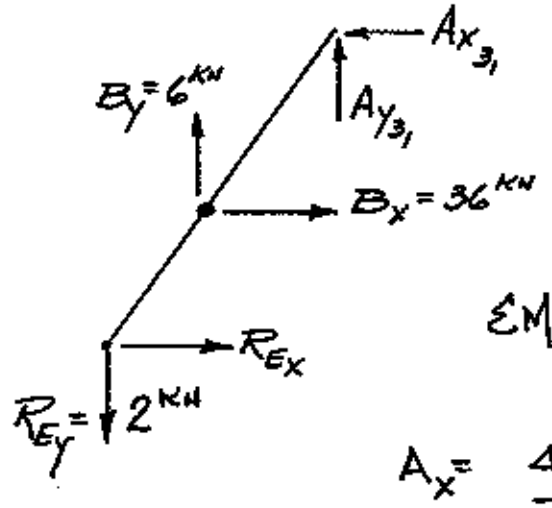
BACK SUB. INTO FORCE EQ.

$B_x = -C_x = 36^{KN} \leftarrow$

$B_y = C_y - 12 = 6^{KN} \downarrow$

} FORCE OF ① ON ②

at pin B, equal & opp. force will apply to ①



$\Sigma F_x = 0 = -A_x + 36^{KN} + R_{EX}$

$\Sigma F_y = 0 = A_y + 6 - 2$

$A_y = -4^{KN}$

$\boxed{A_{y_1} = 4^{KN} \downarrow}$

$\Sigma M_E = 0 = A_x(1.8m) - A_y(.9m) + B_y(.3m) - B_x(.6m)$

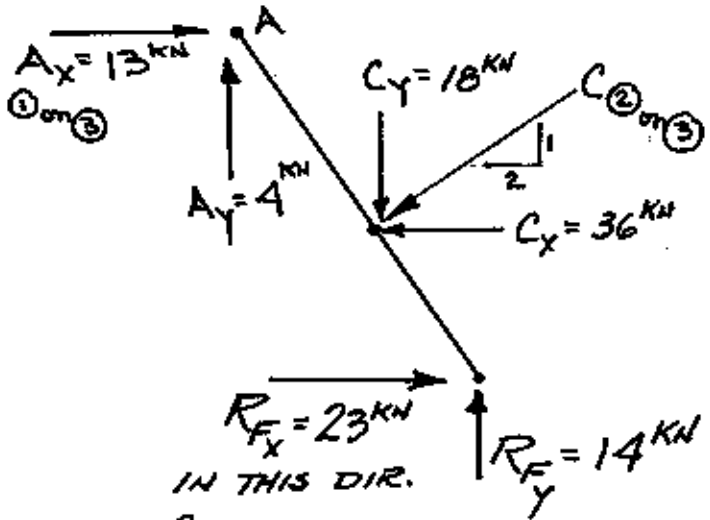
$A_x = \frac{4^{KN}(.9m) - 6^{KN}(.3m) + 36^{KN}(.6m)}{1.8\,m}$

$\boxed{A_x = 13^{KN} \leftarrow}$ assumed correct

$\therefore R_{EX} = A_x - 36 = 13 - 36 = -23$ opp. dir.

$\boxed{R_{EX} = 23^{KN} \leftarrow}$

COMPLETE THE ANALYSIS BY TRANSFERRING THESE FORCES ONTO MEMBER ③



SINCE $R_{E_X} = 23^{KN} \leftarrow$ SEE FIRST EQ.

$$\Sigma F_X = 0 = R_{E_X} - R_{F_X}$$

CHECK:

$$\Sigma F_X = 0 = A_X - C_X + R_{F_X}$$
$$13 - 36 + 23 = 0 \checkmark$$
$$\Sigma F_Y = 0 = A_Y - C_Y + R_{F_Y}$$
$$4 - 18 + 14 = 0 \checkmark$$