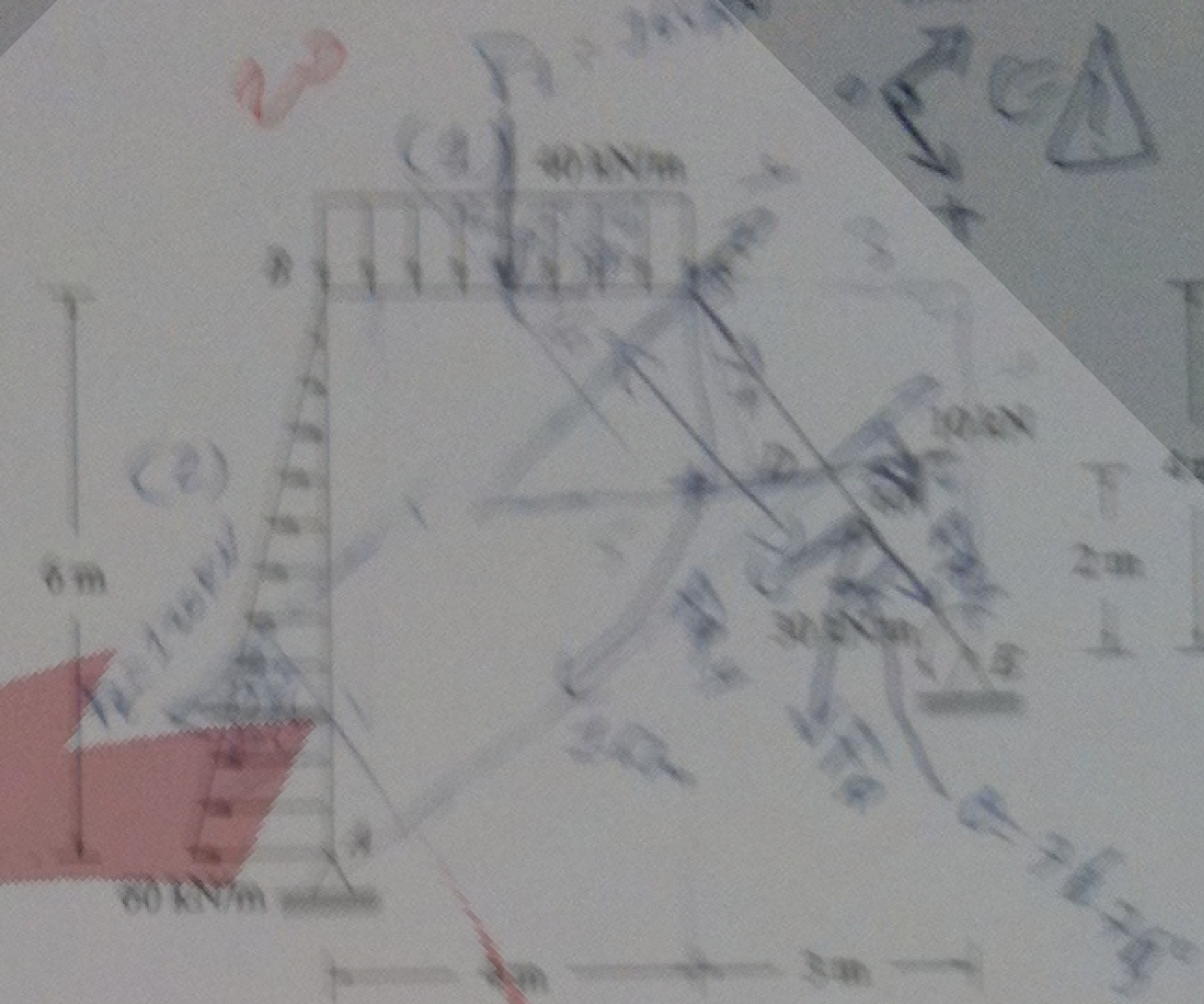
PROBLEM 1: (30 points)

Replace all the loading by an equivalent resultant force and specify where its line of action intersects member *EC* measured from point *C*.



• $F_1 = 40\ KN/m \times 4 = 160\ KN$

Located at: $\bar{x}_1 = \frac{4}{2} = 2\ m$ from C

• $F_2 = (\frac{1}{2})(60\ KN/m) \times (6\ m) = 180\ KN$

Located at: $\bar{x}_2 = 6 - (\frac{1}{3} \times 6) = 6 - 2 = 4\ m$ from C

$\xrightarrow{+} F_{Rx} = \Sigma F_x = 160 \times (\cos 30°) - 180 \times (\cos 60°) + 10 \times (\cos 60°)$

$\Sigma F_x = 53.56\ KN \rightarrow$

$+\uparrow F_{Ry} = \Sigma F_y = -160 \times (\sin 30°) - 180 \times (\sin 60°) + 10 \times (\sin 60°)$

$\Sigma F_y = -227.22\ KN = 227.22\ KN \downarrow$

$F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2} = \sqrt{(53.56)^2 + (-227.22)^2} = 233.44\ KN$

$\theta = \tan^{-1} \left| \frac{F_{Ry}}{F_{Rx}} \right| = \tan^{-1} \left(\frac{227.22}{53.56} \right) = 76.73°$

• $\Sigma M_{Rc} = \Sigma M_C$; $\circlearrowleft + \Sigma M_C = 160 \times 2 - 180 \times 4 + 10 \times (\sin 60°) \times 2.5\ m$

$\circlearrowleft + \Sigma M_C = -378.35\ kN \cdot m = 378.35\ kN \cdot m \circlearrowright$

$\Sigma M_{Rc} = F_R \times x = 233.44\ x$

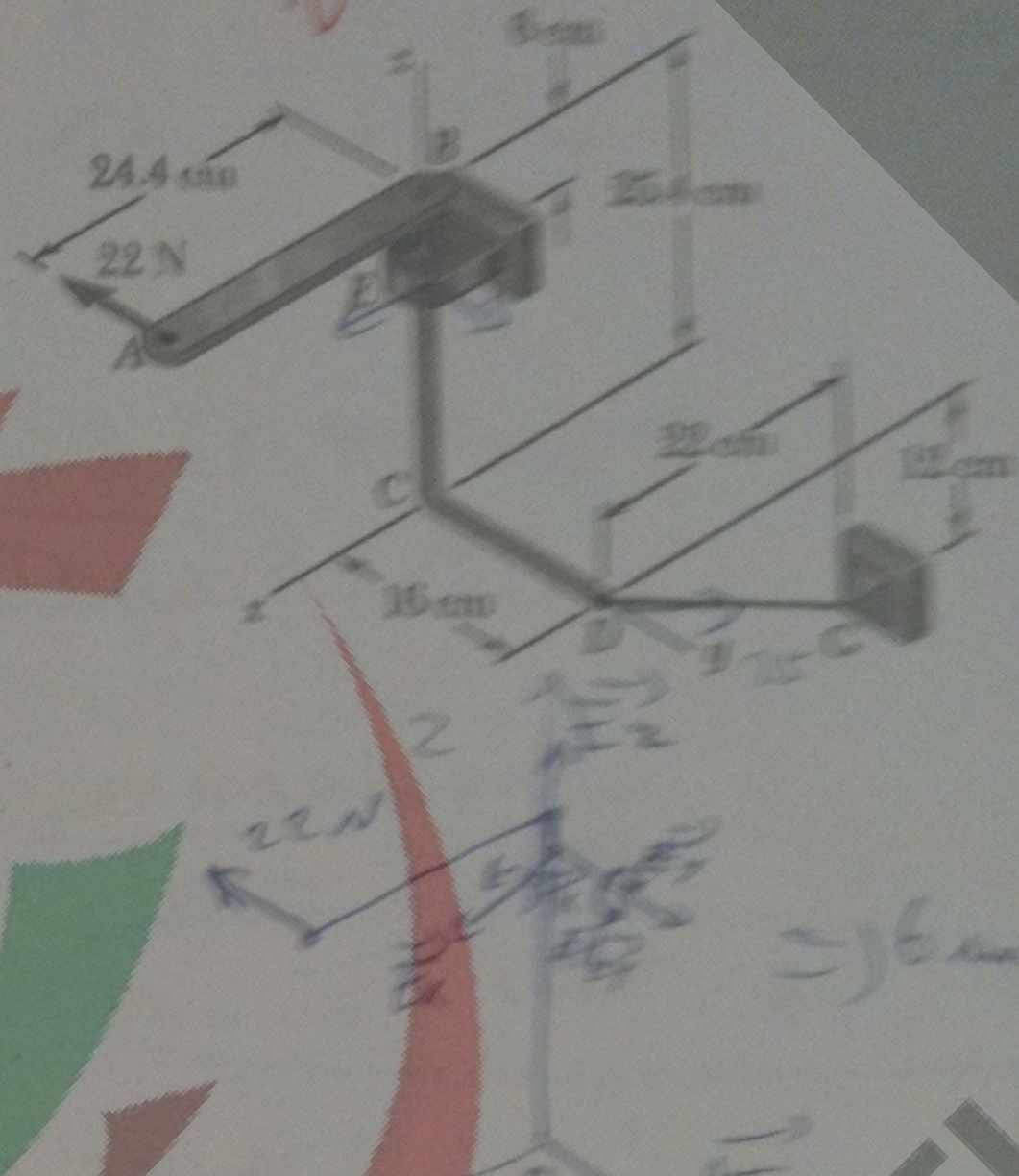
$x = \frac{378.35}{233.44} = 1.62\ m$ from C

PROBLEM 2: **(35 points)**

The lever ***AB*** is welded to the bent rod ***BCD*** which is supported by a thrust bearing ***E*** and by cable ***DG***.
Determine:

- The tension in the cable ***DG***,
- The reactions at ***E***.

N.B.: the order by which the tension in the cable ***DG*** and the reactions at ***E*** are calculated is not important.

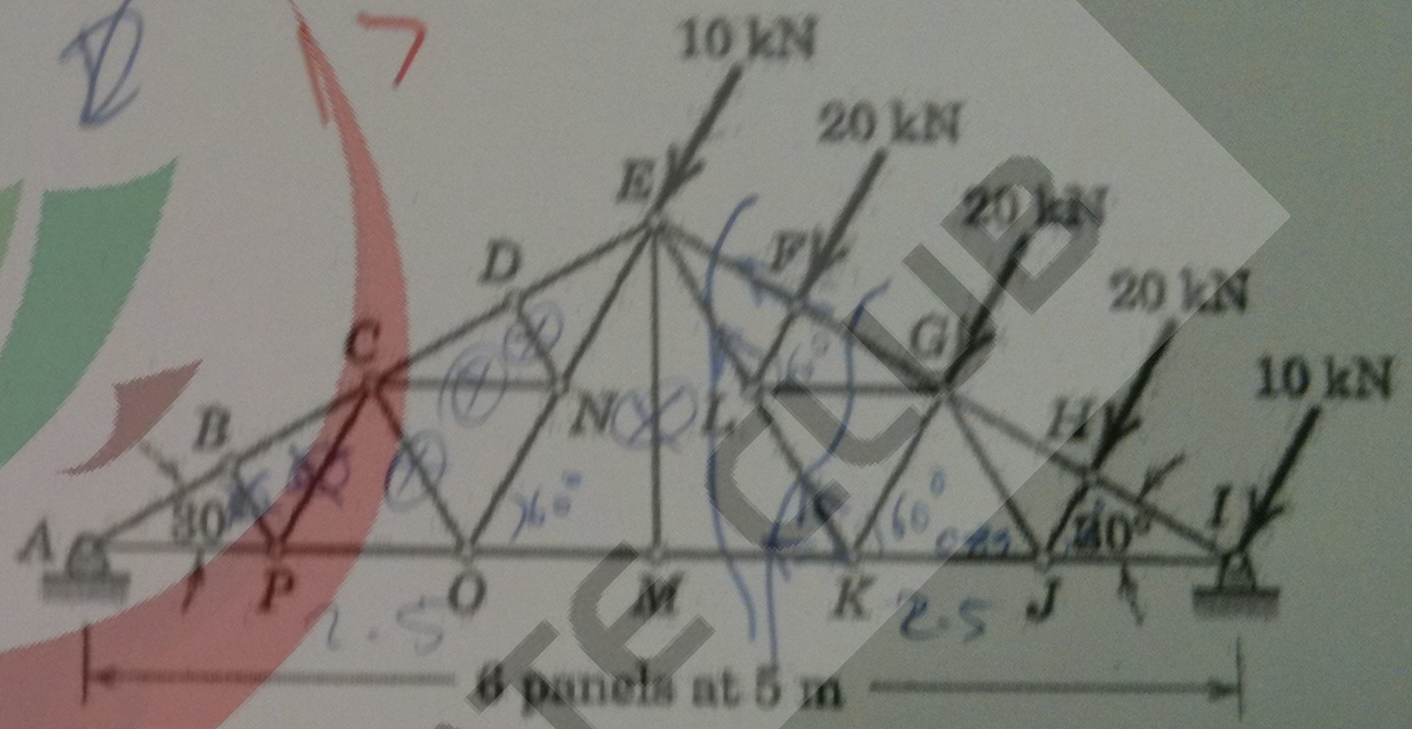


PROBLEM 3: **(35 points)**

For the Fink truss shown in figure:

Determine the reactions at the roller-support *A* and the pin-support *I*.

Using the **method of sections**, determine the forces in members *EF*, *KL*, and *GL*.



$\rightarrow \Sigma F_x = -10\times\cos 60^\circ - 20\times\cos 60^\circ - 20\times\cos 60^\circ$

$\rightarrow \Sigma F_x = -40\ kN = 40\ kN \leftarrow$

$+\uparrow \Sigma F_y = -10\times\sin 60^\circ - 20\times\sin 60^\circ - 20\times\sin 60^\circ - 20\times\sin$