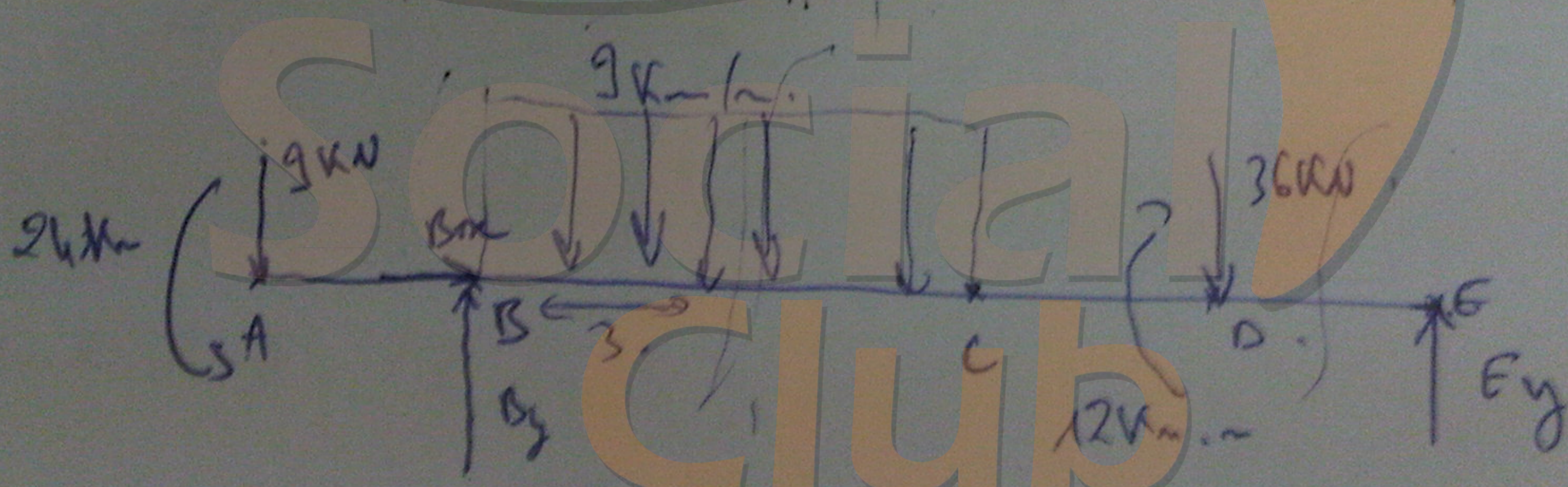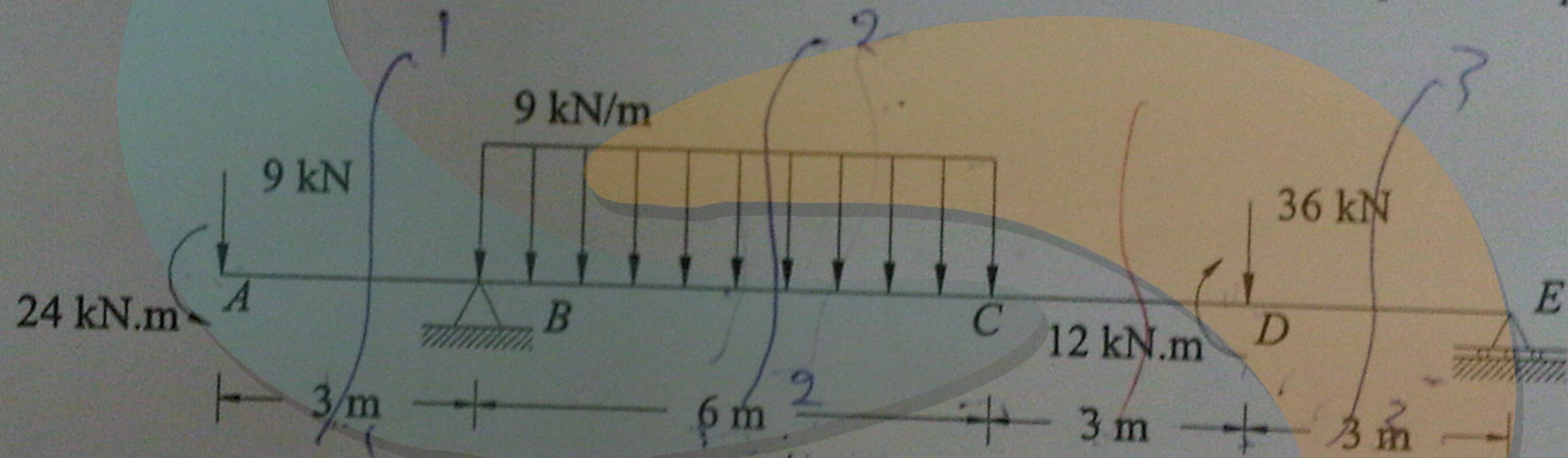PROBLEM 3:   (35 points)

a. Determine the reactions at pin support B and roller support E of the beam shown.
b. Draw the diagrams of the shear force V, and moment M for the beam.

Show all details of calculation leading to draw the V and M diagrams, as well as all particular points.

PROBLEM 1: (30 points)

Replace all the loading by an equivalent resultant force and specify where its line of action intersects member BC measured from point B.
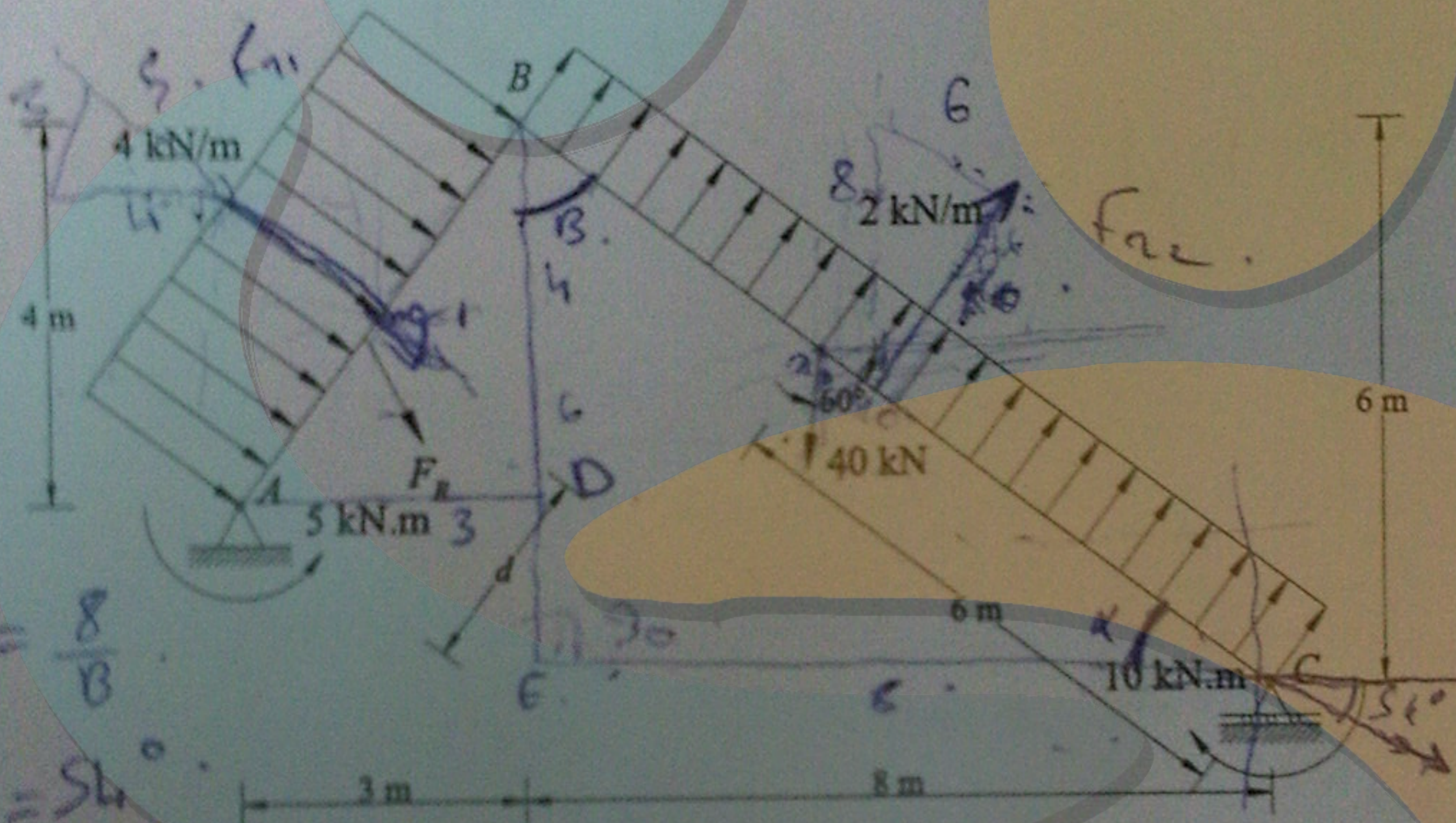
N.B.:

The distributed loads are perpendicular to the members on which they act.

3.75 m

6 kN/m

B

50 kN

9 m

1 m

3 kN/m

D

50 kN

1 m

6 m

E

9 m

9 m
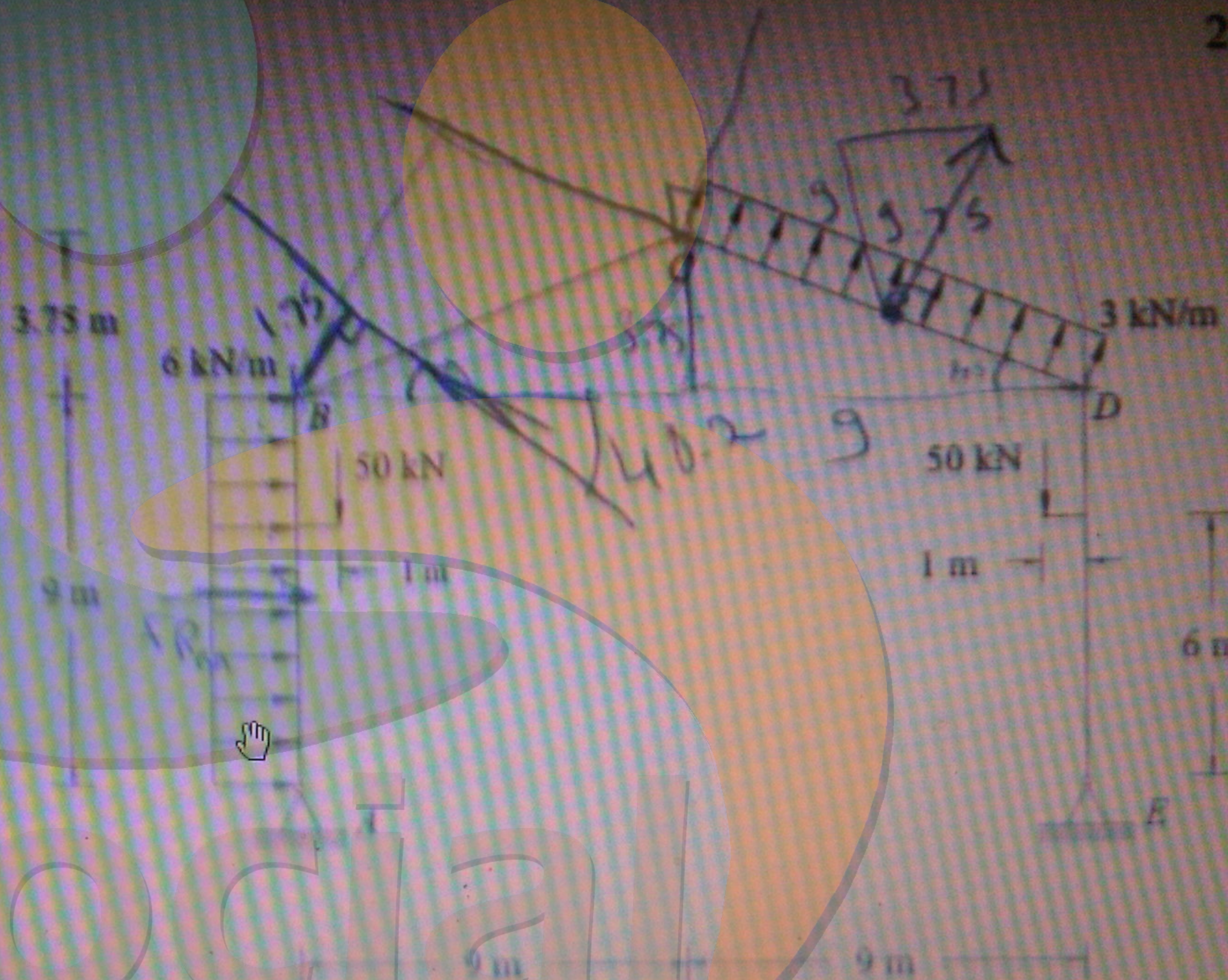
PROBLEM 1:   (30 points)

The frame *ABC* shown is subjected to a force and couple system. Replace the force and couple system by an equivalent resultant force F_R, and specify the distance *d* from point *A* along member *AB* where its line of action intersects member *AB*.

4 kN/m

4 m

B

2 kN/m

6

f_{R2}

6 m

40 kN

A   5 kN.m   3   D F_R

d

E

6 m

10 kN.m   C

3 m   8 m

$\dfrac{6}{\alpha} = \dfrac{8}{\beta}$

$= \dfrac{9 \times 6}{10} = 54$

⓪   Triangle A BD   Pythagore

$3^2 + 4^2 = n_1^2$

$= 4 \times 5$

$= 2 \times 10$

$n_1^2 = 25 \Rightarrow n = 5$

Triangle B CE   Pythagore

$8^2 + 6^2 = n_2^2$

⓪ $n_2 = 10$

$F_{Rx} = \Sigma F_x = 2 \times 10 \times \left(\dfrac{6}{10}\right) + 4 \times 5 \times \left(\dfrac{4}{5}\right) + 40 \cos 60 \times \dfrac{6}{10}$

$= 12 \quad + \quad 16 \quad + 12 = 40 \uparrow$

$F_{Ry} = \Sigma F_y = 2 \times 10 \times \left(\dfrac{8}{10}\right) - 4 \times 5 \times \left(\dfrac{3}{5}\right) - 40 \cos 60 \times 8$

PROBLEM 2:   (35 points)

The 500-N plate *ABCD* is supported by a hinge (to be considered located at point *A*) along edge *AB* and by wire *CE*. The hinge behaves like a thrust bearing i.e., it exerts a reaction along edge *AB*. Knowing that the plate is uniform; determine the reactions developed in the hinge and the tension in wire *CE*.

z

240 mm

240 mm

E

400 mm

A

400 mm

D

200 mm

200 mm

B

480 mm

C
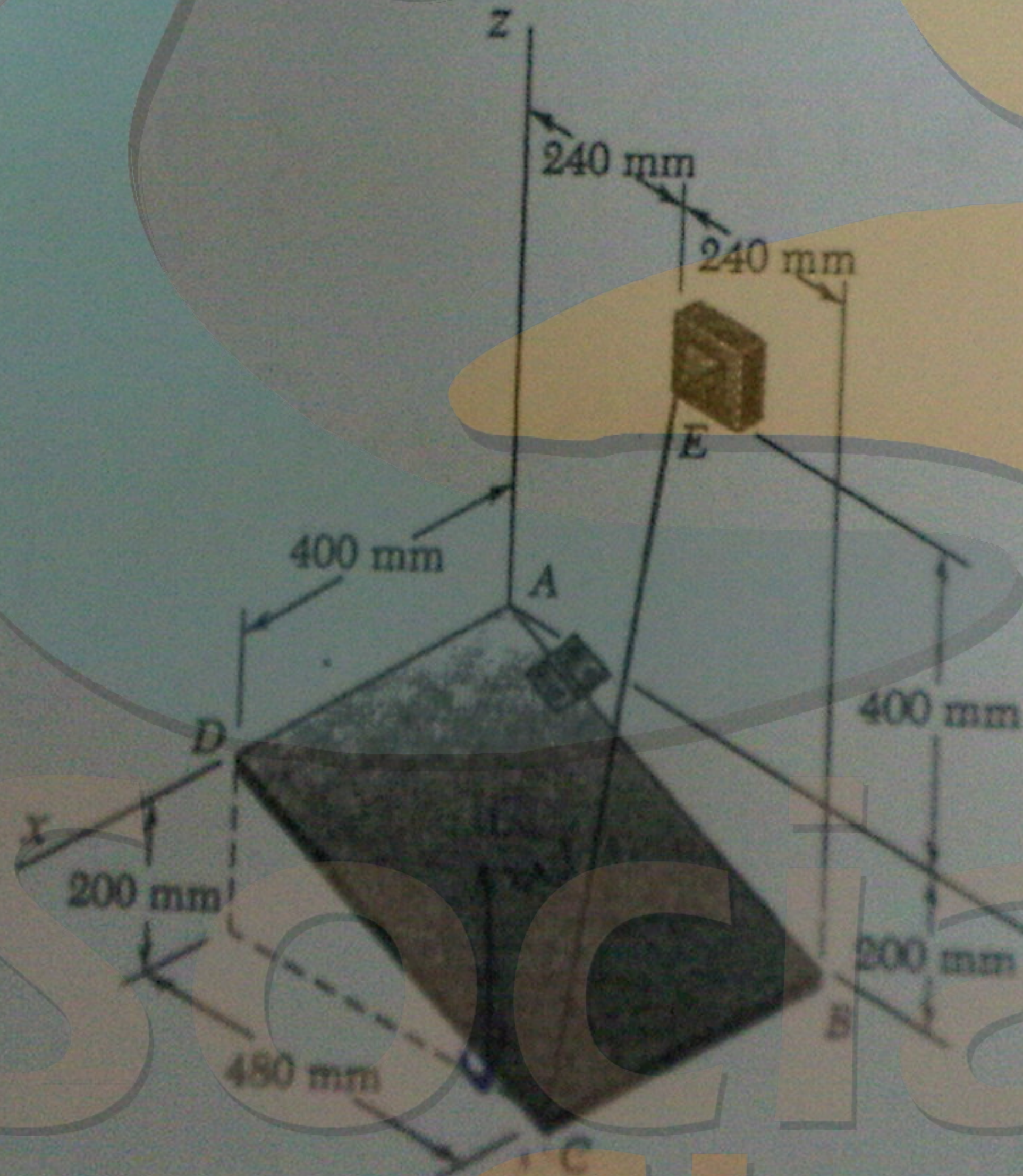
$C =$

$C(400, 480, -200)$

$E(0, 240, 400)$.

$B(200, 240, -100)$

$\vec{AC}(400, 480, -200)$.

$\vec{AB}(200, 240, -100)$

$\vec{A} = A_x \vec{i} + A_y \vec{j} + A_z \vec{k}$.

$M_A = M_{Ax} \vec{i} + M$