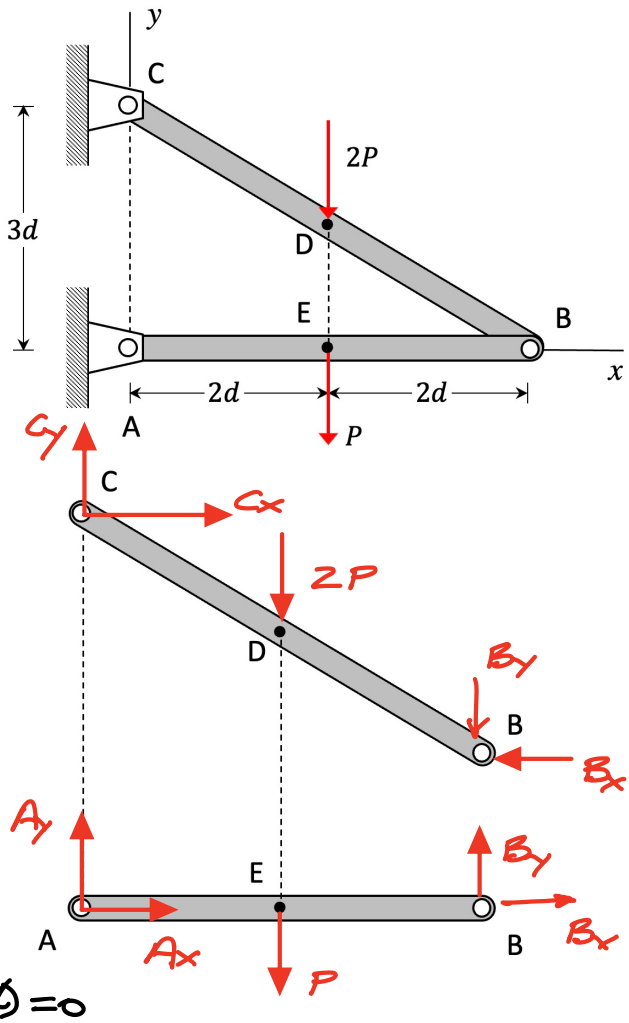
Quiz No. 8 ***Name*** SOLUTION

ME 270 – Summer 2024 - Prague



Given: Consider the frame shown to the right that is made up of two rigid links, AB and BC, with the two links joined together with a pin joint at B. The other ends of the links are pinned to ground at C and A, as shown. Loads of $2P$ and P act vertically at the midpoints of links BC and AB, respectively. Consider the weights of the two links to be negligible compared to the applied loads.

Find: Following the four steps below, you are asked to determine the reactions on link AB at joint B.

<u>*Step 1- FBDs*</u>: On the figures provided, complete the free body diagrams of links BC and AB.

<u>*Step 2- Equilibrium*</u>: Using your FBDs, write down the three equilibrium equations for each of the two links.

BC:

(1) $\Sigma F_x = C_x - B_x = 0$

(2) $\Sigma F_y = C_y - B_y - 2P = 0$

(3) $\Sigma M_C = -2P(2d) - B_y(4d) - B_x(3d) = 0$

AB:

(4) $\Sigma F_x = A_x + B_x = 0$

(5) $\Sigma F_y = A_y - P + B_y = 0$

(6) $\Sigma M_A = -P(2d) + B_y(4d) = 0$

<u>*Step 3- Solvability*</u>: Count the number of equations and the number of unknowns.

6 eqns / 6 unknowns

<u>*Step 4 - Solve*</u>: Using your equilibrium equations, determine the reactions on link AB at joint B. Write your answer as a vector in terms of P.

(6) $\Rightarrow B_y = \frac{1}{2}P$

(3) $\Rightarrow B_x = \frac{1}{3}[-4P - 4B_y] = -2P$

$\therefore$ force on AB at $B = -2P\hat{i} + \frac{1}{2}P\hat{j}$