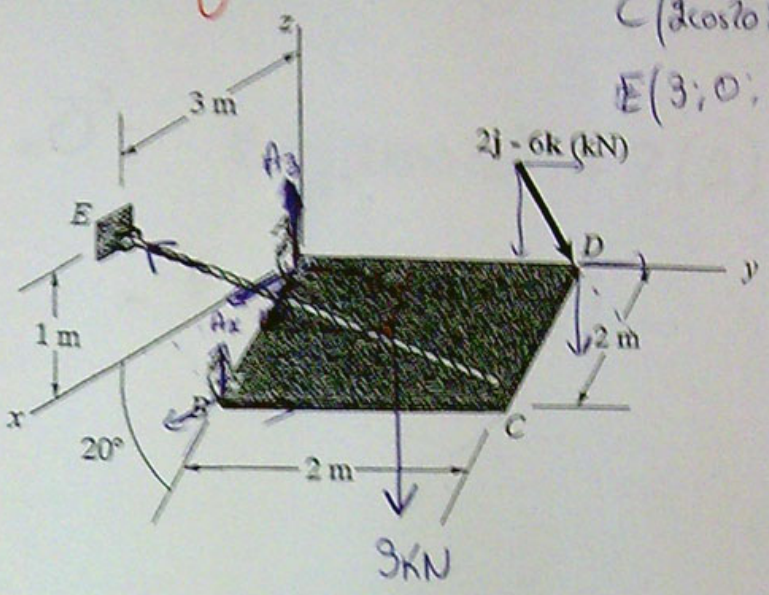
The uniform plate *ABCD* has a weight of 3 kN and is supported by hinges at *A* and *B* and the cable *CE*, and is loaded by the force at *D*. The edge of the plate to which the hinges are attached lies in the *z*-*x* plane, and the axes of the hinges are parallel to the line through points *A* and *B*. The hinges are properly aligned and thus do not exert moment reactions on the plate, and the hinge at *B* does not exert any force along line through points *A* and *B*, that is the reaction vector at *B* is perpendicular to line *AB*.

Determine the reactions exerted by the hinges on the plate, and the tension in the cable *CE*.

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



$C(2\cos 20, 2\cos 20, 2\sin 20)$

$E(3; 0; 1)$

$$\vec{U}_{CE} = \frac{6\cos 20\,\vec{i} - 2\sin 20\,\vec{k}}{32.26}$$

$$= 0.175\,\vec{i} - 0.021\,\vec{k}$$

$$\vec{F}_{CE} = F_{CE}(0.175\,\vec{i} - 0.021\,\vec{k})$$

$\Sigma \vec{F}_x = \vec{0}$; $Ax + Bx + 0.175\,F_{CE} = 0$

$\Sigma \vec{F}_y = \vec{0}$; $Ay + By + 2 = 0$

$\Sigma \vec{F}_z = \vec{0}$; $-3 - 6 + Az + Bz = 0$

$\Sigma \vec{M}_x = \vec{0}$; $-3\cos 20 - 0.175 F_{CE}(2\cos 20)$

$- F_{CE}(0.021)(2) - 6(2\cos 20) + By(2\sin 20) - 2(2) = 0$

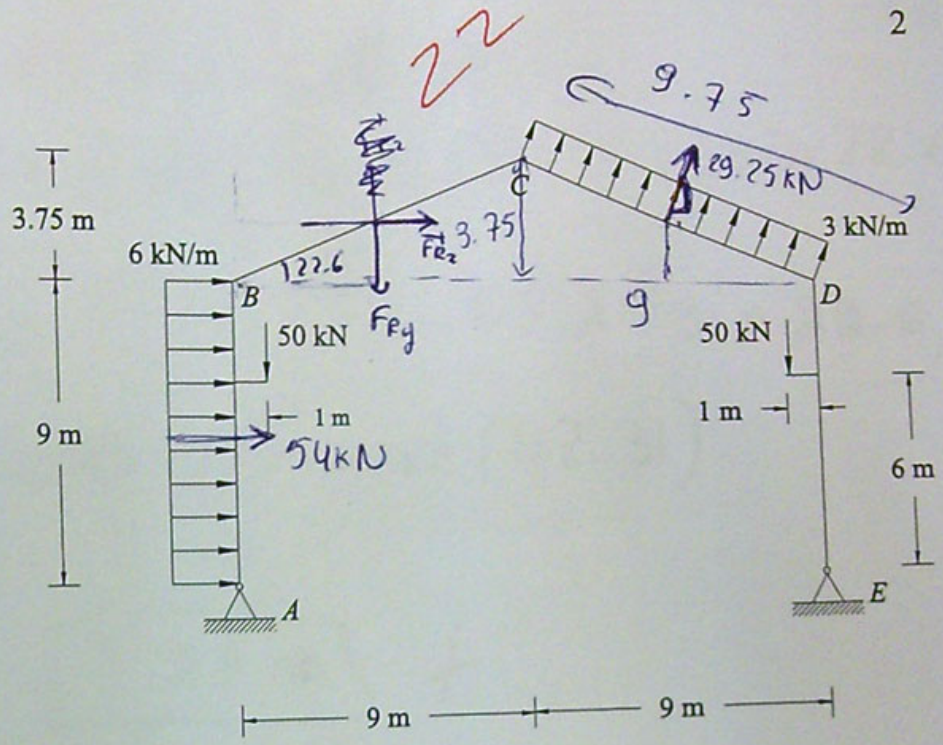
$\Sigma \vec{M}_y = \vec{0}$; $3\cos 20 + Bx(2\cos 20) + 0.021 F_{CE}(2) = 0$ Next

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.



The force along AB: $6\ kN/m \times 9 = 54\ kN$ applied 4.5m from A.

$CD = \sqrt{9^2 + 3.75^2} = 9.75$

The force along CD: $3 \times 9.75 = 29.25\ kN$ applied 4.8 from C

$\Sigma Fx = F_{Rx}$; $54 + 29.25\left(\frac{3.75}{9.75}\right) = 65.25\ kN = \Sigma Fy$ /

$\Sigma Fy = F_{Ry}$; $\Sigma Fy = -50 - 50 + 29.25\left(\frac{9}{9.75}\right) = -73\ kN$ /

$F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2} = 97.9\ kN$

$\theta = \tan^{-1}\left(\frac{F_{Ry}}{F_{Rx}}\right) = 48.2°$ /

$\frac{4.875}{9.75} = \frac{y}{9.75}$; $y = 1.87$

$\frac{x}{9} = \frac{1.875}{3.75}$; $x = 4.5$

$\Sigma \overrightarrow{M}_B = 54(4.5) - 50(8) - 50(1) - 29.25\left(\frac{3.75}{9.75}\right)(1.875$