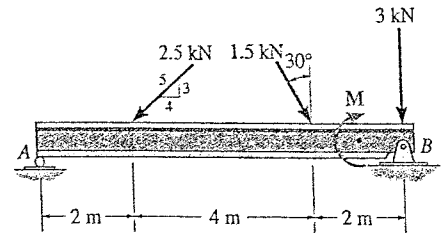


H. W. # 5

4-110

4-110. Replace the force system acting on the beam by an equivalent force and couple moment at point A.



$$\vec{F}_1 = -2.5\left(\frac{4}{5}\right)i - 2.5\left(\frac{3}{5}\right)j \Rightarrow \vec{F}_1 = [-2i - 1.5j] \text{ kN}$$

$$F_2 = \left\{ 1.5 \sin 30^\circ i - 1.5 \cos 30^\circ j \right\} \text{ kN}$$

$$= [0.75i - 1.3j] \text{ kN}$$

$$F_3 = [-3j] \text{ kN}$$

$$\vec{F}_R = F_1 + F_2 + F_3 = [-2i - 1.5j] + [0.75i - 1.3j] + [-3j]$$

$$= [-1.25i - 5.8j] \text{ kN}$$

$$\therefore |\vec{F}_R| = \sqrt{(-1.25)^2 + (-5.8)^2} \Rightarrow \boxed{F_R = 5.93 \text{ kN}}$$

$$\tan \theta_x = \frac{-5.8}{-1.25} \Rightarrow \boxed{\theta = 77.83^\circ}$$

$$M_{\text{couple}}^A = -M - 3(8) - 1.5 \cos 30^\circ (6) - 2.5\left(\frac{3}{5}\right)(2)$$

$$= -\text{O} - 24 - 7.794 - 3$$

$$= -34.794 \text{ kN-m}$$

$$\boxed{M_{\text{couple}}^A = +34.794 \text{ kN-m}}$$