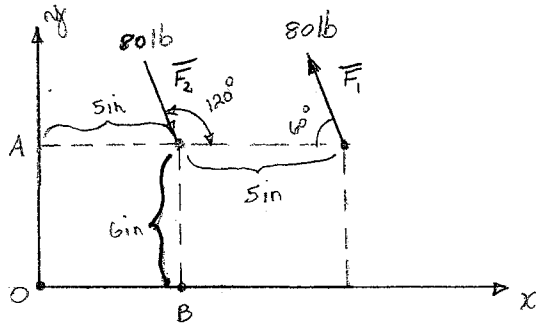
5A. For the force couple shown below

a. Determine the moment created by this force couple about point O and express your answer in Cartesian form.
b. Determine the moment created by this force couple about point A and express your answer in Cartesian form.
c. Determine the moment created by this force couple about point B and express your answer in Cartesian form.



For point O

$\bar{F}_1 = 80\cos 60^\circ(-\bar{i}) + 80\sin 60^\circ(\bar{j}) = 40(-\bar{i}) + 69.3(\bar{j})$ (lb)

$\bar{F}_2 = 40(\bar{i}) + 69.3(-\bar{j})$ (lb)

$\bar{M}_O^{F_1} = 40\text{lb}(6\text{in})(\bar{k}) + 69.3\text{lb}(10\text{in})(\bar{k}) = 933\ \text{lb in}(\bar{k})$

$\bar{M}_O^{F_2} = 40\text{lb}(6\text{in})(-\bar{k}) + 69.3\text{lb}(5\text{in})(-\bar{k}) = 587\ \text{lb in}(-\bar{k})$

$\bar{M}_O^R = \bar{M}_O^{F_1} + \bar{M}_O^{F_2} = (933 - 587)\ \text{lb in}(\bar{k}) = 346\ \text{lb in}(\bar{k})$

For point A

$\bar{M}_A^{F_1} = 40\text{lb}(0\text{in}) + 69.3\text{lb}(10\text{in})(\bar{k}) = 693\ \text{lb in}(\bar{k})$

$\bar{M}_A^{F_2} = 40\text{lb}(0\text{in}) + 69.3\text{lb}(5\text{in})(-\bar{k}) = 346\ \text{lb in}(-\bar{k})$

$\bar{M}_A^R = \bar{M}_A^{F_1} + \bar{M}_A^{F_2} = (693 - 346)\bar{k} = 347\ \text{lb in}(\bar{k})$

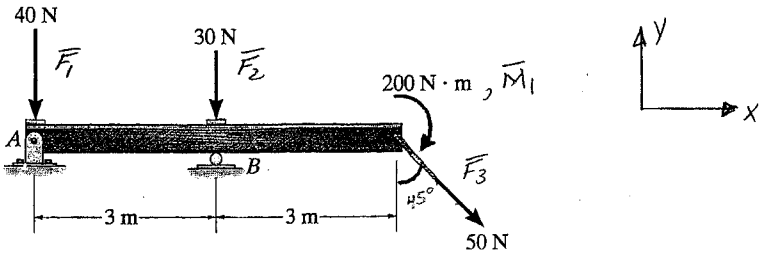
For point B

$$\bar{M}_B^{F_1} = 40\text{lb}(6\text{in})(\bar{k}) + 69.3\text{lb}(5\text{in})(\bar{k}) = 587\text{lbin}(\bar{k})$$

$$\bar{M}_B^{F_2} = 40\text{lb}(6\text{in})(-\bar{k}) = 240\text{lbin}(-\bar{k})$$

$$M_B^R = (587-240)\text{lbin}(\bar{k}) = 347\text{lbin}(\bar{k})$$

58. Replace the force system shown below by an equivalent resultant force and couple moment at point A. Write your answers in Cartesian form.



Resultant Force

$\bar{R} = \bar{F}_1 + \bar{F}_2 + \bar{F}_3$

$\bar{F}_1 = 40N(-\bar{j})$

$\bar{F}_2 = 30N(-\bar{j})$

$\bar{F}_3 = 50N\cos 45^\circ(\bar{i}) + 50N\sin 45^\circ(-\bar{j}) = 35.4(\bar{i}) + 35.4(-\bar{j})\ (N)$

$\bar{R} = 35.4N(\bar{i}) + (-40-30-35.4)(\bar{j})$

$\bar{R} = 35.4N(\bar{i}) + 105N(-\bar{j})$

Moment Resultant

$\bar{M}_A^R = \bar{M}_A^{F_1} + \bar{M}_A^{F_2} + \bar{M}_A^{F_3} + \bar{M}_1$

$\bar{M}_A^{F_1} = 0\bar{k}$

$\bar{M}_A^{F_2} = 30N(3m)(-\bar{k}) = 90Nm(-\bar{k})$

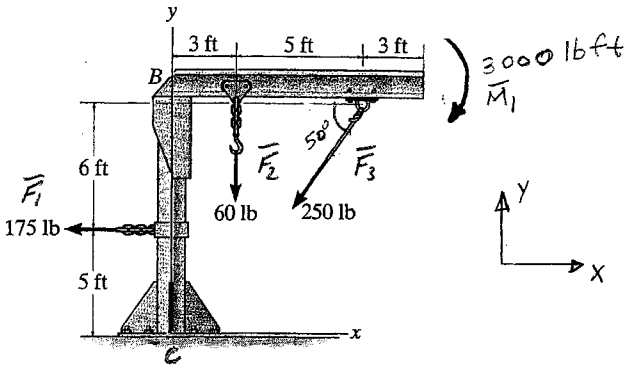
$\bar{M}_A^{F_3} = 50N\cos 45^\circ(6m)(-\bar{k}) = 212Nm(-\bar{k})$

$\bar{M}_1 = 200Nm(-\bar{k})$

$\therefore \bar{M}_A^R = (0-90-212-200)Nm(\bar{k})$

$\bar{M}_A^R = 502Nm(-\bar{k})$

5C. Replace the force system shown below by an equivalent resultant force and couple moment at point C. Write your answers in Cartesian form.



Resultant Force

$\bar{R} = \bar{F}_1 + \bar{F}_2 + \bar{F}_3$

$\bar{F}_1 = 175lb(-\bar{i})$

$\bar{F}_2 = 60lb(-\bar{j})$

$\bar{F}_3 = 250lb\cos 50°(-\bar{i}) + 250lb\sin 50°(-\bar{j})$

$\bar{F}_3 = 161lb(-\bar{i}) + 192lb(-\bar{j})$

$\bar{R} = (-175-161)\bar{i} + (-60-192)\bar{j}$

$\bar{R} = 336(-\bar{i}) + 252(-\bar{j})\ (lb)$

Resultant moment

$\bar{M}_C^R = \bar{M}_C^{F_1} + \bar{M}_C^{F_2} + \bar{M}_C^{F_3} + \bar{M}_1$

$\bar{M}_C^{F_1} = 175lb(5ft)(\bar{k}) = 875lbft(\bar{k})$

$\bar{M}_C^{F_2} = 60lb(3ft)(-\bar{k}) = 180lbft(-\bar{k})$

$\bar{M}_C^{F_3} = 161lb(11ft)(\bar{k}) + 192lb(8ft)(-\bar{k}) = 235lbft(\bar{k})$

$\bar{M}_1 = 3000lbft(-\bar{k})$

$\bar{M}_C^R = (875 - 180 + 235 - 3000)\ lbft(\bar{k}) = 2070lbft(-\bar{k})$