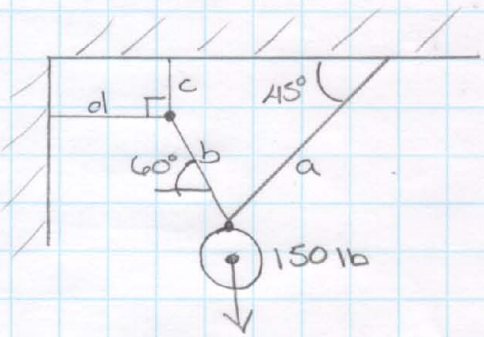
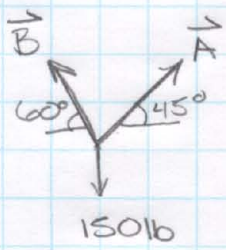
SOLUTIONS 1/4
ENGR. 8
ASSIGNMENT #6

↻+M
↑+y
→+x

1: DETERMINE THE FORCES IN EA. OF THE WIRES





$\Sigma F_y = 0$

$\Sigma F_y = -150^{\#} + \vec{B}\sin 60° + \vec{A}\sin 45°$

$= .866\vec{B} + .707\vec{A} = 150^{\#}$

$\Sigma F_x = -\vec{B}\cos 60° + \vec{A}\cos 45° = 0$

$= .707\vec{A} = .5\vec{B}$

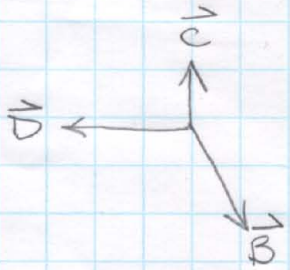
$\vec{B} = 1.41\vec{A}$

$\Sigma F_y = .866(1.41\vec{A}) + .707\vec{A} = 150^{\#}$

$\underline{\vec{A} = 76.76^{\#}}$

$\Sigma F_x = \vec{B} = 1.41(76.76^{\#})$

$\underline{\vec{B} = 108.24^{\#}}$



$\Sigma F_y = 0$

$\Sigma F_y = \vec{C} - \vec{B}\sin 60°$

$\vec{C} = 108.24^{\#}\sin 60°$

$\underline{\vec{C} = 93.74^{\#}}$

$\Sigma F_x = 0$

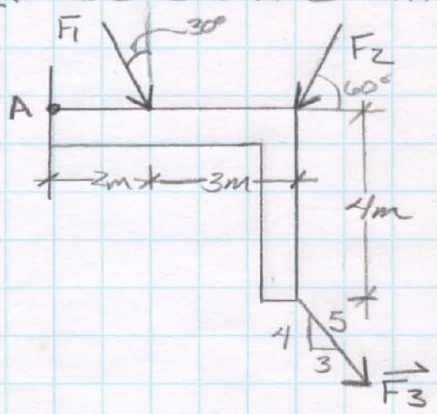
$\Sigma F_x = -\vec{D} + \vec{B}\cos 60°$

$\vec{D} = 108.24^{\#}\cos 60°$

$\underline{\vec{D} = 93.74^{\#}}$

SOLUTIONS 2/4
ENGR. 8
ASSIGNMENT #6

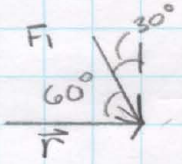
2: DETERMINE THE RESULTANT MOMENT ABOUT POINT A



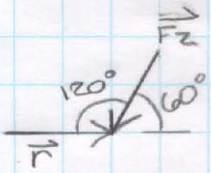
$F_1 = 250\ N$
$F_2 = 300\ N$
$F_3 = 500\ N$

A) SOLVE w/ 2D CROSS PRODUCT
B) SOLVE w/ X & Y COMPONENTS OF FORCE

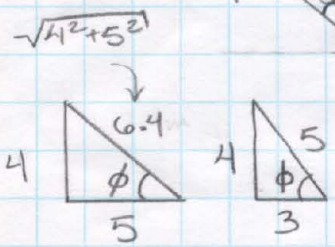
A: $\vec{r} \times \vec{F_1} = |\vec{r}| \times |\vec{F}| \sin\theta = M$



$= 2m(250N)\sin 60°$
$= -433\ N\text{-}m$ * REMEMBER (+) OR USE RIGHT HAND RULE



$= 5m(300N)\sin 120°$
$= -1299\ N\text{-}m$



$\phi = \tan^{-1}(4/5)$
$= 38.65°$
$\phi = \tan^{-1}(4/3)$
$= 53.13°$
$\theta = \phi - \phi = 14.48°$

$|\vec{r}| \times |\vec{F}| \sin\theta = 6.4m(500N)\sin(14.48°)$
$= -800\ N\text{-}m$

$\Sigma M = -433 - 1299 - 800 = \underline{\underline{2532\ N\text{-}m}}$

SOLUTIONS 3/4
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2: B:

$$\vec{r}_1 \times \vec{F}_1 = (2i + 0j) \times (250\sin 30°\, i - 250\cos 30°\, j)$$

$$= \begin{vmatrix} i & j & k \\ 2 & 0 & 0 \\ 125 & -216.5 & 0 \end{vmatrix} = (-433 - 0)k = -433k$$

$$\vec{r}_2 \times \vec{F}_2 = (5i + 0j) \times (-300\cos 60°\, i - 300\sin 60°\, j)$$

$$= \begin{vmatrix} i & j & k \\ 5 & 0 & 0 \\ -150 & -259.8 & 0 \end{vmatrix} = -1299k$$

$$\vec{r}_3 \times \vec{F}_3 = (5i - 4j) \times (500(3/5)i - 500(4/5)j)$$

$$= \begin{vmatrix} i & j & k \\ 5 & -4 & 0 \\ 300 & -400 & 0 \end{vmatrix} = (-2000 + 1200)k = -800k$$

$$\Sigma M = (-433 - 1299 - 800)k = \underline{\underline{-2532k \text{ N-m}}}$$

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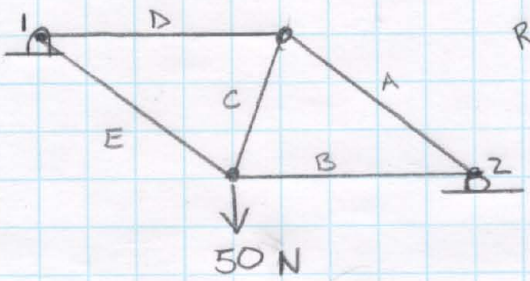
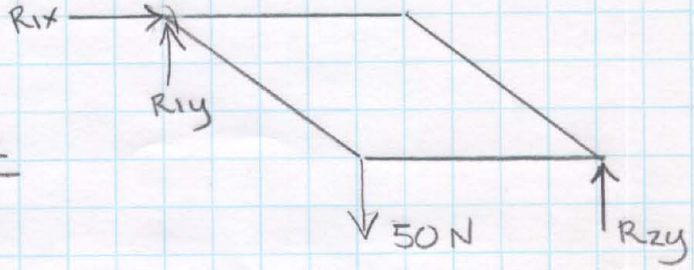
3. USE THE METHOD OF JOINTS TO DETERMINE THE FORCES ON EA. MEMBER





$\Sigma F_y = R_{1y} + R_{2y} - 50N = 0$

$R_{1y} + R_{2y} = 50N$

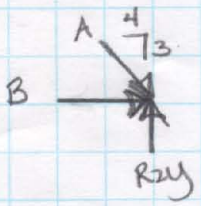
$\Sigma M_1 = R_{2y}(9) - 50N(4) = 0$

$R_{2y} = 22.2\ N$

$\Sigma F_y = R_{1y} + 22.2N = 50N$

$R_{1y} = 27.8\ N$

* ARROW LOOKS LIKE TENSION B. MEMBER IS IN COMPRESSION



$\Sigma F_y = -A(3/5) + R_{2y} = 0$

$A = 5/3\ R_{2y}$

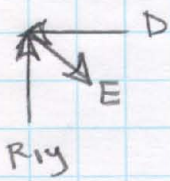
$\underline{A = 37.0\ C}$

$\Sigma F_x = B + A(4/5) = 0$

$B = -4/5\ A$ $\qquad B = -29.63$

* A NEGATIVE ANSWER MEANS THE ARROW IS IN THE WRONG DIRECTION

$\therefore\ \underline{B = 29.63\ T}$



$\Sigma F_y = -E(3/5) + R_{1y} = 0$

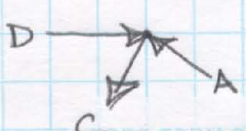
$E = 5/3\ R_{1y}$

$\underline{E = 46.3\ T}$

$\Sigma F_x = -D + E(4/5) = 0$

$D = 4/5\ E$

$\underline{D = 37.04\ C}$



$\Sigma F_y = A(3/5) - C(3/3.16) = 0$ $\qquad \underline{C = 23.39\ T}$

✓ $\Sigma F_x = 37.04 - 37.0(4/5) - 1/3.16(23.39) = 0 \rightarrow$ O.K.