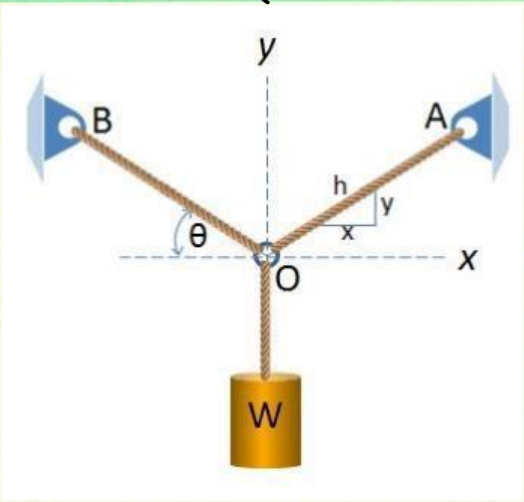
1. Given:

W = 75 lbs
Θ = 40°
x,y,h = 4, 3, 5 (respectively)



Find:
F_A, F_B

Solution:

$\Sigma f_x = 0$

$f_A\left(\frac{x}{h}\right) - f_B \cos\theta = 0$

$\Sigma f_y = 0$

$f_A\left(\frac{y}{h}\right) + f_B \sin\theta = W$

$\Sigma f_x = 0$

$f_A(4/5) - f_B \cos 40 = 0$

$\Sigma f_y = 0$

$f_A(3/5) + f_B \sin 40 = 75$

f_A	f_B		f_A		
$\left(\frac{x}{h}\right)$	$-\cos\theta = 0$	x	4/5	$-\cos 40 = 0$	x
$\left(\frac{y}{h}\right)$	$\sin\theta = W$	y	3/5	$\sin 40 = 75$	y

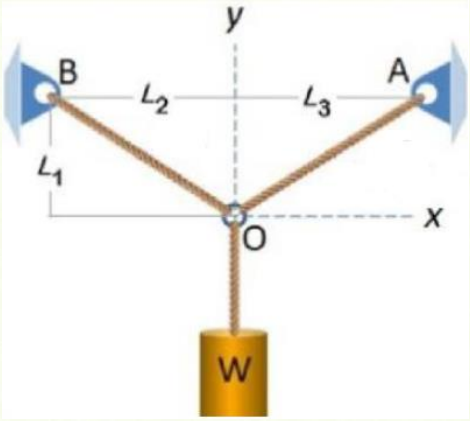
Fa	Fb			Forces*		Constants		
0.8	-0.76604	X		Fa		0		
0.6	0.642788	Y	X	Fb	=	75	lbs	

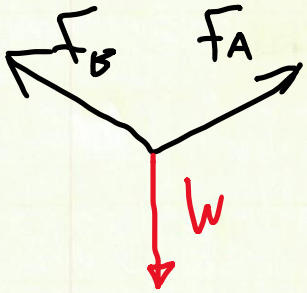
Forces*								
Fa		0.660043	0.786609		0		59.00	
Fb	=	-0.61611	0.821476	X	75	=	61.61	lbs

$f_A = 59$ lbs $f_B = 61.61$ ← f_A, f_B

2. Given:

$L_1 = 3m$
$L_2 = 4m$
$L_3 = 5m$
$F_{BMax} = 500\ N$
$F_{AMax} = 450\ N$





Find:
W_{MAX}

Solution:

I am going to make an educated guess on which rope is going to break first. I think Rope A will break first (because Rope A has the smaller breaking force).

$$\Sigma F_x = 0$$

$$F_{Ax} - F_{Bx} = 0$$

$$F_{Ay} + F_{By} = W$$

$$F_{Ax} = F_A\left(\frac{L_3}{\sqrt{L_3^2 + L_1^2}}\right) = 450\left(\frac{5}{\sqrt{34}}\right) = 385.87\ N$$

$$F_{Ax} = F_{Bx} = 385.87\ N$$

$$F_{By} = \frac{L_1}{L_2}(F_{Bx}) = \frac{3}{4}(385.87) = 289.40\ N$$

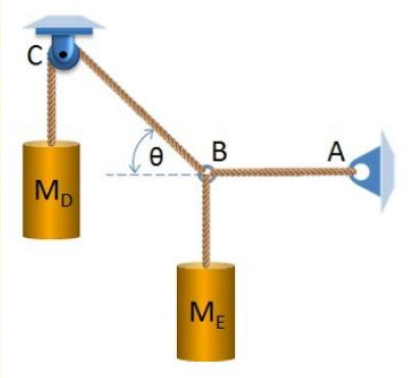
$$F_{Ay} = \frac{L_1}{\sqrt{L_3^2 + L_1^2}}(F_B) = \frac{3}{\sqrt{34}}(450) = 231.52\ N$$

$$F_{Ay} + F_{By} = 289.40 + 231.52 = \underline{520.92\ N} = W_{max} \leftarrow W_{max}$$

3. Given:

$M_D = 120$ kg

$\Theta = 55°$

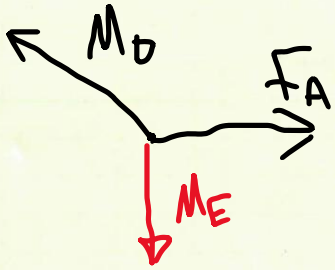


Find:

M_E

Solution:

$\Sigma f_y = 0$



$M_{Dy} - M_E = 0$

$\Sigma f_x = 0$

$-M_{Dx} + F_A = 0$

$$\frac{120(9.81)\sin 55}{9.81} \rightarrow M_E = 98.30 \text{ kg}$$

4. Given:

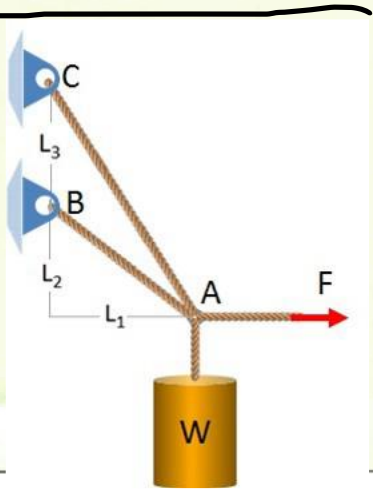
W = 475 lbs

F = 100 lbs

$L_1 = 5$ ft

$L_3 = 2.5$ ft

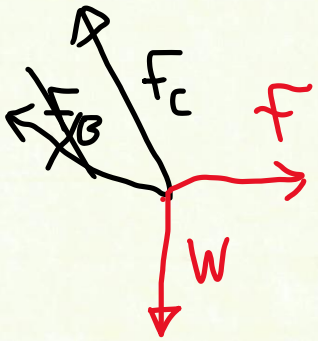
$F_B = 0$ lbs



Find:

L_2

Solution:



$$\Sigma F_y = 0$$

$$F_{cy} - W = 0$$

$$\Sigma F_x = 0$$

$$-F_{cx} + F = 0$$

$$F_c\left(\frac{2.5+L_2}{\sqrt{5^2+(2.5+L_2)^2}}\right) = 475$$

$$F_c\left(\frac{5}{\sqrt{5^2+(2.5+L_2)^2}}\right) = 100$$

$$F_c = 475\left(\frac{\sqrt{5^2+(2.5+L_2)^2}}{2.5+L_2}\right)$$

$$475\left(\frac{\sqrt{5^2+(2.5+L_2)^2}}{2.5+L_2}\right)\left(\frac{5}{\sqrt{5^2+(2.5+L_2)^2}}\right) = 100$$

$$475\left(\frac{5}{2.5+L_2}\right) = 100$$

$$475(5) = 250 + 100\,L_2$$

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$$\frac{475(6) - 260}{100} = L_2 = 21.25 \text{ ft}$$