Homework 9
31 October 2023
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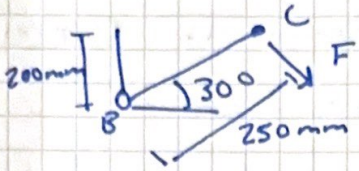
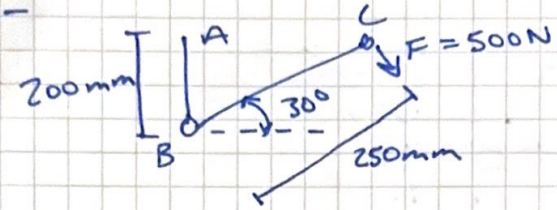
Phys 216-510

1. Given - $F = 500\ N$



Find - The moment of the 500N Force at Point A.

Diagram -



Theory - Find the Moment

Assumptions - the Forces are true, no need to worry about weight of bars

Solution

$$CD = AB - 250\sin(20°)$$

$$CD = 200 - 250\sin 30$$

$$CD = 75$$

$$D = \frac{75}{\sqrt{3}} = \sqrt{7}\cdot 25$$

$$AC = 250\cos(30°) - 25\sqrt{3} = 100\sqrt{3}$$

$$AL = 100\sqrt{3} \times \sin(60) = 150$$

$$500 \cdot 150 \times 10^{-3}$$

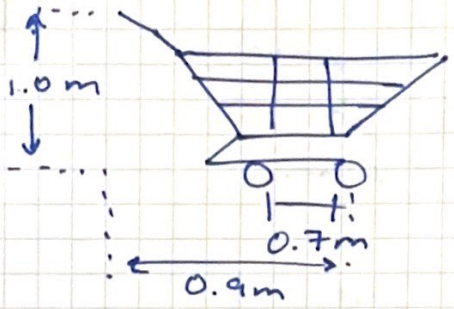
$$\boxed{AL = -75N}$$

2.

Given – 75N force is applied at an angle of 60° from horizontal to the handle
Distance between wheels is 0.7m.

Find – Moments of the force on –
the front wheel.
the back wheel.

Diagram –



Theory – Find X and Y components and find moments by subtracting the force × distance. (Since moment is in N·m)

Solution –

Part a, Moment of front wheel

from Diagram $F_x = 75N(\cos 60°)$

$F_y = 75N(\sin 60°)$

$M_{Front} = [75 \sin 60° \cdot 0.9m] - [75 \cos 60° \cdot 1.0m]$

$M_{Front} = 21\ N \cdot m$

Part b, $(0.9 - 0.7)$

$M_{back} = [75 \sin 60° \times 0.2m] - [75 \cos 60 \times 1.0m]$

$M_{back} = -25 N \cdot m$

Answer,

$M_{Front} = 21 N \cdot m$

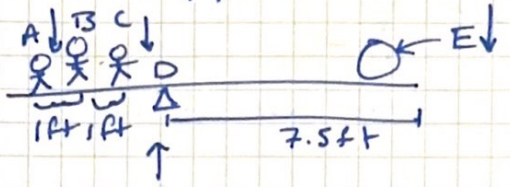
$M_{back} = -25 N \cdot m$

3. Given - Mass of

See-saw - 15 lb
kid A - 35 lb
kid B - 45 lb
kid C - 25 lb

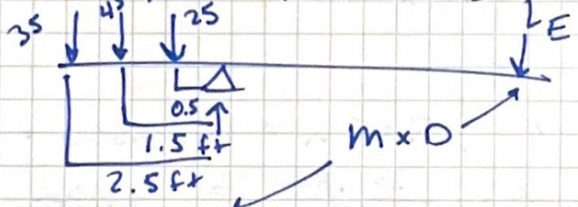
Find - Weight of rock at point E required for the system to remain balanced.
Reaction at support D.

Diagram -



Theory - Calculate distance from point D and multiply force and distance together. Solve for the weight of the rock (L_E).

Solution - Find Distances



(a)

$L_E \times 7.5\ ft = 35lbs \times 2.5 + 45lbs \times 1.5\ ft + 25lbs * 0.5$

$L_e = \frac{167.5 - (15 \times 2.5)}{7.5}$

$L_e = 17.3 lbs$

(b) Reaction @ D

$\sum_y F_y = L_{Applied}$

$R_D = A + B + C + See\text{-}Saw + Rock$

$= 35 + 45 + 25 + 15 + 17.3$

$= 137.3 lbs$

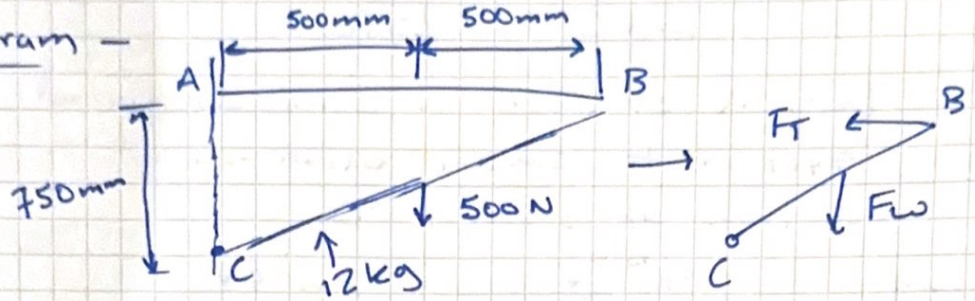
Answers,

$L_e = 17.3 lbs$
$R_D = 137.3 lbs$

4. Given - Mass of 12kg.

Find - Tension in the cable and reaction at support C.

Diagram -



Assumptions - Strut has uniform cross section.

Theory - All forces add up to 0.

Solution -

at point C.

$$Y = \underset{m \times g}{12 \times 9.8} + \underset{\Sigma F}{500}$$

$$Y = 618\,N$$

Calculate Moment

$$F_{Tension} = X \rightarrow \quad 750X = 618 \times 500 + 500(500)$$

$$X = \frac{308,800}{750} = 412\,N$$

Calculate Magnitude -

$$m = \sqrt{x^2 + y^2}$$

$$= \sqrt{618^2 + 412^2}$$

$$= 742\,N$$

Answers

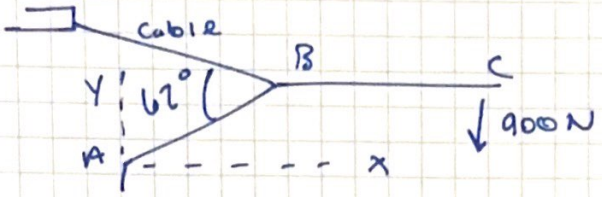
X = 412N
Y = 618N
m = 742N

5.

Given - Forces and Angles of the system

Find - Force Exerted by Cable at B and reaction at support A.

Diagram -



Assumptions - Bar is massless

Theory - Use Equilibrium Equation to Calculate Forces in X and Y and then find the Moment and Reaction

Solution -

$$A_x = B\cos(22°)$$
$$A_y = 900 - B\sin(22°)$$

Moment on A = ~~A(x)+Ay~~ $(A_x \times D_x) + (A_y \times D_y)$

$= (B\sin(22°) \times 300m) + (B\cos(22°) \times 250) = 8\,495{,}000$

$B = 1432$

Plug back in

$A_x = 1432\cos(22°) \times 250m = 1328$

$A_y = (1432 \times \sin(22°) \times 300m) + 900 =$

$= 1{,}600\ N$