

**PRAIRIE VIEW A&M UNIVERSITY
ROY G. PERRY COLLEGE OF ENGINEERING
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
CVEG 2301–ENGINEERING MECHANICS I
FALL 2021**

I. COURSE DESCRIPTION IN ABET FORMAT

II. TESTS

Summary of Topics covered by Test

Original Test Questions & Master Solution/grading scheme used

(Summary of topics can be a separate page or include on the assignment itself)

Above Average (Graded original work)

Average (Graded original work)

Below Average (Graded original work)

III. QUIZZES

Summary of Topics covered by Quiz

Original Quiz Questions & Master Solution/grading scheme used

Above Average (Graded original work)

Average (Graded original work)

Below Average (Graded original work)

IV. HOMEWORK ASSIGNMENTS

Summary of Topics covered by Homework

Original Homework Questions & Master Solution/grading scheme used

Above Average (Graded original work)

Average (Graded original work)

Below Average (Graded original work)

Course Description in ABET Format

Department of Civil & Environmental Engineering

CVEG 2301 –ENGINEERING MECHANICS - I

CREDIT HOURS	3
CONTACT HOURS	4
INSTRUCTOR/ COURSE COORDINATOR	Dr. Abdul M. Choudhury, Ph.D. in Civil Engineering
TEXTBOOK	Engineering Mechanics: Statics, R.C. Hibbeler, 14th ed., Prentice-Hall/Pearson
SUPPLEMENTAL MATERIALS	Class Handouts and Notes; PPT
CATALOG DESCRIPTION	Fundamental concepts and principles; vector algebra and applications; equilibrium of particles and rigid bodies in two and three dimensions; moments and couples, distributed forces; centroids; moments of inertia; friction; introduction to analysis of structures.
PREREQUISITES	PHYS 2513
CO-REQUISITES	None
DESIGNATION	Required
COURSE LEARNING OUTCOMES/GOALS (Outcome introduced, not measured)	ABET Criteria 7: An ability to identify, formulate, and solve engineering problems Students are expected to know and able to apply theory and application of Engineering Mechanics principles: 1) Able to apply knowledge of mathematics, science, and engineering to solve problems in solid mechanics (7) 2) Able to identify, formulate, and solve engineering problems (7) 3) Apply the fundamental equations in various type of force equilibrium equation for solving unknown forces in rigid body mechanics (7)
TOPICS COVERED	1. Introduction to Engineering Mechanics and General Principle (2 hours) 2. Force Vectors (8 hours) 3. Equilibrium of Particles (4 hours) 4. Force system resultants (6 hours) 5. Equilibrium of rigid bodies (4 hours) 6. Structural Analysis (4 hours) 7. Internal Forces (6 hours) 8. Friction (3 hours) 9. Center of Gravity (4 hours) 10. Moment of Inertia (4 hours)

**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

Title of Assignment: TEST 1

TOPICS COVERED IN TEST 1

Test 1 covered the following topics:

1. 2D Vector addition
2. 3D Vector addition
3. Converting a scalar in vector form
4. Angle between two vectors by vector dot product

**CVEG 2301–ENGINEERING MECHANICS I
FALL 2021**

**SAMPLE TEST QUESTIONS, SOLUTION,
AND GRADING SCHEME FOR TEST 1**

Class Test #1
CVEG 2301 (Engineering Mechanics I)

Full Points-100 Time -1 Hour 10 Minutes

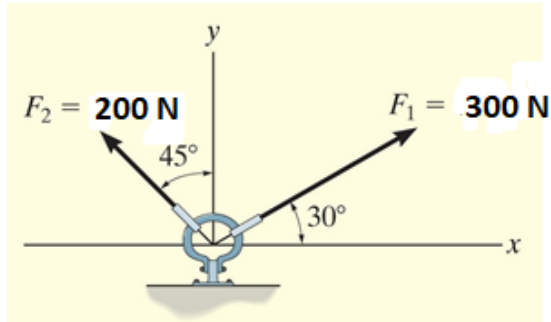


Fig. for Q.1

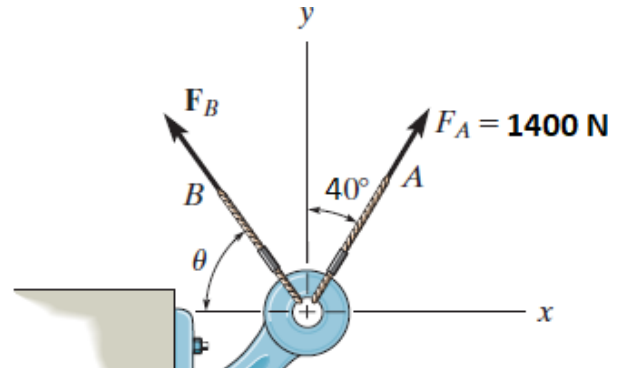


Fig. for Q.2

1. Determine the magnitude and direction of the resultant force. Use force triangle. 25 Points
2. Determine the magnitude of F_B so that the resultant force is directed along the positive y axis and has a magnitude of **3000 N**. 25 Points

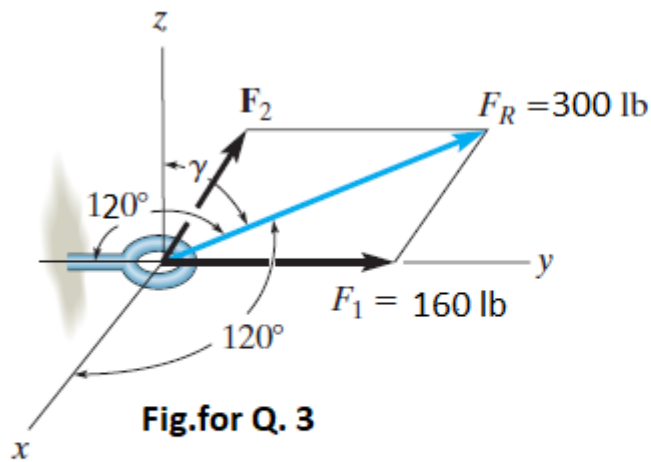


Fig. for Q. 3

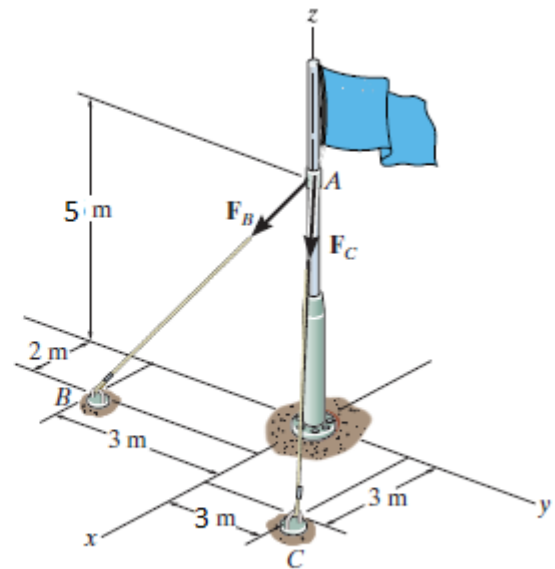


Fig. for Q.4

3. Two forces F_1 and F_2 act on the screw eye. If the resultant force F_R has a magnitude of 300 lb and the coordinate direction angles shown, determine the magnitude of F_2 and its coordinate direction angles. 25 Points
4. If $F_B = 350$ N and $F_C = 280$ N, determine the magnitude and coordinate direction angles of the resultant force acting on the flag pole. 25 Points

YOU MAY DETACH THIS PAGE FROM YOUR ANSWER PAPER

Soln of Test - 1

①

1.

Scale 1m = 100N

in $\triangle ABC$

$$AB = 300$$

$$BC = 200$$

$$\angle B = 30^\circ + 45^\circ = 75^\circ$$

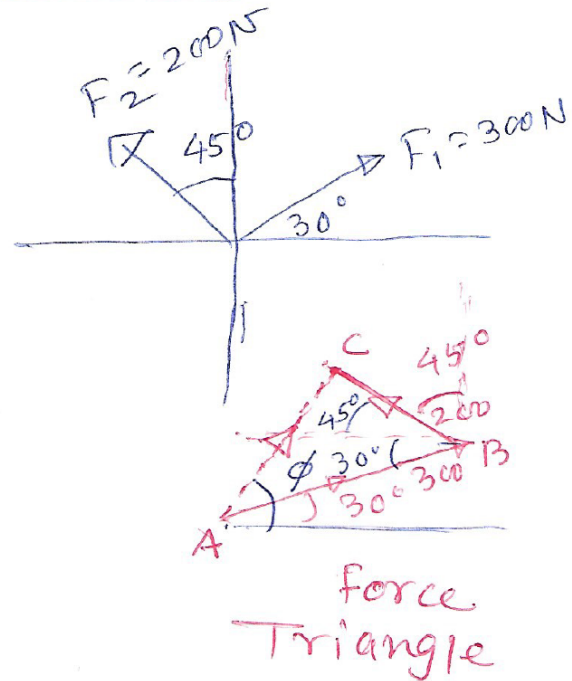
using cosine Rule

$$AC^2 = AB^2 + BC^2 - 2AB \cdot BC \cdot \cos B$$

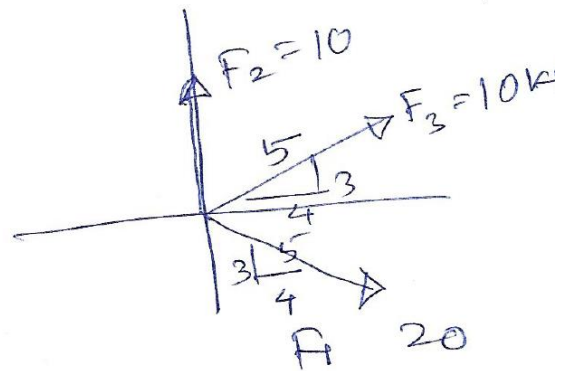
$$= 300^2 + 200^2 - 2 \cdot 300 \cdot 200 \cdot \cos 75^\circ$$

$$= 98941.7$$

$$AC = 314.55 \text{ N}$$



2

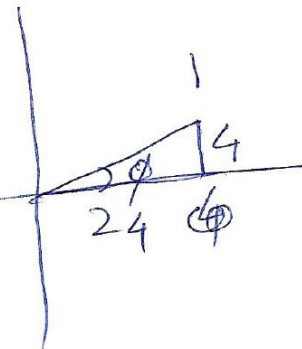


force	x comp	y comp
$F_1 = 20$	$20 \times \frac{4}{5} = 16$	$-20 \times \frac{3}{5} = -12$
$F_2 = 10$	0	10
$F_3 = 10$	$10 \times \frac{4}{5} = 8$	$10 \times \frac{3}{5} = 6$

$$(F_R)_x = \sum F_x = 24 \quad (F_R)_y = \sum F_y = 4$$

$$F_R = \sqrt{24^2 + 4^2} = 24.33 \text{ kN}$$

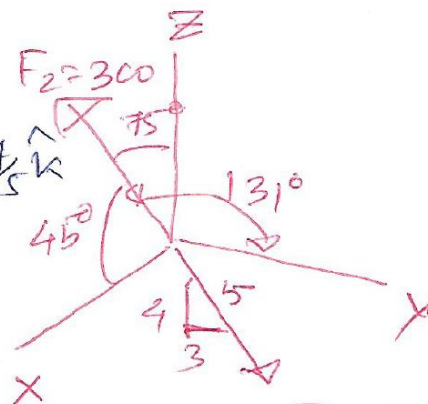
$$\phi = \tan^{-1}\left(\frac{4}{24}\right) = 9.46^\circ$$



3

$$\vec{F}_1 = 0\hat{i} + 250 \times \frac{3}{5}\hat{j} - 250 \times \frac{4}{5}\hat{k}$$

$$\vec{F}_1 = 150\hat{j} - 200\hat{k}$$

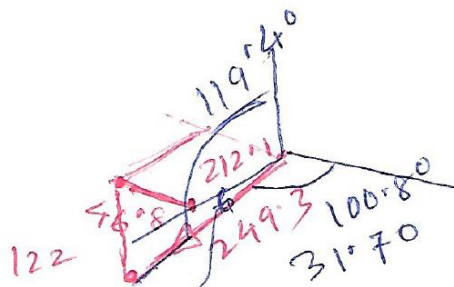


$$\begin{aligned}\vec{F}_2 &= 300 \cos 45^\circ \hat{i} + 300 \cos 131^\circ \hat{j} + 300 \cos 75^\circ \hat{k} \\ &= 212.1 \hat{i} - 196.8 \hat{j} + 77.6 \hat{k}\end{aligned}$$

$$\begin{aligned}\vec{F}_R &= 212.1 \hat{i} + (\cancel{150} - 196.8) \hat{j} \\ &\quad + (-200 + 77.6) \hat{k} \\ &= 212.1 \hat{i} - 46.8 \hat{j} - 122.4 \hat{k}\end{aligned}$$

$$\begin{aligned}F_R &= \sqrt{212.1^2 + (-46.8)^2 + (-122.4)^2} \\ &= 249.3 \text{ N}\end{aligned}$$

$$\begin{aligned}\cos \alpha_R &= \frac{212.1}{249.3} & \cos \beta_R &= \frac{-46.8}{249.3} & \cos \gamma_R &= \frac{-122.4}{249.3} \\ \alpha_R &= 31.70^\circ & \beta_R &= 100.80^\circ & \gamma_R &= 119.4^\circ\end{aligned}$$



$$\begin{aligned}\underline{\underline{4.}} \quad \vec{r}_{AB} &= (8-4)\hat{i} + (6-0)\hat{j} \\ &\quad + (-8-4)\hat{k} \\ &= 4\hat{i} + 6\hat{j} - 12\hat{k}\end{aligned}$$

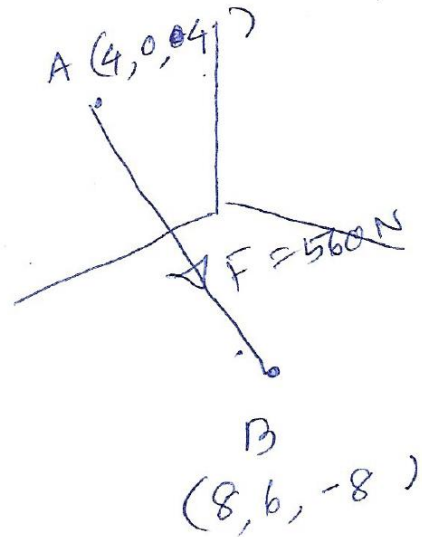
$$\begin{aligned}r_{AB} &= \sqrt{4^2 + 6^2 + (-12)^2} \\ &= 14\end{aligned}$$

$$\hat{u}_{AB} = \frac{4\hat{i} + 6\hat{j} - 12\hat{k}}{14}$$

$$\begin{aligned}\vec{F} &= F \cdot \hat{u}_{AB} = 560 \cdot \frac{4\hat{i} + 6\hat{j} - 12\hat{k}}{14} \\ &= 40 \times (4\hat{i} + 6\hat{j} - 12\hat{k}) \\ &= 160\hat{i} + 240\hat{j} - 480\hat{k}\end{aligned}$$

$$\cos \alpha = \frac{160}{560} \quad \cos \beta = \frac{240}{560} \quad \cos \gamma = \frac{-480}{560}$$

$$\alpha = 73.4^\circ \quad \beta = 64.6^\circ \quad \gamma = 149^\circ$$



ABOVE AVERAGE

NAME Michael BoguesROSTER #3

Instructions: You need to write your answer in serial order. Diagrams are not drawn to scale unless stated otherwise. **If you need additional space, please use the backside of the paper.** Your numerical answer should not go beyond two places after the decimal point.

You can use the formula sheet, which was provided in the class

POLICY TO ERADICATE CHEATING (PROTECT INTEGRITY OF EXAMS)

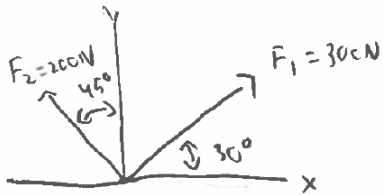
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EXAM GUIDELINES

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ANSWER FOR QUESTION 1

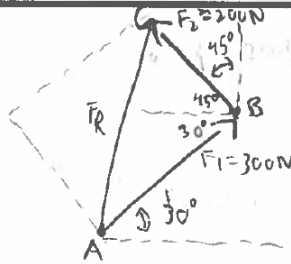


$$\frac{314.55 \text{ N}}{\sin 75^\circ} = \frac{200 \text{ N}}{\sin \theta}$$

$$\sin \theta = \left(\frac{200 \sin 75^\circ}{314.55} \right)$$

$$\theta = \sin^{-1} \left(\frac{200 \sin 75^\circ}{314.55} \right)$$

$$\theta = 37.89^\circ + 30^\circ = 67.89^\circ$$



$$\beta = 30 + 45 = 75^\circ$$

$$AC^2 = AB^2 + BC^2 - 2(AB)(BC)\cos \beta$$

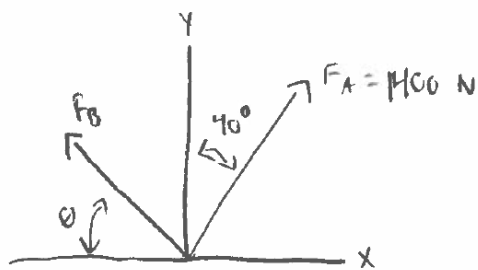
$$AC^2 = 300^2 + 200^2 - 2(300)(200)\cos 75^\circ$$

$$AC^2 = 98941.7$$

$$AC = \sqrt{98941.7}$$

$$AC = 314.55 \text{ N}$$

ANSWER FOR QUESTION 2



$$F_B \cos(64.97^\circ) = 899.903$$

$$F_B = \frac{899.903}{\cos(64.97^\circ)}$$

$$F_B = 2126.96 \text{ N}$$

25 ✓

	x direction	y direction
F_A	$1400 \sin 40^\circ$	$1400 \cos 40^\circ$
F_B	$-F_B \cos \theta$	$F_B \sin \theta$

$$F_{Rx} = 899.903 - F_B \cos \theta = 0$$

$$F_{Ry} = 1072.46 + F_B \sin \theta = 3000$$

$$F_B \sin \theta = 1927.54$$

$$F_B \cos \theta = 899.903$$

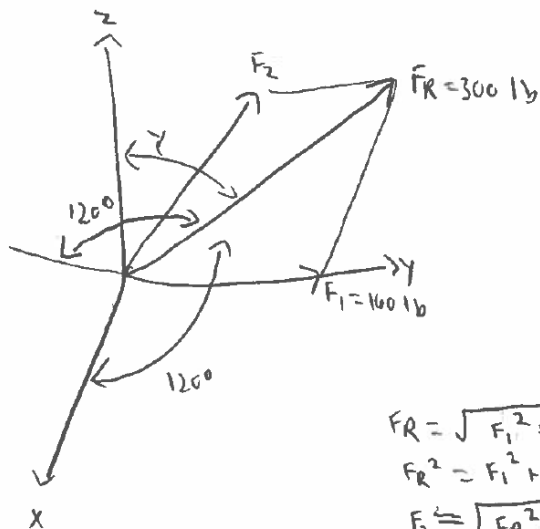
$$\tan \theta = \frac{1927.54}{899.903}$$

$$\theta = \tan^{-1} \left(\frac{1927.54}{899.903} \right)$$

$$\theta = 64.97^\circ$$

✓

ANSWER FOR QUESTION 3



	X direction	Y direction	Z direction
F_1	0	160	0
F_R	$300 \cos 120^\circ$ $= -150$	$300 \cos 60^\circ$ $= 150$	$300 \cos 45^\circ$ $= 212.132$

$$F_R = \sqrt{F_1^2 + F_2^2}$$

$$F_R^2 = F_1^2 + F_2^2$$

$$F_2 = \sqrt{F_R^2 - F_1^2}$$

$$F_2 = \sqrt{(-150)^2 + (150)^2 + (212.132)^2}$$

$$F_2 = 260.1b$$

$$(\cos(120))^2 + (\cos(60))^2 + (\cos(\gamma))^2 = 1$$

$$(\cos(\gamma)) = 1 - .5$$

$$\cos^2 \gamma = .5$$

$$\cos \gamma = 0.707107$$

$$\gamma = \cos^{-1}(0.707107)$$

$$\gamma = 45^\circ$$

$$260 \cos \alpha = -150$$

$$\alpha = \cos^{-1}\left(\frac{-150}{260}\right)$$

$$\alpha = 125.23^\circ$$

$$260 \cos \beta = -10$$

$$\beta = \cos^{-1}\left(\frac{-10}{260}\right)$$

$$\beta = 92.20^\circ$$

$$260 \cos \gamma = 212.132$$

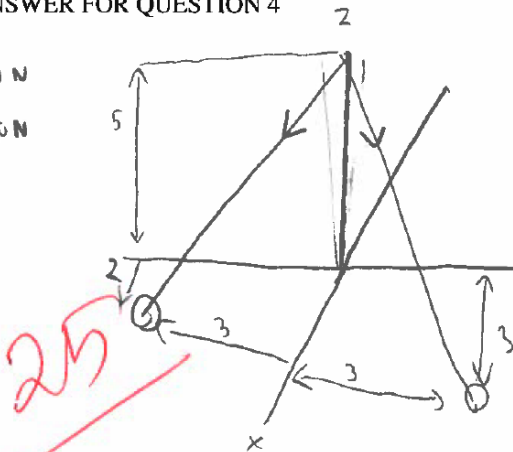
$$\gamma = \cos^{-1}\left(\frac{212.132}{260}\right)$$

$$\gamma = 35.32^\circ$$

ANSWER FOR QUESTION 4

$$F_B = 350 \text{ N}$$

$$F_C = 280 \text{ N}$$



$$B(\text{Head}): (2, -3, 0)$$

$$A(\text{Tail}): (0, 0, 5)$$

$$C(\text{Head}): (3, 3, 0)$$

$$A(\text{Tail}): (0, 0, 5)$$

$$u_{BA} = (2-0)\hat{i} + (-3-0)\hat{j} + (0-5)\hat{k}$$

$$u_{BA} = 2\hat{i} - 3\hat{j} - 5\hat{k}$$

$$|u_{BA}| = \sqrt{2^2 + (-3)^2 + (-5)^2} = 6.16441$$

$$u_{CA} = (3-0)\hat{i} + (3-0)\hat{j} + (0-5)\hat{k}$$

$$u_{CA} = 3\hat{i} + 3\hat{j} - 5\hat{k}$$

$$|u_{CA}| = \sqrt{3^2 + 3^2 + (-5)^2} = 6.55744$$

$$554.593 \cos \alpha = 241.654 \rightarrow \alpha = \cos^{-1} \left(\frac{241.654}{554.593} \right)$$

$$\alpha = 64.17^\circ$$

$$554.593 \cos \beta = -42.234 \rightarrow \beta = \cos^{-1} \left(\frac{-42.234}{554.593} \right)$$

$$\beta = 94.37^\circ$$

$$554.593 \cos \gamma = -497.386 \rightarrow \gamma = \cos^{-1} \left(\frac{-497.386}{554.593} \right)$$

$$\gamma = 153.747^\circ$$

$$F_B = 350 \left(\frac{2\hat{i} - 3\hat{j} - 5\hat{k}}{6.16441} \right)$$

$$= 113.555\hat{i} - 170.333\hat{j} - 283.888\hat{k}$$

$$F_C = 280 \left(\frac{3\hat{i} + 3\hat{j} - 5\hat{k}}{6.55744} \right)$$

$$= 128.099\hat{i} + 128.099\hat{j} - 213.498\hat{k}$$

$$F = \sqrt{F_B^2 + F_C^2}$$

$$\sqrt{(113.555 + 128.099)^2 + (128.099 - 170.333)^2 + (-283.888 - 213.498)^2}$$

$$(-283.888 - 213.498)$$

$$F = 554.593 \text{ N}$$

AVERAGE

NAME

Harry Moses

ROSTER

13

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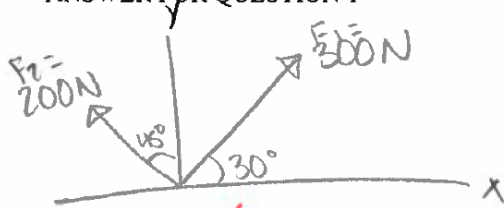
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ANSWER FOR QUESTION 1



0.5

Force	X component	Y component
$F_1 = 300\text{ N}$	$(300)(\cos(30^\circ)) = 259.81$	$(300)(\sin(30^\circ)) = 150$
$F_2 = 200\text{ N}$	$(200)\sin(45^\circ) = 141.42$	$(200)(\cos(45^\circ)) = 141.42$
F_R	$F_R \cos(\theta)$	$F_R \sin(\theta)$

$$F_{Rx} = + \sum 259.81 + 141.42 = 401.23$$

$$F_{Ry} = + \sum 150 + 141.42 = 291.42$$

$$F_R^2 = \sqrt{F_{Rx}^2 + F_{Ry}^2}$$

$$F_R = \sqrt{(401.23)^2 + (291.42)^2} = 495.89\text{ N}$$

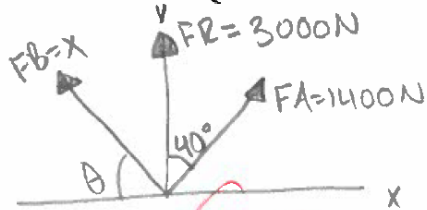
$$F_R \cos(\theta) = 401.23$$

$$\frac{(495.89) \cos(\theta)}{495.89} = \frac{401.23}{495.89}$$

$$\theta = \cos^{-1}\left(\frac{401.23}{495.89}\right) = 35.99^\circ$$

Force Triangle

ANSWER FOR QUESTION 2



Force	x component	y component
$F_A = 1400 \text{ N}$	$(1400)(\sin(40^\circ)) = 899.90$	$(1400)(\cos(40^\circ)) = 1072.46$
$F_B =$	$F_B \cos(\theta)$	$F_B \sin(\theta)$
	$F_{Rx} - F_{Ax} = 0 - 899.90$	$F_{Ry} - F_{Ay} = 3000 - 1072.46$
	$= -899.90$	$= 1927.54$
$F_R = 3000 \text{ N}$	0	3000

$$F_{Rx} = F_{Ax} + F_{Bx} \quad 0 = 899.90 + x$$

$$x = -899.90$$

$$F_{Ry} = F_{Ay} + F_{By} \quad 3000 = 1072.46 + x$$

$$x = 1927.54$$

$$\theta = \tan^{-1} \left(\frac{1927.54}{-899.90} \right) = 64.97^\circ$$

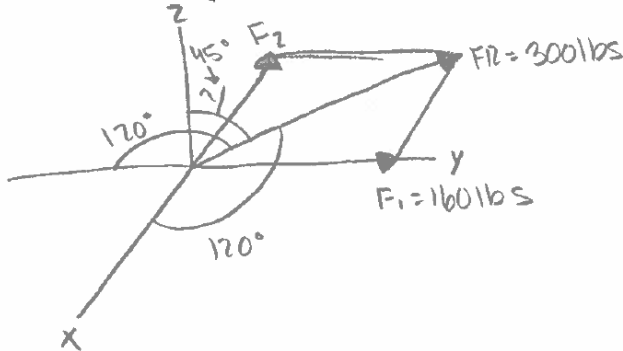
$$F_B \sin(\theta) = 1927.54$$

$$F_B \sin(64.97^\circ) = 1927.54$$

$$\frac{(F_B)(0.90609)}{0.90609} = 1927.54$$

$$F_B = 2127.32 \text{ N}$$

ANSWER FOR QUESTION 3



$$\begin{aligned}\cos^2(\alpha) + \cos^2(\beta) + \cos^2(\gamma) &= 1 \\ (\cos(120^\circ))^2 + (\cos(120^\circ))^2 + (\cos(\gamma))^2 &= 1 \\ 0.25 + 0.25 + (\cos(\gamma))^2 &= 1 \\ -0.5 + (\cos(\gamma))^2 &= 1 \\ \sqrt{(\cos(\gamma))^2} &= \sqrt{0.5} \\ \cos(\gamma) &= 0.7071\end{aligned}$$

$$\gamma = \cos^{-1}(0.7071) = 45^\circ$$

Force	x component	y component	z component
$F_1 = 160 \text{ lbs}$	0	160	0
$F_2 = 234.44$	-150	99.81	150
$FR = 300 \text{ lbs}$	$(300)(\cos(120^\circ)) = -150$ (+)	$(300)(\sin(120^\circ)) = 259.81$	150

$$\begin{aligned}FR &= \sqrt{FR_x^2 + FR_y^2 + FR_z^2} \quad (300)^2 = \sqrt{(-150)^2 + (259.81)^2 + FR_z^2} \quad 300 = \sqrt{22500 + 67501.24 + FR_z^2} \\ (300)^2 &= \sqrt{67501.24 + FR_z^2} \quad 90000 = 67501.24 + FR_z^2 \quad \sqrt{FR_z^2} = \sqrt{22498.76} \\ FR_z &= 150\end{aligned}$$

$$F_{2x} = FR_x - F_{1x} = -150 - 0 = -150$$

$$F_{2y} = FR_y - F_{1y} = 259.81 - 160 = 99.81$$

$$F_{2z} = FR_z - F_{1z} = 150 - 0 = 150$$

$$F_2 = \sqrt{(-150)^2 + (99.81)^2 + (150)^2}$$

$$F_2 = 234.44 \text{ lbs}$$

$$\alpha = \cos^{-1}\left(\frac{-150}{234.44}\right) = 129.78^\circ$$

$$\beta = \cos^{-1}\left(\frac{99.81}{234.44}\right) = 64.80^\circ$$

$$\gamma = \cos^{-1}\left(\frac{150}{234.44}\right) = 50.22^\circ$$

ANSWER FOR QUESTION 4

$$A = 0i + 0j + 5k$$

$$B = 2i - 3j + 0k$$

$$C = 3i + 3j + 0k$$

$$\overline{AB} = (2-0)i + (-3-0)j + (0-5)k \\ = 2i - 3j - 5k$$

$$\overline{AC} = (3-0)i + (3-0)j + (0-5)k \\ = 3i + 3j - 5k$$

$$AB = \sqrt{2^2 + 3^2 + 5^2} = 6.16 \quad U_{AB} = (6.16)(2i - 3j - 5k) = 12.32i - 18.48j - 30.8k$$

$$AC = \sqrt{3^2 + 3^2 + 5^2} = 6.56 \quad U_{AC} = (6.56)(3i + 3j - 5k) = 19.68i + 19.68j - 32.8k$$

$$|AB| = (350)(12.32i - 18.48j - 30.8k) = 4312i - 6468j - 10780k$$

$$|AC| = (180)(19.68i + 19.68j - 32.8k) = 5510.4i + 5510.4j - 9184k$$

$$FR = AB + AC = 9822.4i - 957.6j - 19964k$$

$$FR = \sqrt{9822.4^2 + 957.6^2 + 19964^2} = 22270.11N$$

$$\alpha = \cos^{-1}\left(\frac{9822.4}{22270.11}\right) = 63.83^\circ$$

$$\beta = \cos^{-1}\left(\frac{-957.6}{22270.11}\right) = 92.46^\circ$$

$$\gamma = \cos^{-1}\left(\frac{-19964}{22270.11}\right) = 153.70^\circ$$

BELOW AVERAGE

NAME Jacorien LouallROSTER 9

Instructions: You need to write your answer in serial order. Diagrams are not drawn to scale unless stated otherwise. **If you need additional space, please use the backside of the paper.** Your numerical answer should not go beyond two places after the decimal point.

You can use the formula sheet, which was provided in the class

POLICY TO ERADICATE CHEATING (PROTECT INTEGRITY OF EXAMS)

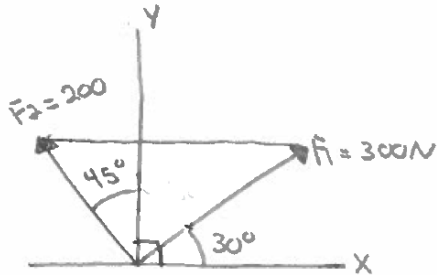
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ANSWER FOR QUESTION 1



$$|\vec{R}| = \sqrt{F_1^2 + F_2^2 + 2 F_1 F_2 \cos \theta}$$

$$= \sqrt{(300)^2 + (200)^2 + 2(300)(200) \cos 105^\circ}$$

$$= 420.4 \text{ N}$$

$$F_1 = 300 \sin 30 + 300 \cos 30 = 401.81^\circ$$

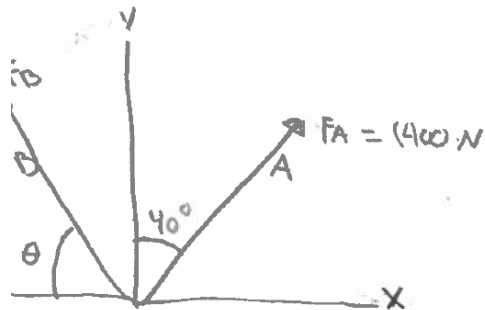
$$F_2 = 200 \cos 45 + 200 \sin 45 = 282.84^\circ$$

$$\tan \theta = .6902$$

$$\theta = \tan^{-1}(.6902)$$

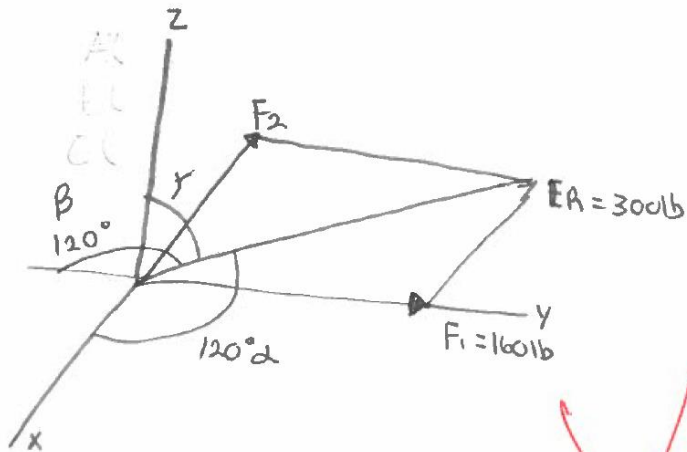
$$\theta = 34.6^\circ$$

ANSWER FOR QUESTION 2



$$|F| = 3000\text{ N}$$

ANSWER FOR QUESTION 3



$$\theta = 120 - 30 = 90^\circ$$

ANSWER FOR QUESTION 4

$$A(0,0,5)$$

$$B(3,2,0)$$

$$C(3,3,0)$$

$$F_B = 350 \text{ N}$$

$$F_C = 280 \text{ N}$$

$$\vec{F}_{AB} = 350 \left(\frac{-3\mathbf{i} - 2\mathbf{j} + 5\mathbf{k}}{\sqrt{3^2 + 2^2 + 5^2}} \right) = 350(-.47\mathbf{i} + .32\mathbf{j} + .81\mathbf{k})$$

$$F_{AC} = 280 \left(\frac{-3\mathbf{i} - 3\mathbf{j} + 5\mathbf{k}}{\sqrt{3^2 + 3^2 + 5^2}} \right) = 280(-.46\mathbf{i} - .46\mathbf{j} + .76\mathbf{k})$$

10

??

**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

Title of Assignment: TEST 2 (Mid-term test)

TOPICS COVERED IN TEST 2

Test 2 covered the following topics:

1. Free body diagram
2. Point equilibrium
3. Moment of a force (Scalar formulation)

ABOVE AVERAGE

Mid Term Test (2nd test)
CVEG 2301 (Engineering Mechanics I)
Full Points-100 Time -1 Hour 10 Minutes

NAME Daniel BenitezROSTER #2

Instructions: You need to write your answer in serial order. Diagrams are not drawn to scale unless stated otherwise. **If you need additional space, please use the backside of the paper.** Your numerical answer should not go beyond two places after the decimal point.

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1. Express the force as a Cartesian Vector.

25 Points

 $F =$

$$= (300 \cos 60^\circ \mathbf{i}) + 0\mathbf{j} + 300 \cos 45^\circ$$

$$-300 \cos 60^\circ = -150\mathbf{i} \quad 300 \cos 45^\circ = 212.13$$

$$-150\mathbf{i} + 0\mathbf{j} + 212.13$$

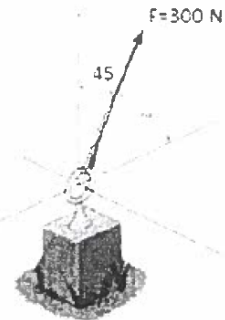
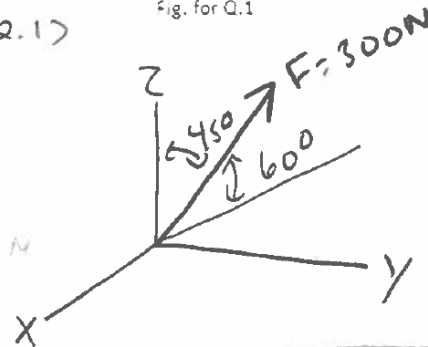


Fig. for Q.1



$$F^2 = F_x^2 + F_y^2 + F_z^2$$

$$300^2 = (-150)^2 + (x)^2 + (212.13)^2$$

$$90,000 = 22,500 + x^2 + 44,999$$

$$90,000 = x^2 +$$

$$- 67,499$$

$$\sqrt{22501} = \sqrt{x^2}$$

$$x = 150.0$$

$$\begin{array}{r} 22,500 \\ + 44,999 \\ \hline 67,499 \end{array}$$

$$F = (-150\mathbf{i} + 150\mathbf{j} + 212.13\mathbf{k})$$

2. Determine the tension developed in wires CA and CB required for equilibrium of the 20-kg Cylinder. Take $\theta = 40^\circ$.
25 Points

$$\sum F_x = 0$$

$$T_{CB} \cos 40 - T_{CA} \cos 30 = 0$$

$$① \cdot 766 - \cdot 866 = 0$$

$$\sum F_y = 0$$

$$T_{CB} \sin 40 + T_{CA} \sin 30 = 196.2$$

$$\cdot 642 + \cdot 5 = 196.2 \quad ②$$

$$T_{CB} = 180.95 \text{ N}$$

$$T_{CA} = 160.05 \text{ N}$$

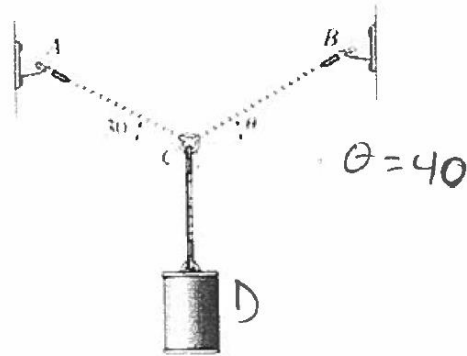


Fig. for Q. 2

$$20 \text{ kg} \times 9.81 = 196.2$$

lets say
its D

$$\cdot 766 - \cdot 866 = 0$$

$$\cdot 642 + \cdot 5 = 196.2$$

3. If the spring DB has an unstretched length of 2 m, determine the stiffness of the spring to hold the 20 kg crate in the position shown. 25 Points

$$k = \frac{F}{s}$$

$$S = l_{DB} - l_{0B}$$

$$S = \sqrt{13} - 2 = 1.6 \text{ m}$$

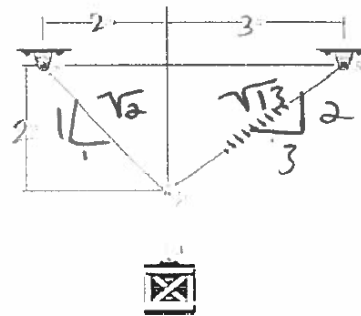


Fig. for Q. 3

$$\sum F_x = 0$$

$$T_{DB} \frac{3}{\sqrt{13}} - T_{DA} \frac{1}{\sqrt{2}} = 0$$

$$.832 - .707 = 0$$

$$\sum F_y = 0$$

$$T_{DB} \frac{2}{\sqrt{13}} + T_{DC} \frac{1}{\sqrt{2}} = 196.2 = 0$$

$$.554 + .707 = 196.2$$

$$T_{DB} = 141.55$$

$$T_{DC} = 166.58$$

$$k_{DB} = \frac{F_{DB}}{s_{DB}}$$

$$k = \frac{141.55}{1.6} = 88.46$$

$$k_{DB} = 88.46 \text{ N/m}$$

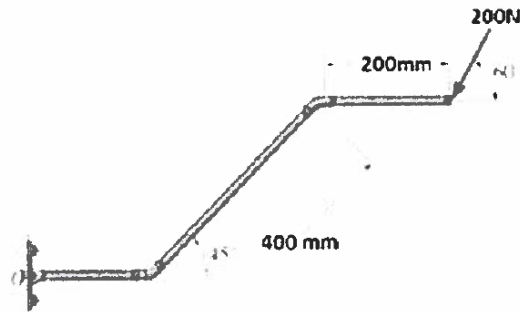
$$\frac{2}{\sqrt{13}} = \frac{1}{\sqrt{2}}$$

$$20 \times 9.81 =$$

$$196.2$$

4. Determine the moment of the force about point O.

25 Points



200 mm

Fig. for Q. 4

mm $\rightarrow$ m

$$200 \text{ mm} = .2 \text{ m}$$



200 mm

Distance

Force $\curvearrowright$

$$200 \sin 60^\circ = 173.20 \quad (0.6828) = -118.26 \text{ N}\cdot\text{m} \quad 282.8$$

$$200 \cos 60^\circ = 100 \quad (0.2828) = 28.28 \text{ N}\cdot\text{m} \quad 282.8$$

$$\begin{pmatrix} + \uparrow \end{pmatrix}$$

$$\begin{array}{r} .2 \text{ m} \\ + .2 \text{ m} \\ .2828 \\ \hline .6828 \text{ m} \end{array}$$

$$\begin{array}{r} -118.26 \\ + 28.28 \\ \hline -89.98 \end{array}$$

$$\curvearrowright F \sum M_O = -89.98 \text{ N}\cdot\text{m}$$

or
-90 if round

AVERAGE

Mid Term Test (2nd test)
CVEG 2301 (Engineering Mechanics I)
Full Points-100 Time -1 Hour 10 Minutes

NAME Danie HadnotROSTER 8

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1. Express the force as a Cartesian Vector.

25 Points

$$F_y = 300 \sin(45) = 212.1 \text{ N}$$

$$F_x = 300 \cos(45) = 212.1 \text{ N}$$

$$F_z = 300 \cos(45) = 212.1$$

$$(-150, 212.1, 212.1)$$

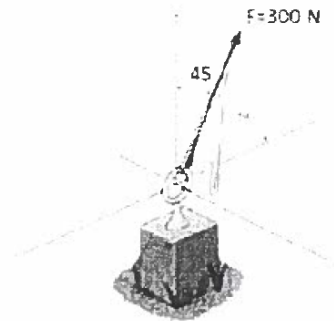


Fig. for Q.1

2. Determine the tension developed in wires CA and CB required for equilibrium of the 20-kg Cylinder. Take $\theta = 40^\circ$.
25 Points

$$F_w = 20 \text{ kg}(9.81) = 196.2 \text{ N}$$

$$\sum F_y = 0 = 196.2 - AC \sin(30^\circ) + BC \sin(40^\circ)$$

$$\sum F_x = AC \cos(30^\circ) - BC \cos(40^\circ) = 0$$

$$AC = 864.6 \text{ N}$$

$$BC = 977.5 \text{ N}$$

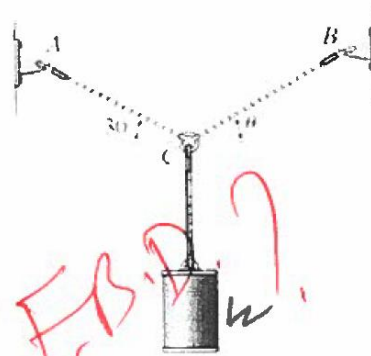


Fig. for Q. 2

3. If the spring DB has an unstretched length of 2 m, determine the stiffness of the spring to hold the 20 kg crate in the position shown. 25 Points

$$F_K = 20 \text{ kg}(9.81) = 196.2 \text{ N}$$

$$\theta = \tan^{-1}\left(\frac{2}{3}\right) = 33.6$$

$$\sum F_y = -196.2 + F_R \sin(45) + F_K \sin(33.6) = 0$$

$$\sum F_x = F_R \cos(45) - F_K \cos(33.6) = 0$$

$$F_K = 141.4 \text{ N}$$

$$x = \sqrt{2^2 + 3^2} = 3.6 \text{ m}$$

$$\Delta x = 3.6 - 2 = 1.6 \text{ m}$$

$$F_{\text{spring}} = K \Delta x$$

$$\frac{F_{\text{spring}}}{\Delta x} = K$$

$$\frac{141.4}{1.6} =$$

20

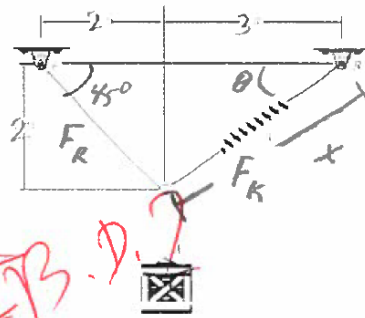


Fig. for Q. 3

4. Determine the moment of the force about point O.

25 Points

$$\sum M_x = 0.4 \cos(45) + 0.4 \cdot 200 \sin(60) \uparrow = 118.3 \text{ N}\cdot\text{m}$$

$$\sum M_y = 0.4 \sin 45 \cdot 200 \cos(60) \downarrow = 28.3 \text{ N}\cdot\text{m}$$

$$118.3 + 28.3 = \boxed{146.6 \text{ N}\cdot\text{m}}$$

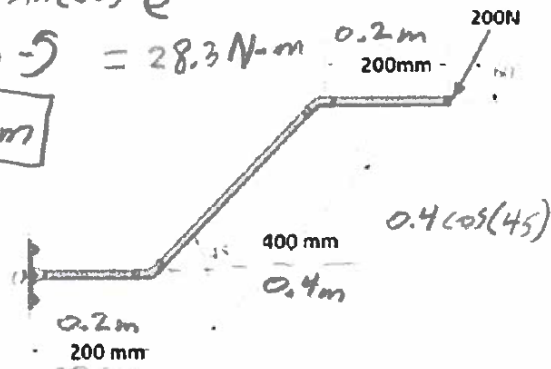


Fig. for Q. 4

BELOW AVERAGE

Mid Term Test (2nd test)
CVEG 2301 (Engineering Mechanics I)
Full Points-100 Time -1 Hour 10 Minutes

NAME Yaffet TekicROSTER 24

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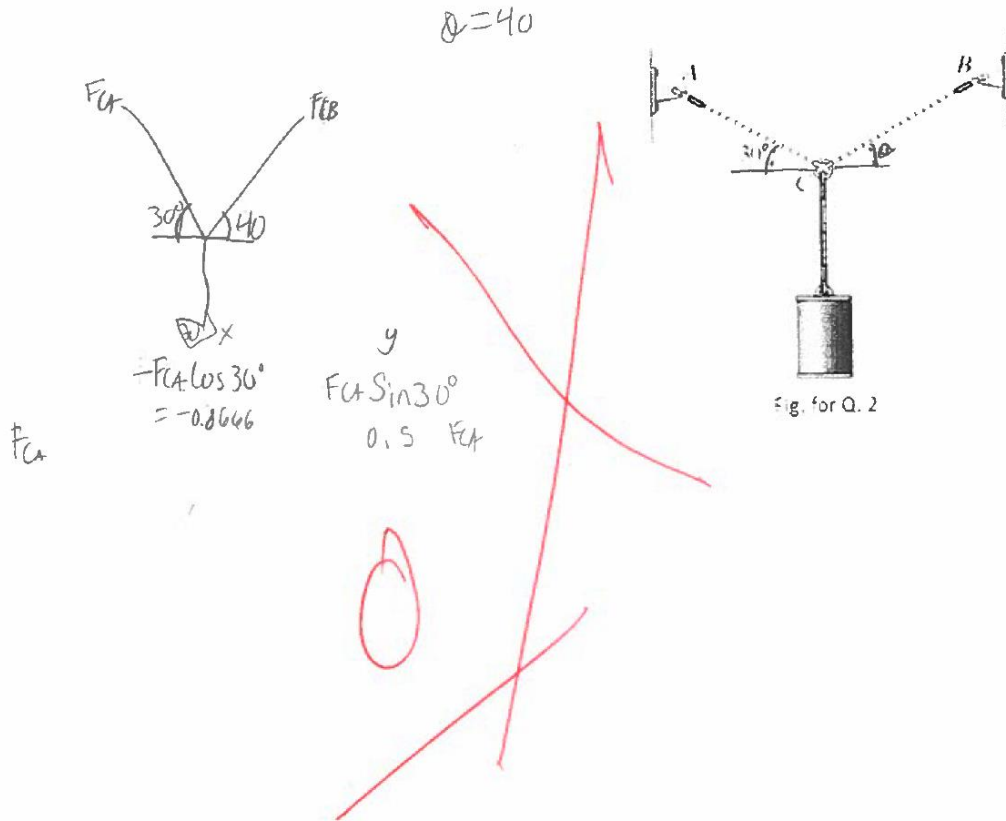
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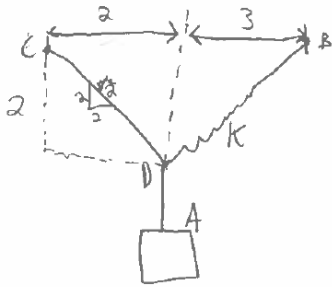
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2. Determine the tension developed in wires CA and CB required for equilibrium of the 20-kg Cylinder. Take $\theta = 40^\circ$.
25 Points



3. If the spring DB has an unstretched length of 2 m, determine the stiffness of the spring to hold the 20 kg crate in the position shown. 25 Points



$$F_{DA} = (20)(9.81) = 196.2 \text{ N}$$

$$\tan \theta = \frac{2}{3}$$

$$\theta = \tan^{-1}\left(\frac{2}{3}\right)$$

$$\theta = 33.69^\circ$$

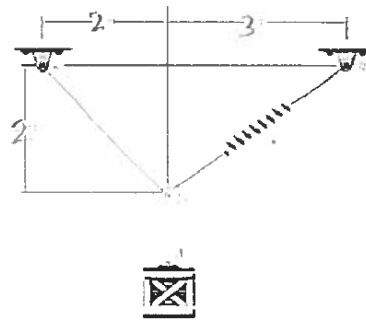


Fig. for Q. 3

$$\begin{aligned} &F_{DL} \cos 45^\circ = 0.707 \\ &F_{DL} \sin 45^\circ = 0.707 \\ &F_{DB} \cos 33.69^\circ = 0.832 \\ &F_{DB} \sin 33.69^\circ = 0.555 \end{aligned}$$

$$\begin{bmatrix} -0.707 & 0.832 \\ 0.707 & 0.555 \end{bmatrix} \begin{bmatrix} F_{DL} \\ F_{DB} \end{bmatrix} = \begin{bmatrix} 0 \\ 196.2 \end{bmatrix}$$

$$[A] = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 166.466 \\ 141.956 \end{bmatrix}$$

$$= 166.466$$

$$= 141.956$$

4. Determine the moment of the force about point O.

25 Points

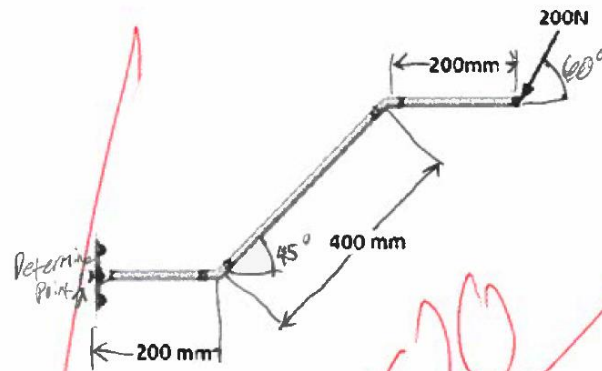


Fig. for Q. 4

**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

Title of Assignment: TEST 3

TOPICS COVERED IN TEST 3

Test 3 covered the following topics:

1. Moment of a force (Vector formulation)
2. Moment due to a couple
3. Simplification of force and moment
4. Reduction of a simply distributed load
5. Equilibrium of rigid body
6. Structural Analysis
7. Simple trusses
8. Internal forces

ABOVE AVERAGE

Test 3**CVEG 2301 (Engineering Mechanics I)**

Full Points-100

Time -1 Hour 10 Minutes

NAME Micheal SandsROSTER 19

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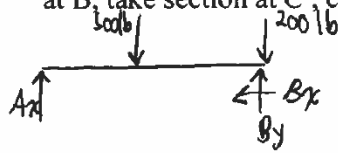
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1. Determine the shear force and moment at point C. [Hints : First find the support reaction at B, take section at C consider FBD of part CB] 25 Points



$$\sum M_A = 0$$

$$0 = (-500 \times 6 - 200 \times 14 + B_y \times 14) \text{ lb ft}$$

$$B_y = 414.28 \text{ lb}$$

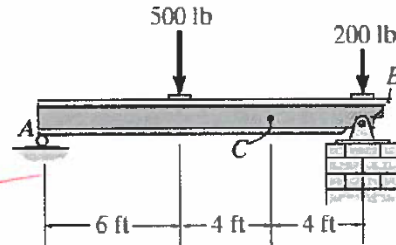
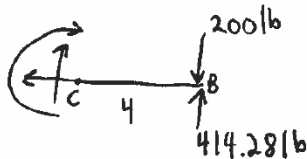


Fig. for Q. 1



$$N_C = 0$$

$$\sum F_y = 0$$

$$0 = (414.281 - 200 + V_C) \text{ lb}$$

$$V_C = -214.281 \text{ lb} \downarrow$$

~~$$\sum M_B = 0$$~~

~~$$0 = -214.281$$~~

~~$$\sum M_B = 0$$~~

~~$$0 = 214.281 \times 4 + M_C$$~~

~~$$\sum M_C = -852.124 \text{ lb ft}$$~~

~~$$0 = -214.281 \times 4 + M_C$$~~

~~$$\sum M_C = 214.281$$~~

23

$$N_C = 0$$

$$V_C = -214.281 \downarrow$$

$$\sum M_C = 214.281 \circlearrowleft$$

2. Replace the force system by an equivalent resultant force and moment acting at point A. 25 Points

$$\sum F_x = 100\left(\frac{4}{5}\right) N$$

$$= 80 N \rightarrow$$

$$\sum F_y = (-60 - 100\left(\frac{3}{5}\right)) N$$

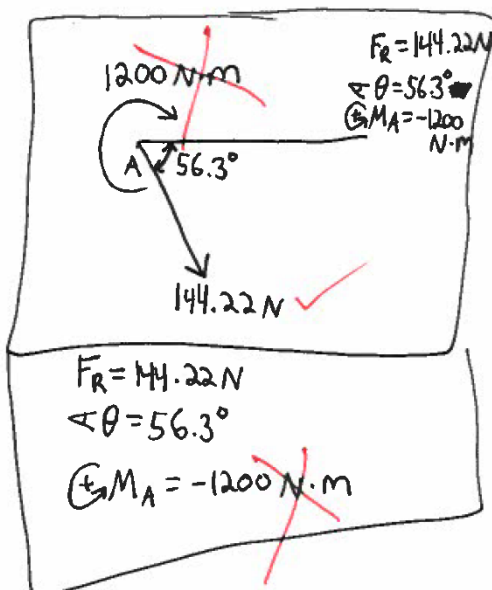
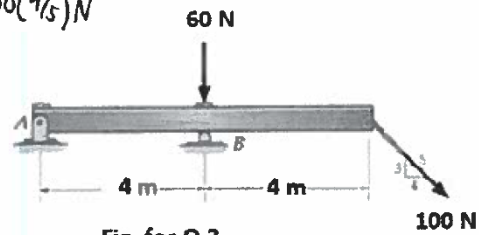
$$= -120 N \downarrow$$

$$\theta = \tan^{-1}\left(\frac{120}{80}\right) = 56.3^\circ$$

$$F_R = \sqrt{80^2 + (-120)^2} = 144.22 N$$

$$\sum M_A = (-60 \times 4 - 120 \times 8) N \cdot m$$

$$\sum M_A = -1200 N \cdot m$$



3. Determine the resultant force and specify where it acts on the beam measured from A

25 Points

$$P_1 = (12 \times 3) \text{ kN} = 36 \text{ kN} @ 1.5 \text{ m left of A}$$

$$P_2 = (18 \times 6) \text{ kN} = 108 \text{ kN} @ 3 \text{ m ~~left~~ ^{right} of A}$$

$$P_3 = (6 \times 3) \text{ kN} = 18 \text{ kN} @ (6 + 1.5) \text{ m} = 7.5 \text{ m right of A}$$

$$\sum F_x = 0$$

$$\sum F_y = (-36 - 108 - 18) \text{ kN} = -162 \text{ kN}$$

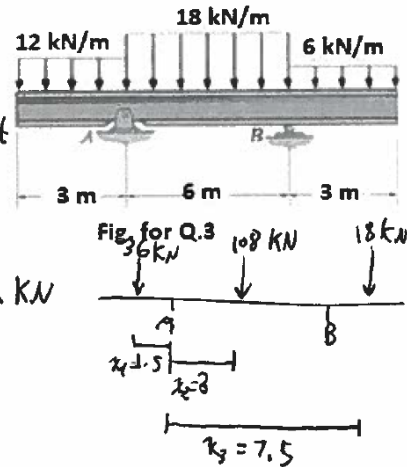
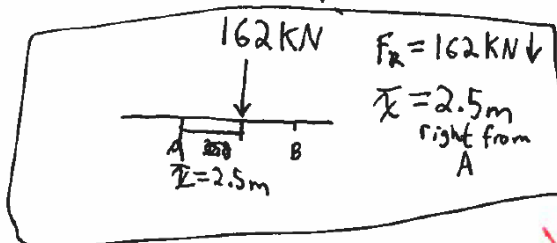
$$\sum M_A = (36 \times 1.5 - 108 \times 3 - 18 \times 7.5) \text{ kNm}$$

$$\sum M_A = -405 \text{ kNm}$$

$$\bar{x} = \frac{-405 \text{ kNm}}{-162 \text{ kN}}$$

~~$$\bar{x} = 2.5 \text{ m}$$~~

$$\bar{x} = 2.5 \text{ m}$$

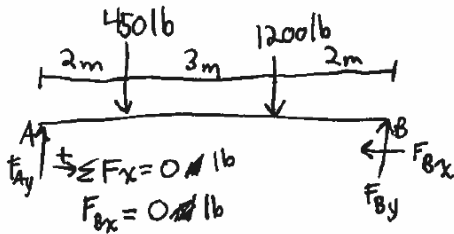


4. Draw the Free body diagram (FBD) of the beam and hence find support reactions.

25 Points

$$P_1 = \left(\frac{1}{2} \times 3 \times 300\right) \text{ lb} = 450 \text{ lb} @ 3\left(\frac{2}{3}\right) = 2 \text{ right from A}$$

$$P_2 = \left(\frac{1}{2} \times 4 \times 300\right) \text{ lb} = 1200 \text{ lb} @ 3+2 = 5 \text{ right from A}$$



$$\sum M_A = 0 \text{ lb ft}$$

$$0 = (-450 \times 2 - 1200 \times 5 + F_{By} \times 7) \text{ lb ft}$$

$$F_{By} = 985.7 \text{ lb} \uparrow$$

$$\sum F_y = 0 \text{ lb}$$

$$0 = (985.7 - 450 - 1200 + F_{Ay}) \text{ lb}$$

$$F_{Ay} = 664.3 \text{ lb} \uparrow$$

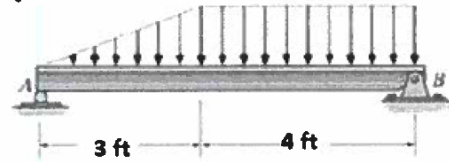


Fig. for Q.4

25

~~Reaction~~

$$R_{Ay} = 664.3 \text{ lb} \uparrow$$

$$R_{Ax} = 0 \text{ lb}$$

$$R_{By} = 985.7 \text{ lb} \uparrow$$

AVERAGE

Test 3**CVEG 2301 (Engineering Mechanics I)**

Full Points-100 Time -1 Hour 10 Minutes

NAME Clayton StrublingROSTER # 22

Instructions: You need to write your answer in serial order. Diagrams are not drawn to scale unless stated otherwise. **If you need additional space, please use the backside of the paper.** Your numerical answer should not go beyond two places after the decimal point.

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1. Determine the shear force and moment at point C. [Hints : First find the support reaction at B, take section at C , consider FBD of part CB]
25 Points

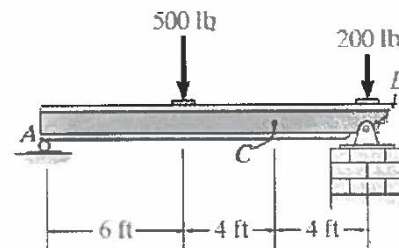


Fig. for Q. 1

$$R_A + R_B =$$

$$500 + 200 = 700 \text{ lb}$$

$$R_B (14) - 200(4) - 500(6) = 0$$

$$R_B = 414.3 \text{ lb}$$

$$R_A = 700 - 414.3 = 285.7 \text{ lb}$$

$$\sum F_y = 0$$

$$V_C + 200 = 414.3$$

$$V_C = 414.3 - 200$$

$$V_C = 214.3 \text{ lb}$$

$$M_C = 414.3(4) - 200(4)$$

$$M_C = 857.2 \text{ lb-ft}$$

F.B.D.?
Section!

2. Replace the force system by an equivalent resultant force and moment acting at point A.

25 Points

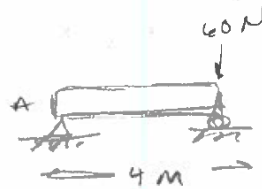
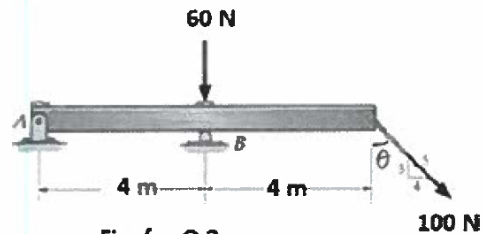
$$\theta = \tan^{-1}\left(\frac{120}{80}\right)$$

$$\theta = 56.30^\circ$$

$$\sum F_x = 0$$

$$100 \times \frac{4}{5} = 80 \text{ N}$$

$$\begin{aligned}\sum F_y &= -60 - 100 \times \frac{3}{5} \\ &= -120 \text{ N}\end{aligned}$$



20

$$F_{RA} = \sqrt{80^2 + 120^2} = 144.2221 \text{ N}$$

$$M_{RA} = 60 \times 4 + 100 \times \frac{3}{5} \times 4 = 480 \text{ N}\cdot\text{m}$$

$$\boxed{M_{RA} = 480 \text{ N}\cdot\text{m}}$$

$\theta = ?$
 $H_9 = ?$

3. Determine the resultant force and specify where it acts on the beam measured from A
25 Points

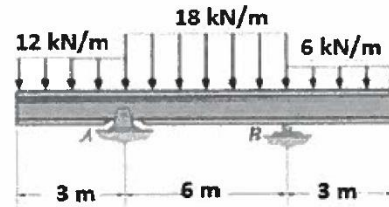


Fig. for Q.3

$$\sum M_A = 0$$

$$12 \times 3 \times 1.5 = 18 \times 6 \times 3 + 6 \times 3 \times 7.5 - R_B \times 6$$

$$R_B = 67.5$$

$$\sum F_y = 0$$

$$R_A + R_B - 12 \times 3 - 18 \times 6 - 6 \times 3 = 0$$

$$R_A + 67.5 - 12 \times 3 - 18 \times 6 - 6 \times 3 = 0$$

$$R_A = 67.5 - 12 \times 3 - 18 \times 6 - 6 \times 3$$

$$R_A = 94.5$$

$$F_R = A + B = 67.5 + 94.5$$

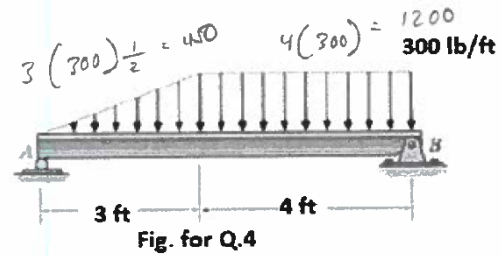
$$F_R = 162 \text{ kN}$$

Fig. ?

$x = ?$

4. Draw the Free body diagram (FBD) of the beam and hence find support reactions.

25 Points

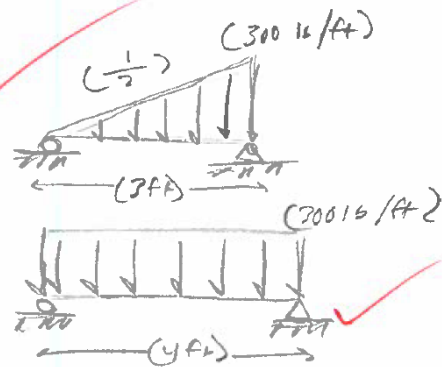


$$R_A = 450 \text{ lb/ft} \quad \checkmark$$

$$L_b = 1200 \text{ lb/ft} \quad \checkmark$$

$$R_A + R_B = 1200 + 450$$

$$= 1650 \text{ lb}$$



10

$A_y = ?$
 $B_y = ?$
 $R_A = ?$

BELOW AVERAGE

Test 3**CVEG 2301 (Engineering Mechanics I)**

Full Points-100 Time -1 Hour 10 Minutes

NAME Yafet TesieROSTER 24

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25 Points

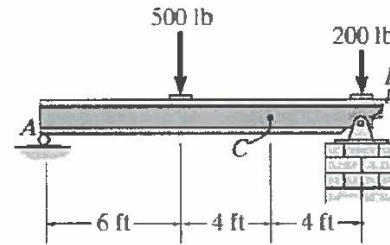
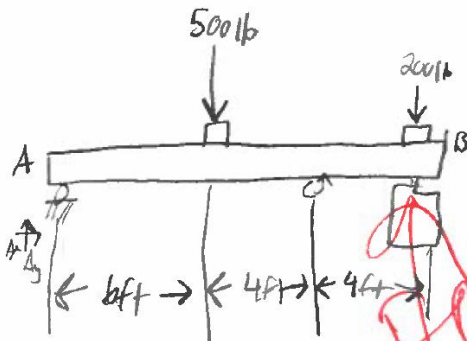


Fig. for Q. 1



$$\sum (M)_A = 0$$

$$-A_y \times 14 + 500 \times 8 = 0$$

$$A_y = \frac{500 \times 8}{14} \rightarrow \frac{4000}{14} \rightarrow \boxed{285.71 \text{ lb}}$$

$$285.71 - 500 - 200 + B_y = 0 \quad \boxed{B_y = 0 \text{ lb}}$$

$$B_y = \boxed{414.29 \text{ lb}}$$

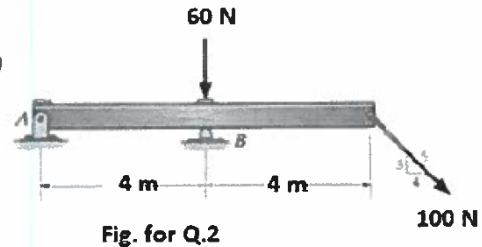
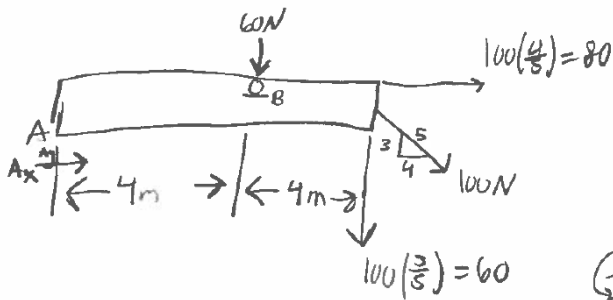
$$285.71 - 500 - V_c = 0$$

$$\boxed{V_c = -214.29 \uparrow}$$

$$285.71 \times 10 + 500 \times 4 + M_c = 0$$

$$2857.1 + 2000 \quad \boxed{M_c = 4857.1}$$

2. Replace the force system by an equivalent resultant force and moment acting at point A.
25 Points

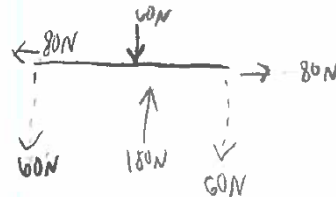


$$A_y \times 4 - 60 \times 4 = 0$$

$$A_y = -60 \text{ N}$$

$$B_y \times 4 - 60 \times 4 - 60 \times 8 = 0$$

$$B_y = 180 \text{ N}$$



$$\sum F_x = 80 \text{ N}$$

$$F_y = -60 - 60 = -120 \text{ N}$$

$$\theta = \tan^{-1}\left(\frac{-120}{80}\right)$$

$$= -56.3099^\circ$$

$$180 - 56.3099$$

$$= 123.69^\circ$$

$R = ?$

$M = ?$
Fig?

3. Determine the resultant force and specify where it acts on the beam measured from A
25 Points

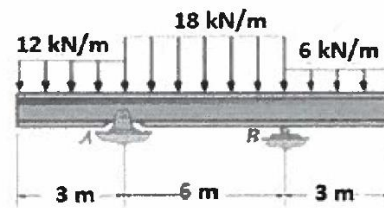


Fig. for Q.3

4. Draw the Free body diagram (FBD) of the beam and hence find support reactions.

25 Points

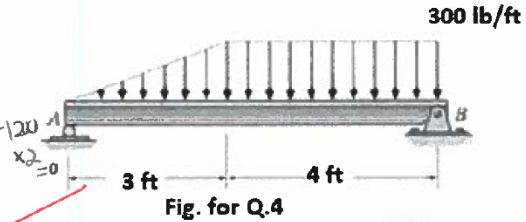
$$300 \times 4 = 1200 \text{ lb}$$

$$\frac{1}{2}(300) \times 3 = 450 \text{ lb}$$

$$\sum \mathcal{M}_B = 0$$

$$-A_y \times 7 + 450 \times 5 + 1200 \times 1 = 0$$

$$= 664.286 \text{ lb}$$



10 $\sum F_x = 0$
664.28

FBD?

**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

Title of Assignment: TEST 4 (Comprehensive Final Exam)

TOPICS COVERED IN TEST 4

Test 4 covered the following topics:

1. All topics covered in Test 1, Test2 & Test 3
2. Friction
3. Centroid of composite bodies
4. Moment of Inertia of areas
5. Parallel axis theorem
6. Moment of Inertia of composite areas

ABOVE AVERAGE

FINAL EXAM
CVEG 2301 (Engineering Mechanics I)
Full Points-100 Time -2 Hours

95
100

NAME Haley Moss

ROSTER 13

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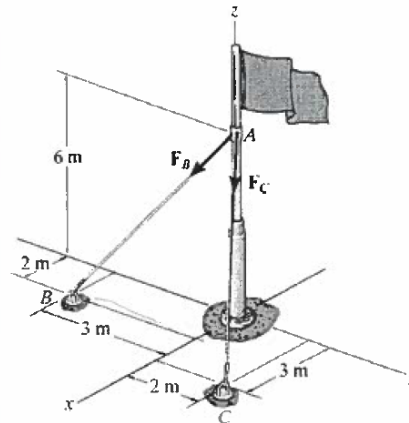
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1. If $F_B = 1400 \text{ N}$ and $F_C = 1120 \text{ N}$, determine the magnitude and coordinate direction angles of the resultant force acting on the flag pole. 20 Points



$$A = 0\mathbf{i} + 0\mathbf{j} + 6\mathbf{k}$$

$$B = 2\mathbf{i} - 3\mathbf{j} + 0\mathbf{k} \quad F_B = 1400 \text{ N}$$

$$C = 3\mathbf{i} + 2\mathbf{j} + 0\mathbf{k} \quad F_C = 1120 \text{ N}$$

$$\mathbf{r}_{BA} = (2-0)\mathbf{i} + (-3-0)\mathbf{j} + (0-6)\mathbf{k} \\ = 2\mathbf{i} - 3\mathbf{j} - 6\mathbf{k}$$

$$|\mathbf{r}_{BA}| = \sqrt{2^2 + 3^2 + 6^2} = 7$$

$$\mathbf{F}_B = \frac{(F_B)(\mathbf{r}_{BA})}{|\mathbf{r}_{BA}|} = \frac{(1400)(2\mathbf{i} - 3\mathbf{j} - 6\mathbf{k})}{7} = \frac{2800\mathbf{i} - 4200\mathbf{j} - 8400\mathbf{k}}{7} \\ = 400\mathbf{i} - 600\mathbf{j} - 1200\mathbf{k}$$

$$\mathbf{r}_{CA} = (3-0)\mathbf{i} + (2-0)\mathbf{j} + (0-6)\mathbf{k} = 3\mathbf{i} + 2\mathbf{j} - 6\mathbf{k}$$

$$|\mathbf{r}_{CA}| = \sqrt{3^2 + 2^2 + 6^2} = 7$$

$$\mathbf{F}_C = \frac{(F_C)(\mathbf{r}_{CA})}{|\mathbf{r}_{CA}|} = \frac{(1120)(3\mathbf{i} + 2\mathbf{j} - 6\mathbf{k})}{7} = \frac{3360\mathbf{i} + 2240\mathbf{j} - 6720\mathbf{k}}{7} \\ = 480\mathbf{i} + 320\mathbf{j} - 960\mathbf{k}$$

$$\mathbf{F}_R = \mathbf{F}_B + \mathbf{F}_C = (400\mathbf{i} - 600\mathbf{j} - 1200\mathbf{k}) + (480\mathbf{i} + 320\mathbf{j} - 960\mathbf{k}) = 880\mathbf{i} - 280\mathbf{j} - 2160\mathbf{k}$$

$$|\mathbf{F}_R| = \sqrt{880^2 + 280^2 + 2160^2} = 2349.13 \text{ N}$$

$$\alpha = \cos^{-1}(880/2349.13) = 68^\circ$$

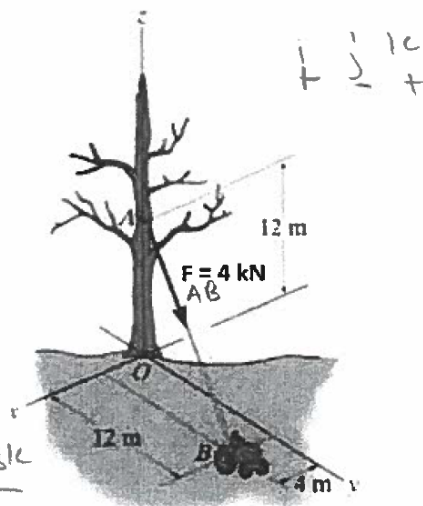
$$\beta = \cos^{-1}(-280/2349.13) = 96.85^\circ$$

$$\gamma = \cos^{-1}(-2160/2349.13) = 156.85^\circ$$

2. Determine the moment produced by the force $\mathbf{F}$ about point O. Express the result as a Cartesian Vector.

20 Points

$$\begin{aligned}
 A &= 0\mathbf{i} + 0\mathbf{j} + 12\mathbf{k} \\
 B &= 4\mathbf{i} + 12\mathbf{j} + 0\mathbf{k} \\
 O &= 0\mathbf{i} + 0\mathbf{j} + 0\mathbf{k} \\
 \vec{r}_{AB} &= (4-0)\mathbf{i} + (12-0)\mathbf{j} + (0-12)\mathbf{k} \\
 &= 4\mathbf{i} + 12\mathbf{j} - 12\mathbf{k} \\
 |\vec{r}_{AB}| &= \sqrt{4^2 + 12^2 + 12^2} = 17.44 \\
 \vec{F}_{AB} &= \frac{(4)(4\mathbf{i} + 12\mathbf{j} - 12\mathbf{k})}{17.44} = \frac{16\mathbf{i} + 48\mathbf{j} - 48\mathbf{k}}{17.44} \\
 &= 0.92\mathbf{i} + 2.75\mathbf{j} - 2.75\mathbf{k}
 \end{aligned}$$

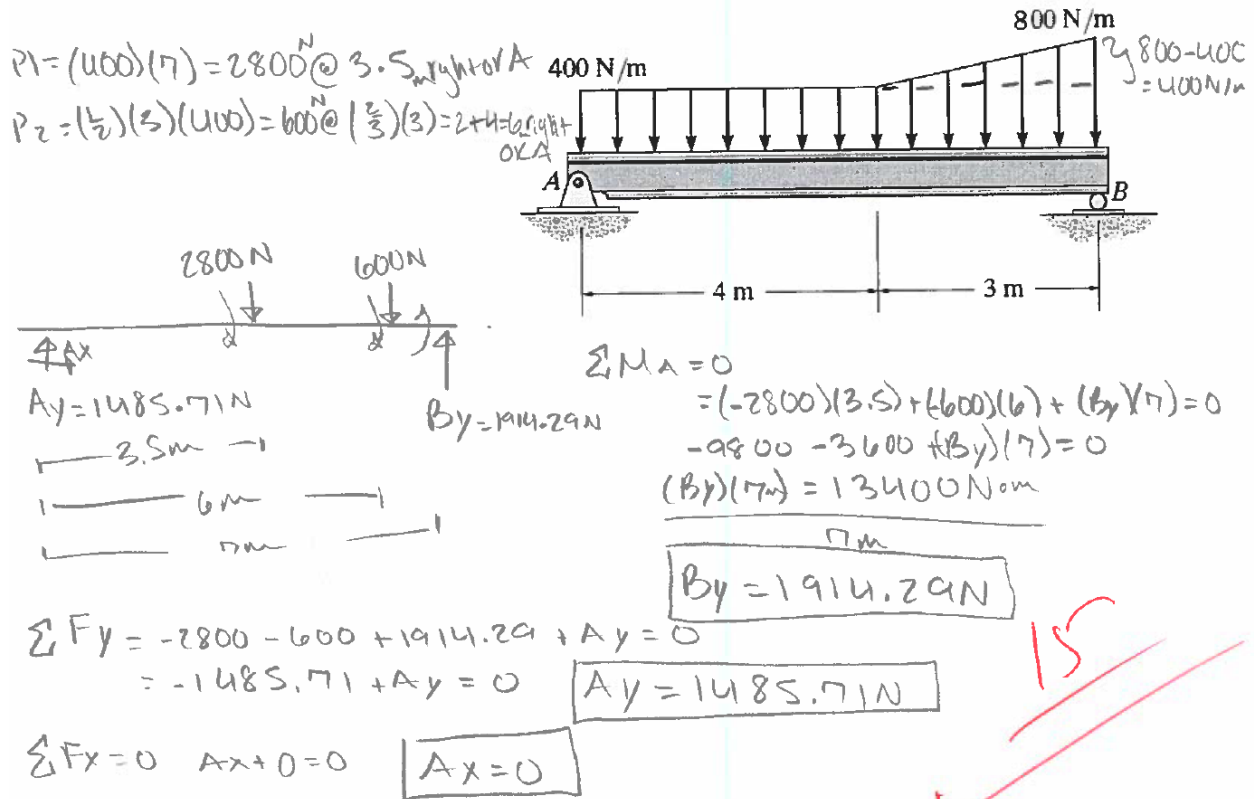


$$(\mathbf{M}_F)_O = (\vec{r}_{AB}) \times (\vec{F}) = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 4 & 12 & -12 \\ 0.92 & 2.75 & -2.75 \end{vmatrix}$$

$$\begin{aligned}
 (\mathbf{M}_F)_O &= ((12 \cdot -2.75) - (-12 \cdot 2.75))\mathbf{i} - ((4 \cdot -2.75) - (0.92 \cdot -12))\mathbf{j} + ((4 \cdot 2.75) - (0.92 \cdot 12))\mathbf{k} \\
 &= 0\mathbf{i} - 0.4\mathbf{j} - 0.4\mathbf{k}
 \end{aligned}$$

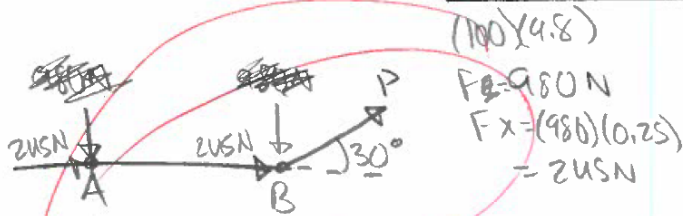
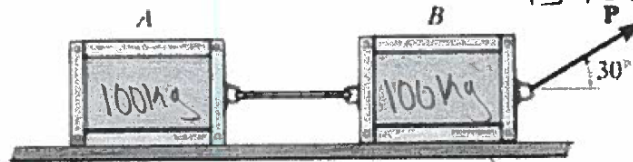
3. Determine the reactions at the supports A and B for equilibrium of the beam.

15 Points



4. Determine the maximum force P that can be applied without causing the two 100-Kg crates to move. The coefficient of static friction between each crate and the ground is $\mu = 0.25$.

~~25 Points~~
15 Points



$$\begin{aligned} (100)(9.8) \\ F_g = 980 \text{ N} \\ F_x = (980)(0.25) \\ = 245 \text{ N} \end{aligned}$$

$$\begin{aligned} (100)(9.8) \\ F_g = 980 \text{ N} \\ F_x = (980)(0.25) \\ = 245 \text{ N} \end{aligned}$$

$$\sum F_x = 0$$

$$\begin{aligned} \sum F_x &= 245 + 245 + (P)(\cos(30^\circ)) = 0 \\ &= 245 + 245 + 0.87P = 0 \end{aligned}$$

$$0.87P = 490$$

$$P = 565.8 \text{ N}$$

10

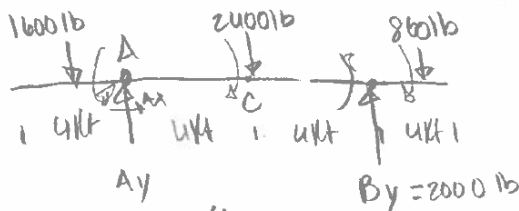
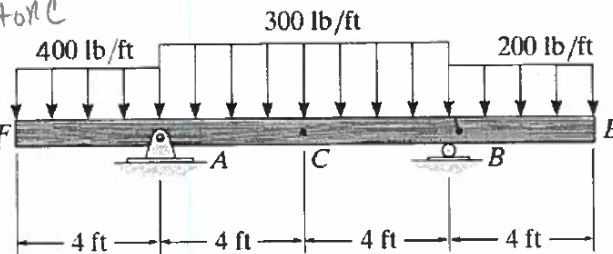
5. Determine the internal normal force, shear force, and moment acting at point C.

15 Points

$$P_1 = (400)(4) = 1600 \text{ @ } 2+4 = 6 \text{ ft to } A$$

$$P_2 = (300)(8) = 2400 \text{ @ } C$$

$$P_3 = (200)(4) = 800 \text{ @ } 4+2 = 6 \text{ ft to } B$$

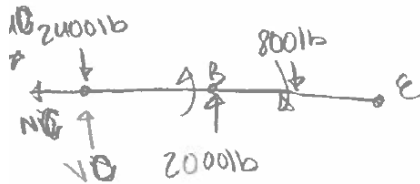


$$\sum F_x = 0 \quad A_x + 0 = 0$$

$$\sum M_A = 0 = (1600)(2) + (2400)(4) + (By)(8) + (-800)(12) = 0$$

$$= 3200 - 9600 + (By)(8) - 9600 = 0$$

$$= -16000 + (By)(8) = 0 \quad \frac{(By)(8) = 16000}{8} \quad By = 2000$$



$$\sum F_x = 0 = N_C + 0 = 0 \quad \boxed{N_C = 0}$$

$$\sum F_y = 0 = 2000 - 2400 - 800 + V_C = 0$$

$$= -1200 + V_C = 0 \quad \boxed{V_C = 1200 \text{ lb}}$$

$$\sum M_C = 0 = (2000)(4) + (-800)(6) - M_C = 0$$

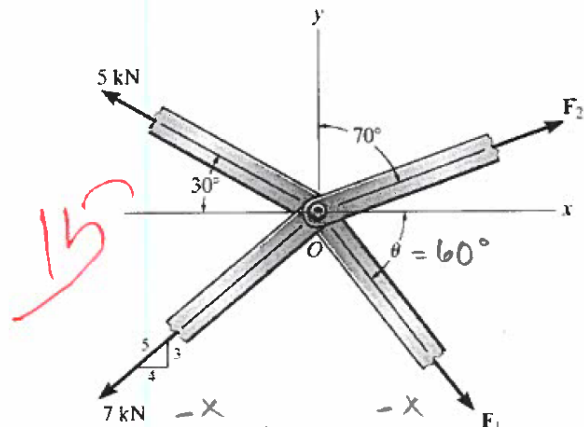
$$= 8000 - 4800 - M_C = 0$$

$$\boxed{M_C = 3200 \text{ lb} \cdot \text{ft}}$$

6

The members of a truss are pin connected at joint O .
Determine the magnitudes of F_1 and F_2 for equilibrium.
Set $\theta = 60^\circ$.

15 Points



Since θ about y

$$\sum F_x = (F_2)(\sin(70^\circ)) + F_1(\cos(60^\circ)) + (7\text{ kN})\left(-\frac{4}{5}\right) + (5)(\cos(30^\circ)) = 0$$

$$= (F_2)(0.94) + (F_1)(0.5) - 5.6 - 4.33 = 0$$

$$= 0.94F_2 + 0.5F_1 = 9.93$$

$$\sum F_y = (F_2)(\cos(70^\circ)) - F_1(\sin(60^\circ)) + (7\text{ kN})\left(-\frac{3}{5}\right) + (5)(\sin(30^\circ)) = 0$$

$$= (F_2)(0.34) - (F_1)(0.87) - 4.2 + 2.5 = 0$$

$$= 0.34F_2 - 0.87F_1 = 1.7$$

$$\text{Matrix } \begin{bmatrix} 0.94 & 0.5 & 9.93 \\ 0.34 & -0.87 & 1.7 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 9.61 \\ 0 & 1 & 1.80 \end{bmatrix} \begin{matrix} F_2 = 9.61 \\ F_1 = 1.80 \text{ N} \end{matrix}$$

$$F_2 = 9.61 \text{ kN}$$

$$F_1 = 1.80 \text{ kN}$$

7

AVERAGE

FINAL EXAM

CVEG 2301 (Engineering Mechanics I)

Full Points-100 Time -2 Hours

NAME

Frika Rivera

ROSTER

17

Instructions: You need to write your answer in serial order. Diagrams are not drawn to scale unless stated otherwise. **If you need additional space, please use the backside of the paper.** Your numerical answer should not go beyond two places after the decimal point.

POLICY TO ERADICATE CHEATING (PROTECT INTEGRITY OF EXAMS)

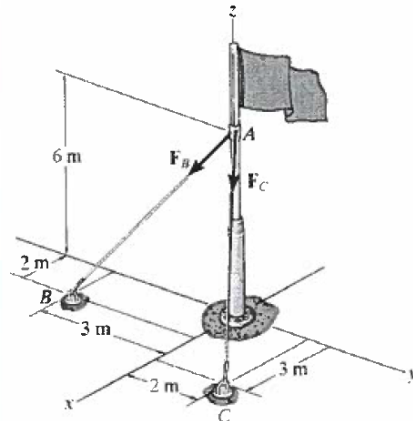
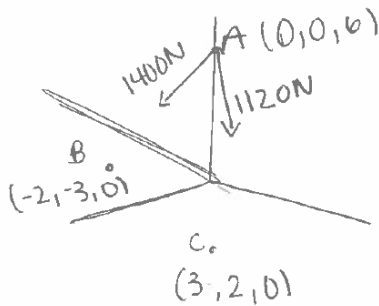
Cheating is unprofessional, unethical and is antithetical to our core value of "Excellence in Civil Engineering Education," and **WILL NOT BE TOLERATED** at any level. To combat this serious problem, the Civil & Environmental Engineering (CEE) Department has adopted the following rules to eradicate cheating.

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1. If $F_B = 1400$ N and $F_C = 1120$ N, determine the magnitude and coordinate direction angles of the resultant force acting on the flag pole. 20 Points



$$\vec{AB} = (-2\mathbf{i} - 3\mathbf{j} + 0\mathbf{k}) - (0\mathbf{i} + 0\mathbf{j} + 6\mathbf{k})$$

$$\vec{AB} = -2\mathbf{i} - 3\mathbf{j} - 6\mathbf{k}$$

$$\sqrt{(-2)^2 + (-3)^2 + (-6)^2} = 7$$

$$= \frac{-2}{7}\mathbf{i} - \frac{3}{7}\mathbf{j} - \frac{6}{7}\mathbf{k} = [-.286\mathbf{i} - .429\mathbf{j} - .857\mathbf{k}]$$

$$1400(-.286\mathbf{i} - .429\mathbf{j} - .857\mathbf{k}) = -400.4\mathbf{i} - 600.6\mathbf{j} - 1199.8\mathbf{k} = \vec{A}$$

$$\vec{AC} = (3\mathbf{i} + 2\mathbf{j} + 0\mathbf{k}) - (0\mathbf{i} + 0\mathbf{j} - 6\mathbf{k})$$

$$\vec{AC} = 3\mathbf{i} + 2\mathbf{j} - 6\mathbf{k}$$

$$\sqrt{(3)^2 + (2)^2 + (-6)^2} = 7$$

$$\vec{AC} = (\frac{3}{7}\mathbf{i} + \frac{2}{7}\mathbf{j} - \frac{6}{7}\mathbf{k})$$

$$= 1120(.429\mathbf{i} + .286\mathbf{j} - .857\mathbf{k})$$

$$\vec{AC} = 480.48\mathbf{i} + 320.32\mathbf{j} - 959.8\mathbf{k}$$

$$\vec{AB} - 400.4\mathbf{i} - 600.6\mathbf{j} - 1199.8\mathbf{k}$$

$$+ \vec{AC} + 480.48\mathbf{i} + 320.32\mathbf{j} - 959.8\mathbf{k}$$

$$\vec{FR} = 80.08\mathbf{i} - 280.28\mathbf{j} - 2159.6\mathbf{k}$$

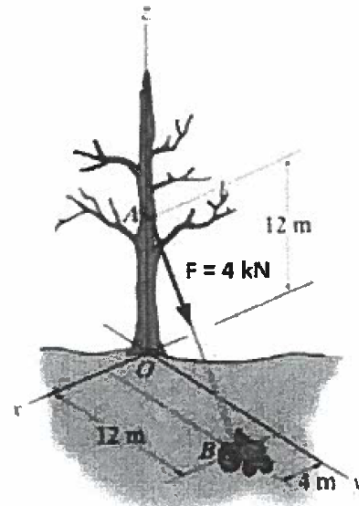
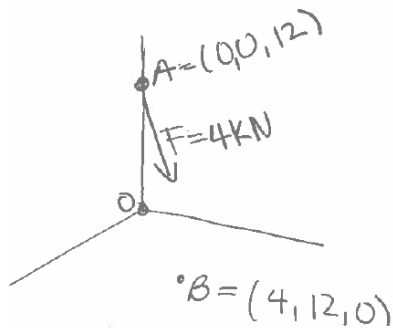
$$\sqrt{(80.08)^2 + (-280.28)^2 + (-2159.6)^2} = 2179.18$$

$$\alpha = \cos\left(\frac{80.08}{2179.18}\right) = 87.89^\circ$$

$$\beta = \cos\left(\frac{-280.28}{2179.18}\right) = 97.38^\circ$$

$$\gamma = \cos\left(\frac{-2159.6}{2179.18}\right) = 172.35^\circ$$

2. Determine the moment produced by the force $\mathbf{F}$ about point O. Express the result as a Cartesian Vector. 20 Points



$$\vec{AB} = (4\mathbf{i} + 12\mathbf{j} + 0\mathbf{k}) - (0\mathbf{i} + 0\mathbf{j} + 12\mathbf{k})$$

$$\vec{AB} = \{4\mathbf{i} + 12\mathbf{j} - 12\mathbf{k}\}$$

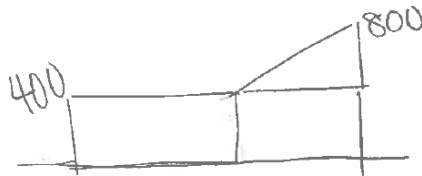
$$\sqrt{(4)^2 + (12)^2 + (-12)^2} = 17.44$$

$$\left\{ \frac{4}{17.43}\mathbf{i} + \frac{12}{17.43}\mathbf{j} - \frac{12}{17.43}\mathbf{k} \right\} = 4\{.229\mathbf{i} + .688\mathbf{j} - .688\mathbf{k}\}$$

$$\vec{AB} = \{.916\mathbf{i} + 2.752\mathbf{j} - 2.752\mathbf{k}\}$$

3. Determine the reactions at the supports A and B for equilibrium of the beam.

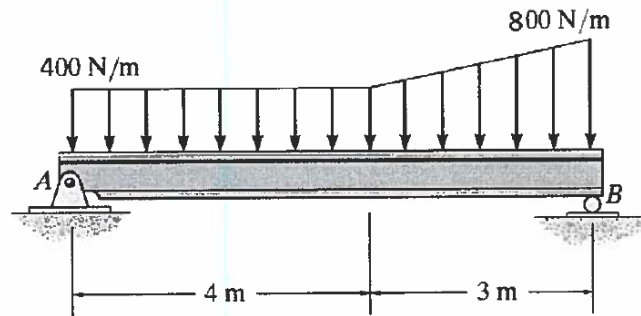
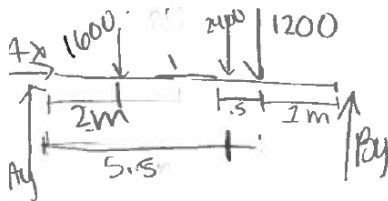
15 Points



$$400(\cdot) = 1600$$

$$(1/2)(800)(3) = 1200$$

$$(800)(3) = 2400$$



$$\sum (M_A) = 0$$

$$-(1600 \cdot 2m) + (By \cdot 7m) - (1200 \cdot 6m) - (2400 \cdot 5.5) = 0$$

$$By = 3371.43N$$

$$\sum F_y =$$

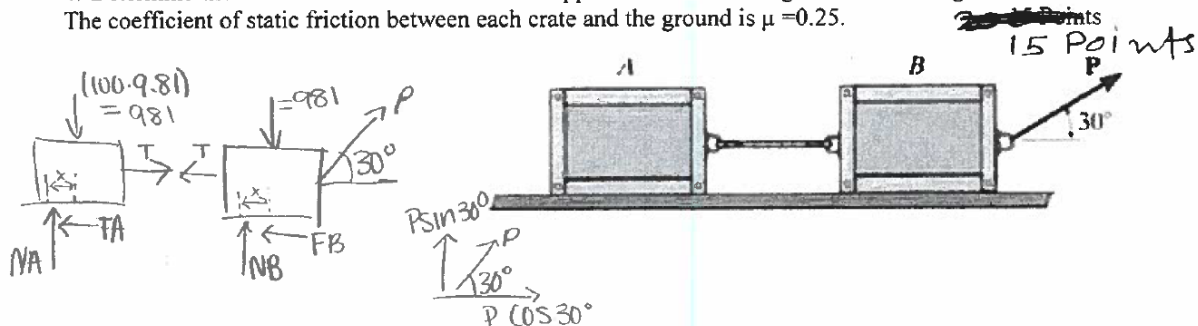
$$-1600 - 1200 - 2400 + 3371.43 + Ay$$

$$Ay = 1828.52N$$

$$\sum F_x =$$

$$Ax = 0$$

4. Determine the maximum force P that can be applied without causing the two 100-Kg crates to move. The coefficient of static friction between each crate and the ground is $\mu = 0.25$.



Box A

$$\sum F_y = 0$$

$$N_A - 981 = 0$$

$$N_A = 981$$

$$\sum F_x = 0$$

$$-F(0.25) + T = 0$$

$$-(981)(0.25) + T = 0$$

$$T = 245.25$$

Box B

$$\sum F_x = 0$$

$$-T - (F(0.25) - P \sin 30) + P \cos 30 = 0$$

$$-(245.25) - (981(0.25) - 0.5P) + 0.87P = 0$$

$$-(245.25) - 245.25 + 490.5P + 0.87P = 0$$

$$\frac{491.37P}{491.37} = \frac{490.5}{491.37}$$

$$P = 0.998$$

$$\sum F_y = 0$$

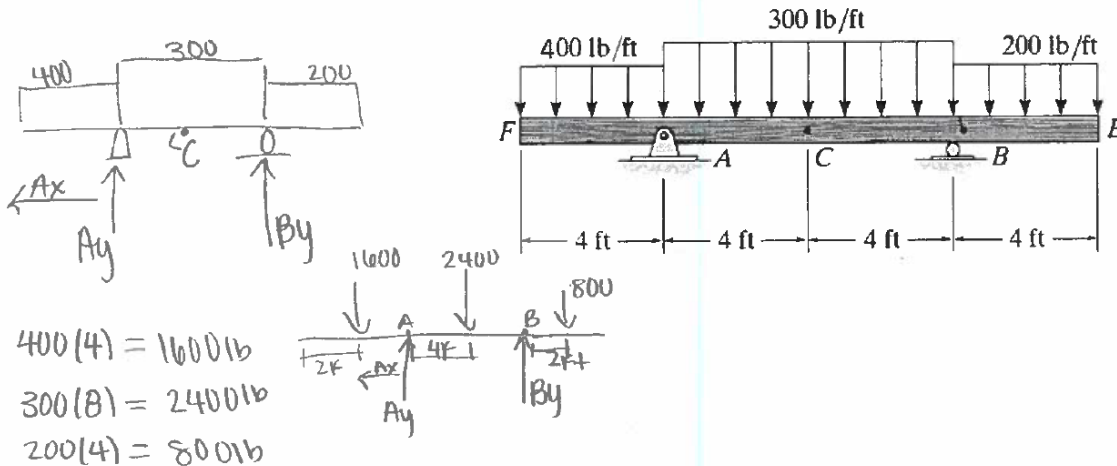
$$-981 + (0.998 \sin 30) + N_B = 0$$

$$-981 + 0.499 + N_B = 0$$

$$N_B = 980.50$$

5. Determine the internal normal force, shear force, and moment acting at point C.

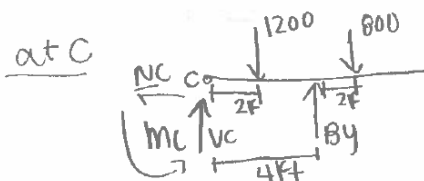
15 Points



$$\sum M_A =$$

$$+ (1600 \cdot 2\text{ft}) + (-2400 \cdot 4\text{ft}) + (-800 \cdot 10\text{ft}) + (B_y \cdot 8\text{ft}) = 0$$

$$\frac{8 B_y}{8} = \frac{14400}{8} \quad B_y = 1800 \text{ lb}$$



$$\sum F_x = 0$$

$$N_C = 0$$

$$\sum F_y = 0$$

$$+ V_C - 1200 - 800 + 1800 = 0$$

$$V_C = 200 \text{ lb}$$

$$\sum M_C =$$

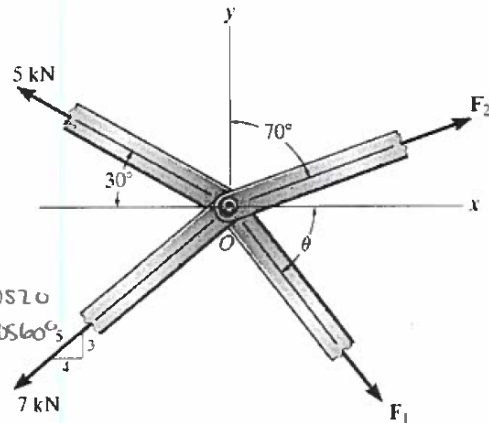
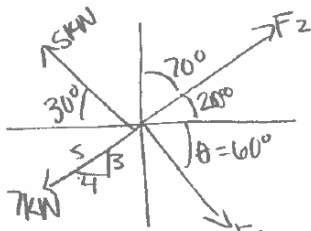
$$M_C - (1200 \cdot 2) - (800 \cdot 6) + (1800 \cdot 4) = 0$$

$$M_C = 0$$

6

The members of a truss are pin connected at joint O . Determine the magnitudes of F_1 and F_2 for equilibrium. Set $\theta = 60^\circ$.

15 Points



$$\sum F_x = 0$$

$$(-7(4/5)) - (5 \cos 30^\circ) + (F_1 \cos 60^\circ) + (F_2 \cos 20^\circ) = 0$$

$$(0.5 F_1) + (0.9397 F_2) = 9.93$$

$$\sum F_y = 0$$

$$(5 \sin 30^\circ) + (F_2 \sin 20^\circ) - (F_1 \sin 60^\circ) - (7(3/5)) = 0$$

$$-0.86 F_1 + 0.34 F_2 = 1.7$$

$$\begin{bmatrix} 0.5 & 0.9397 \\ -0.86 & 0.34 \end{bmatrix} \begin{bmatrix} F_1 \\ F_2 \end{bmatrix} = \begin{bmatrix} 9.93 \\ 1.7 \end{bmatrix}$$

$$F_1 = 1.8 \rightarrow \underline{F_1 = 2 \text{ kN}}$$

$$F_2 = 9.59 \rightarrow \underline{F_2 = 10 \text{ kN}}$$

7

BELOW AVERAGE

FINAL EXAM
CVEG 2301 (Engineering Mechanics I)
Full Points-100 Time -2 Hours

NAME Safa Mokafash ROSTER 10

Instructions: You need to write your answer in serial order. Diagrams are not drawn to scale unless stated otherwise. **If you need additional space, please use the backside of the paper.** Your numerical answer should not go beyond two places after the decimal point.

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~~$F_B \cos \theta$~~
1400 x

$$\sqrt{(3)^2 + (2)^2} = \sqrt{13}$$

$$= \sqrt{(\sqrt{3})^2 + (6)^2}$$

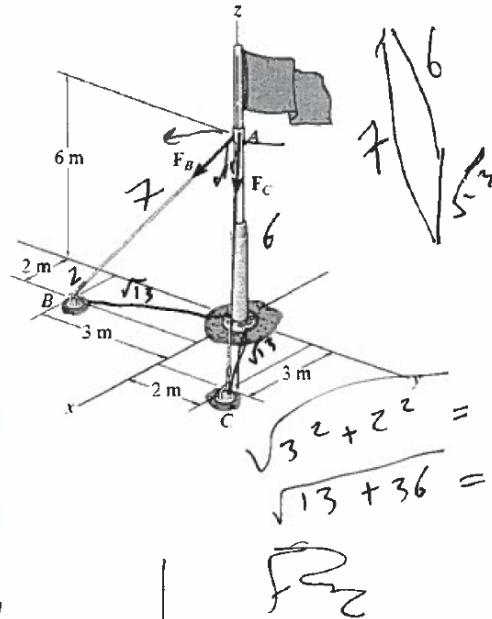
$$= \sqrt{13 + 36}$$

$$F_x$$

$$1400 \times \frac{\sqrt{13}}{7} =$$

+

$$1120 \times \frac{\sqrt{13}}{7}$$



7

$$1400 \times \frac{6}{7}$$

$$1120 \times \frac{6}{7}$$

$$2520 \times \frac{6}{7} \text{ N}$$

$$\sum F_y = 2160 \text{ N} \downarrow$$

Resultant $\frac{\sqrt{3}}{7} \times 2520 \text{ N}$
 $\Sigma F_x = 360 \sqrt{3} \text{ N}$

$$O(\sqrt{13}N)$$

$$\approx 1297.9 \text{ N}_2 \leftarrow +$$

$$F_R = \sqrt{(2160)^2 + (1297)^2}$$

$$F_R = \sqrt{4665600 + 1684544 \cdot 41} = 2519.5$$

2. Determine the moment produced by the force F about point O . Express the result as a Cartesian Vector. 20 Points

Force
AA moment
 $F \times \frac{12}{17.4}$
 $F \times \frac{12.6}{17.4}$

Distancation sign moment z

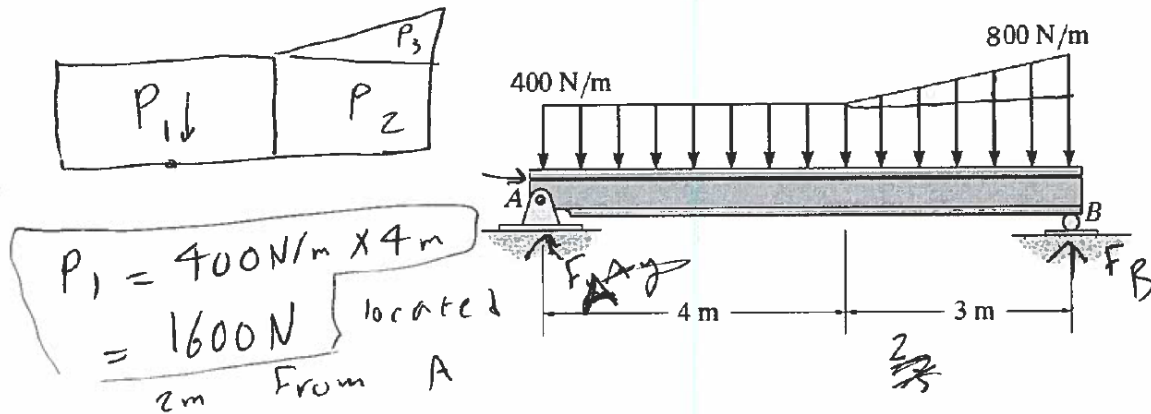
$(0, 0, 12)$
 $F = 4 \text{ kN}$
 12 m
 17.4
 12 m
 4 m

$(12, 4, 12)$
 12
 12.6
 4

$F \times d = M$
 $F_x \times \frac{12.6}{17.4} \times 12.6 = 2.9 \text{ kN}$
 $F_y \times \frac{12}{17.4} \times 12 = -8.2 \text{ kN}$
 $OB = \sqrt{(4)^2 + (12)^2} = \sqrt{16 + 144} = 12.6 \text{ m}$
 $AB = \sqrt{(12.6)^2 + (12)^2} = \sqrt{158.76 + 144} = 17.4$
 $F_z = 0$
 $M_z = 2.9 - 8.2 = -5.3 \text{ kN-m}$
Counter clockwise

3. Determine the reactions at the supports A and B for equilibrium of the beam.

15 Points



$$P_1 = 400 \text{ N/m} \times 4 \text{ m} = 1600 \text{ N}$$

located 2m from A

$$P_2 = 800 \times 3 = 2400$$

$$P_3 = \frac{1}{2} \times 800 \times 3 = 1200$$

$$\sum F_y = 0$$

$$F_A + F_B - 1600 \text{ N} - 2400 - 1200 = 0$$

$$F_A + F_B = 5200$$

$$F_B = 5200 - F_A \quad \text{--- (1)}$$

$$\sum M_A = 0$$

$$(F_B \times 7) - (1600 \times 2) - \frac{2400}{2} \times (1.5 + 4) - (1200 \times 6) = 0$$

$$7F_B - 3200 - 13200 - 7200 = 0$$

$$7F_B = 23600$$

$$F_B = 3371.41$$

$t =$

$F = \mu N$

4. Determine the maximum force P that can be applied without causing the two 100-Kg crates to move. The coefficient of static friction between each crate and the ground is $\mu = 0.25$.

15 Points

$$\sum F_x = 0$$

as equilibrium

$$P \cos 30 = 200 \times 0.25$$

$$P \cos 30 = 50$$

$$P \times 0.866 =$$

~~$F = \mu N$ (Normal reaction)~~

$$P \cos 30 = 0.25 \times R$$

$$0.866 P = 0.25 N \quad \text{--- (1)}$$

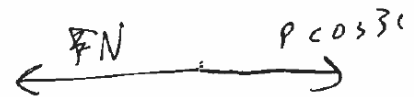
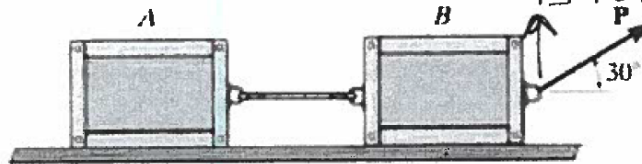
$$\sum F_y = 0$$

$$-200 \times 9.81 + P \sin 30 = 0$$

$$-1962 + \frac{1}{2} P = 0$$

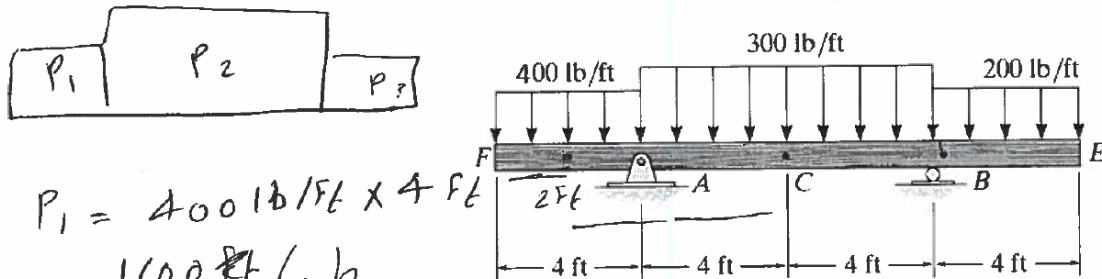
$$P = \frac{1962}{2} = 981 \text{ N}$$

put it on (1) $0.866 \times 981 = 0.25 N$



5. Determine the internal normal force, shear force, and moment acting at point C.

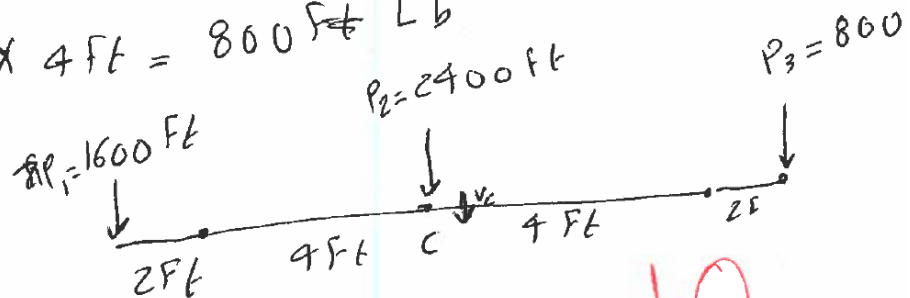
15 Points



$$P_1 = 400 \text{ lb/ft} \times 4 \text{ ft} = 1600 \text{ lb}$$

$$P_2 = 300 \times (4 \text{ ft} + 4 \text{ ft}) = 300 \times 8 = 2400 \text{ lb}$$

$$P_3 = 200 \times 4 \text{ ft} = 800 \text{ lb}$$



$$\sum F_x = 0$$

$$N_F + F_x = 0$$

$$N_F + 0 = 0$$

$$\Rightarrow N_F = 0$$

$$(+\sum M_C = 0)$$

Take the section

$$(+\sum M_F = 0)$$

$$-1600 \times 2 - (2400 \times 6) \pm V_C \times 8 = 0$$

$$-3200 - 14400 - 8 V_C = 0$$

$$V_C = \frac{17600}{8} = 2200 \text{ lb}$$

For it the FB

6

The members of a truss are pin connected at joint O.

Determine the magnitudes of F_1 and F_2 for equilibrium.

Set $\theta = 60^\circ$.

$$90^\circ - 70^\circ =$$

$$\sum F_x = 0$$

$$F_2 \cos 20^\circ - (5 \times \cos 30^\circ) + F_1 \cos 60^\circ - (7 \times \frac{4}{5}) = 0$$

$$0.9396 F_2 - 4.33 + \frac{1}{2} F_1 - \frac{28}{5} = 0$$

$$\frac{1}{2} F_1 = -0.9396 F_2 + 4.33 + \frac{28}{5}$$

$$\frac{1}{2} F_1 = -0.9396 F_2 + 9.93$$

$$F_1 = 1.879 F_2 + 19.86 \quad \text{--- (1)}$$

$$\sum F_y = 0$$

$$F_2 \sin 20^\circ + 5 \sin 30^\circ - (7 \times \frac{3}{5}) - F_1 \sin 60^\circ = 0$$

$$0.342 F_2 + 2.5 - 4.2 - F_1 \sin 60^\circ = 0$$

$$0.342 F_2 - 1.7 - 0.866 F_1 = 0 \quad \text{--- (2)}$$

put (1) in (2)

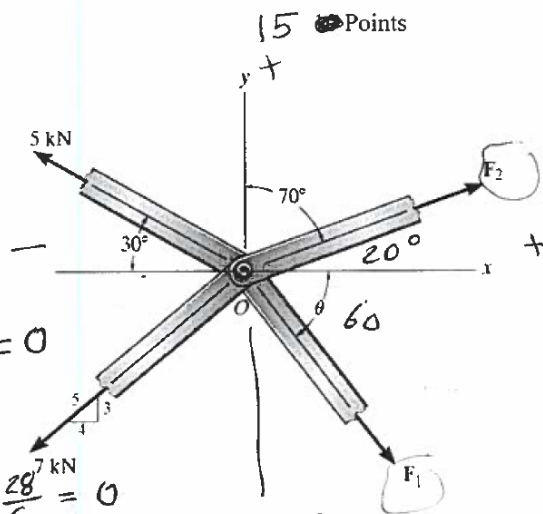
$$0.342 F_2 - 1.7 - 0.866 (1.879 F_2 + 19.86) = 0$$

$$0.342 F_2 - 1.7 - 1.627 F_2 - 17.198 = 0$$

$$-1.285 F_2 = 18.898$$

$$F_2 = 14.69 \text{ kN}$$

$$F_2 = \frac{20.525}{0.342}$$



**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

Title of Assignment: Quiz 1 (Pre-requisite quiz)

TOPICS COVERED IN QUIZ 1

- 1. Introduction to Mechanics**
- 2. Two types of Units**
- 3. Conversion of mass to force**

ABOVE AVERAGE

10/ Congrats!

10 = 1.77 m/s
1 ft = 0.3048 m
1 slug = 14.59 kg

Name Craig Rothschild

Roster 18

FPS $g = 32.2 \text{ ft/s}^2$
SI $g = 9.81 \text{ m/s}^2$

formed (rigid body)
deformable (unrigid body)
fluids

QUIZ-1

CVEG 2043 (Engg Mech I)

Full Points-10 Time -20 Minutes
Closed book exam, Cell phone not permitted

1. Name all the three divisions of Mechanics uniform body 1 Point
~~rigid~~ rigid fluid mechanics - study of fluids
~~deformable~~ deformable - where volume/shape changes
2. In FPS (US Customary Unit) System the unit of Mass is slug and the Unit of Force is lb (Fill up the blanks) 2 points.

3. Calculate the weight of a mass of 10 kg on moon. Given the acceleration due to gravity on Moon is 1.625 m/sec^2 $W = mg$ $g = 1.625 \text{ m/s}^2$ 1 Point
 $m = 10 \text{ kg}$

$W = (10 \text{ kg}) (1.625 \text{ m/s}^2) = 16.25 \rightarrow 16.3 \text{ N}$

4. Calculate the force by which a mass of 2 slug is attracted by the center of Earth 1 Point
 $F = ma$ $F = (2 \text{ slug}) (32.2 \text{ ft/s}^2)$ $g = 32.2 \text{ ft/s}^2$
 $= 64.4 \text{ slug} \cdot \text{ft/s}^2 \rightarrow \text{lb}$
5. Convert 2 km/h to ft/s. Given 1 ft = 0.3048 m. 2 Points
 $2 \text{ km} \rightarrow 2000 \text{ m}$

$\frac{2000 \text{ m}}{3600 \text{ s}} \cdot \frac{1 \text{ ft}}{0.3048 \text{ m}} = 1.822 \rightarrow 1.82 \text{ ft/s}$

6. Match the following: 3 Points

1. Newton <u>B</u>	A. Time
2. Archimedes <u>C</u>	B. Gravitational law
3. Galileo <u>A</u>	C. Buoyancy

You are the only person who got 10 out of 10 Keep it up!!!

AVERAGE

Name Courtney MooreRoster 11

QUIZ-1

CVEG 2043 (Engg Mech I)

Full Points-10 Time -20 Minutes
Closed book exam, Cell phone not permitted

1. Name all the three divisions of Mechanics

1 Point

Fluid mechanics dynamic mechanics
Static mechanics

2. In FPS (US Customary Unit) System the unit of Mass is
- lbs
- and the Unit of Force is
- lbf
- . (Fill up the blanks)

2 points.

3. Calculate the weight of a mass of 10 kg on moon. Given the acceleration due to gravity on Moon is
- 1.625 m/sec^2

1 Point

$$(10 \text{ kg})(1.625 \text{ m/sec}^2) = 16.25 \text{ kg m/sec}^2 \text{ N}$$

4. Calculate the force by which a mass of 2 slug is attracted by the center of Earth

1 Point

$$(2)(9.8 \text{ m/sec}^2) = 19.6 \text{ m/sec}^2$$

5. Convert 2 km/h to ft/s. Given 1 ft = 0.3048m.

2 Points

$$\frac{2 \text{ km}}{\text{h}} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ ft}}{0.3048 \text{ m}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{60 \text{ s}} = \frac{2000}{1097.28} = 1.823 \text{ ft/s}$$

6. Match the following:

3 Points

1. Newton	B	A. Time
2. Archimedes	C	B. Gravitational law
3. Galileo	A	C. Buoyancy

BELOW AVERAGE

Name Kiron BuieRoster # 4

QUIZ-1

CVEG 2043 (Engg Mech I)

Full Points-10 Time -20 Minutes

Closed book exam, Cell phone not permitted

1. Name all the three divisions of Mechanics

1 Point

Static, kinematics, kinetic

2. In FPS (US Customary Unit) System the unit of Mass is
- P
- and the Unit of Force is
- pounds
- . (Fill up the blanks)

2 points.

3. Calculate the weight of a mass of 10 kg on moon. Given the acceleration due to gravity on Moon is
- 1.625 m/sec^2

1 Point

$$10(1.625) = 16.25 \text{ N}$$

4. Calculate the force by which a mass of 2 slug is attracted by the center of Earth

1 Point

$$2(9.81) = 19.62 \text{ lbs}$$

5. Convert 2 km/h to ft/s. Given 1 ft = 0.3048m.

2 Points

$$\frac{2 \text{ km}}{1 \text{ h}} \times \frac{1 \text{ m}}{10^{-3} \text{ m}} \times \frac{0.3048 \text{ ft}}{1 \text{ m}} \times \frac{1 \text{ h}}{3600 \text{ s}}$$

6. Match the following:

3 Points

1. Newton	A. Time
2. Archimedes	B. Gravitational law
3. Galileo	C. Buoyancy

1B

2A

3C

**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

Title of Assignment: Quiz 2

TOPICS COVERED IN QUIZ 2

- 1. Conversion of a scalar into vector form**
- 2. Direction cosine**
- 3. Finding resultant of 2D and 3D vectors**

ABOVE AVERAGE

QUIZ-2

CVEG 2301 (Engineering Mechanics)

Full Points-10

Time -20 Minutes

Name Michael Bogues

Class Roster Number #3

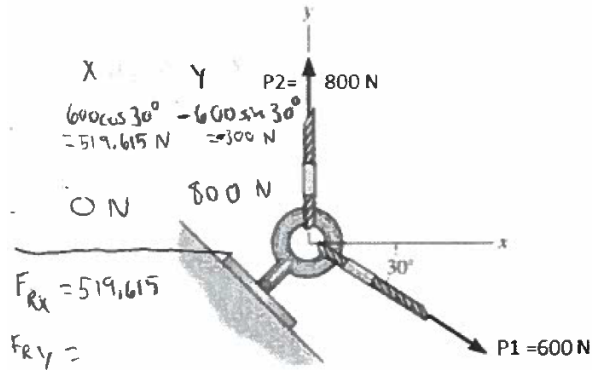


Fig. for Q.1,2 and 3

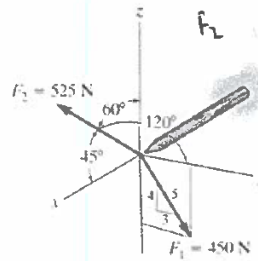


Fig. for Q. 4 & 5

	x	y	z
F_1	0	$450 \cos 45^\circ$	$-450 \sin 45^\circ$
F_2	$525 \cos 60^\circ$	0	$525 \cos 120^\circ$

1. Referring to the figure above, What are the X and Y components of P1

1 Point

X comp = 519.615 N Y Comp = -300 N

2. What are the X and Y components of P2

1 Point

X comp = 0 N Y Comp = 800 N

3. Express force P1 as a vector.

1 Points

$\vec{P}_1 = (519.615\hat{i} - 300\hat{j}) \text{ N}$

4. Referring to the figure given above, express the force F_1 as a Cartesian Vector

2 Points

Ans: $\vec{F}_1 = (0\hat{i} + 270\hat{j} - 360\hat{k}) \text{ N}$

5. Referring to the figure given above, express the force F_2 as a Cartesian Vector

2 Points

Ans: $\vec{F}_2 = (371.23\hat{i} - 262.5\hat{j} + 262.5\hat{k}) \text{ N}$

6. Find the magnitude of the vector $(460\hat{i} - 40\hat{j} - 1080\hat{k}) \text{ N}$

1 Point

Ans: 1174.56 N

7. What is the angle the vector $460\hat{i} - 40\hat{j} - 1080\hat{k}$ makes (in degrees) with the Z axis?

2 Points

Ans: 156.85°

$\frac{460\hat{i} - 40\hat{j} - 1080\hat{k}}{1174.56 \text{ N}} \rightarrow 0.391636\hat{i} - 0.034055\hat{j} - 0.91949\hat{k}$

$\cos \theta = -0.919493$

$\theta = \cos^{-1}(-0.919493) = 156.85^\circ$

AVERAGE

QUIZ-2

CVEG 2301 (Engineering Mechanics)

Name Daniel Hadnot Full Points-10 Time -20 Minutes

Class Roster Number 8

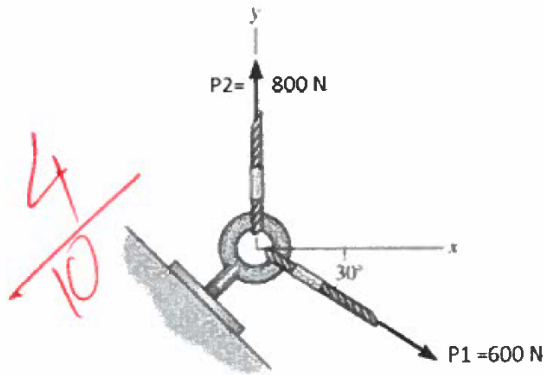


Fig. for Q.1,2 and 3

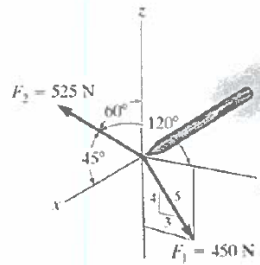


Fig. for Q. 4 & 5

1. Referring to the figure above, What are the X and Y components of P1

1 Point

X comp = 519.6 N Y Comp = $600 \sin(30) = -300 \text{ N}$
 $600 \cos 30 = 519.6$

2. What are the X and Y components of P2

1 Point

X comp = 0 N Y Comp = 800 N

3. Express force P1 as a vector.

1 Points

$600 \text{ N} = 519.6 \hat{i} - 300 \hat{j}$

4. Referring to the figure given above, express the force F_1 as a Cartesian Vector

2 Points

Ans: $(270, 360, 0)$

5. Referring to the figure given above, express the force F_2 as a Cartesian Vector

2 Points

Ans: $(371.2, -371.2, 262.5)$
 $\sqrt{460^2 + (-40)^2 + (-1080)^2} = 1174.6 \text{ N}$

6. Find the magnitude of the vector $(460 \hat{i} - 40 \hat{j} - 1080 \hat{k}) \text{ N}$

1 Point

Ans: 1174.6 N

7. What is the angle the vector $460 \hat{i} - 40 \hat{j} - 1080 \hat{k}$ makes (in degrees) with the Z axis?

2 Points

Ans: _____

BELOW AVERAGE

QUIZ-2

CVEG 2301 (Engineering Mechanics)

Full Points-10

Time -20 Minutes

Name Jacorian Lovell

Class Roster Number 9

01
10

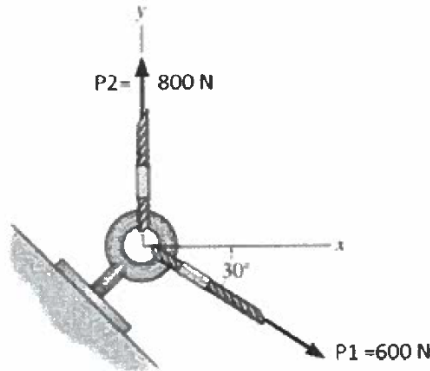


Fig. for Q. 1, 2 and 3

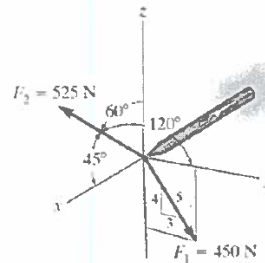


Fig. for Q. 4 & 5

1. Referring to the figure above, What are the X and Y components of P1

1 Point

X comp = $600 \sin 30^\circ$ Y Comp = $600 \cos 30^\circ$

2. What are the X and Y components of P2

1 Point

X comp = $800 \sin \theta$ Y Comp = $800 \cos \theta$

3. Express force P1 as a vector.

1 Points

600

4. Referring to the figure given above, express the force F_1 as a Cartesian Vector

2 Points

Ans: $450 \times \frac{5}{13} \cos i + 450 \times \frac{4}{13} \sin j = 750 \cos i + 360 \sin j$

5. Referring to the figure given above, express the force F_2 as a Cartesian Vector

2 Points

Ans: $-525 \cos 60 i + 525 \sin 60 j$

6. Find the magnitude of the vector $(460 i - 40 j - 1080 k)$ N

1 Point

Ans: $1174.56 N$

7. What is the angle the vector $460 i - 40 j - 1080 k$ makes (in degrees) with the Z axis?

2 Points

Ans:

**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

Title of Assignment: Quiz 3

TOPICS COVERED IN QUIZ 3

- 1. Moment due a 2D force**
- 2. Moment of 3D force (in vector form)**
- 3. Moment of a couple**
- 4. Replacement of forces and moment**
- 5. Replacement of distributed forces**

ABOVE AVERAGE

Name Chelsea Guidry

Roster 7

QUIZ-3 FALL 2021

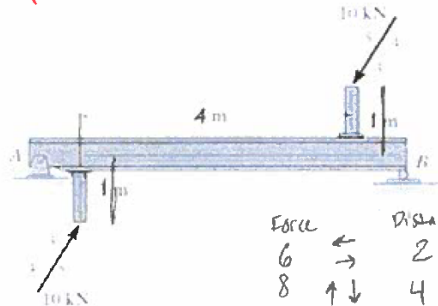
CVEG 2301 (Engineering Mechanics)

Full Points-10 Time -20 Minutes

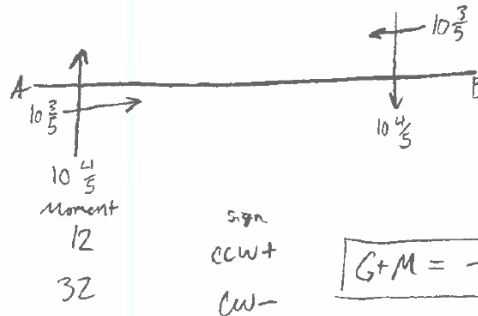
10
10

1. Determine the couple moment acting on the beam.

4 Points



Force	Distance
6	2
8	4

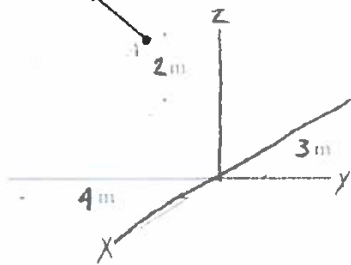


$$G+M = -20 \text{ kN/m}$$

2. Determine the moment of the force about the origin. Express the result in the determinant form.

4 Points

$$F = 30i - 20j + 50k \text{ N}$$



$$A = -3i - 4j + 2k$$

$$O = 0i + 0j + 0k$$

$$A_0 = -3i - 4j + 2k$$

$$\begin{vmatrix} i & j & k \\ -3 & -4 & 2 \\ 30 & -20 & 50 \end{vmatrix}$$

$$i = (-4 \cdot 50) - (2 \cdot -20) = -200 + 40 = -160$$

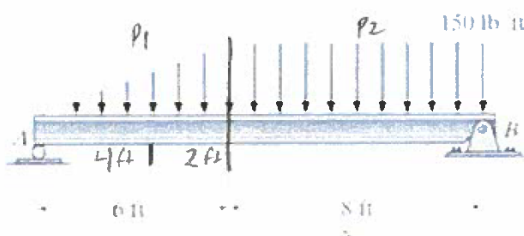
$$-j = (-3 \cdot 50) - (2 \cdot 30) = -150 - 60 = -210$$

$$k = (-3 \cdot -20) - (-4 \cdot 30) = 60 + 120 = 180$$

$$G M = \{-160\hat{i} + 210\hat{j} + 180\hat{k}\}$$

3. Determine the resultant force of the following loading diagram.

2 Points



$$P_1 = \frac{1}{2} \cdot 150 \cdot 6 = 450 \text{ lb/ft}$$

$$P_2 = 150 \cdot 8 = 1200 \text{ lb/ft}$$

$$R = 450 + 1200 = 1650 \text{ lb/ft}$$

AVERAGE

PRAIRIE VIEW A&M UNIVERSITY, COLLEGE OF ENGINEERING Fall-2021

Name Daniel Haddad

Roster 8

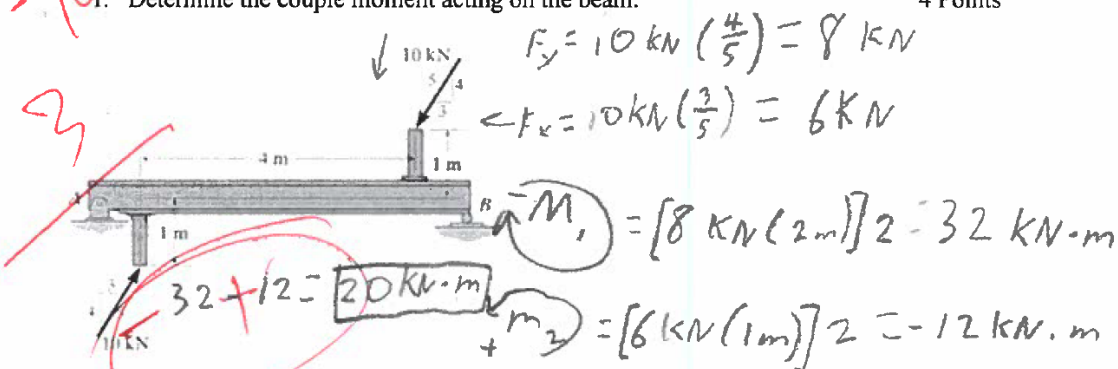
QUIZ-3 FALL 2021

CVEG 2301 (Engineering Mechanics)

Full Points-10 Time -20 Minutes

1. Determine the couple moment acting on the beam.

4 Points

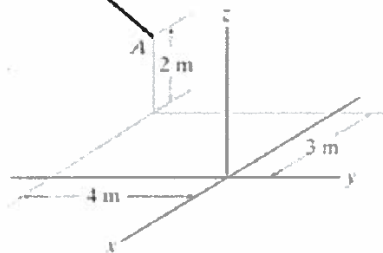


2. Determine the moment of the force about the origin. Express the result in the determinant form.

4 Points

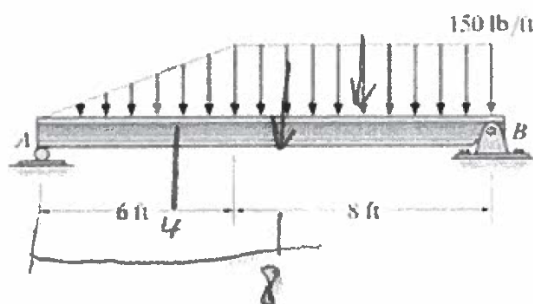
$F = (30\mathbf{i} - 20\mathbf{j} + 50\mathbf{k}) \text{ N}$

$-3 \text{ m} (30 \text{ N})$



3. Determine the resultant force of the following loading diagram.

2 Points



Handwritten calculations for Question 3:

$$8 \cdot 150 = 1200 \text{ lb}$$

$$(8 \cdot 150) / 2 = 450 \text{ lb}$$

$$1200 \text{ lb} + 450 \text{ lb} = 1650 \text{ lb}$$

BELOW AVERAGE

PRAIRIE VIEW A&M UNIVERSITY, COLLEGE OF ENGINEERING Fall-2021

NAME Sajden Williams

Roster 25

QUIZ-3 FALL 2021

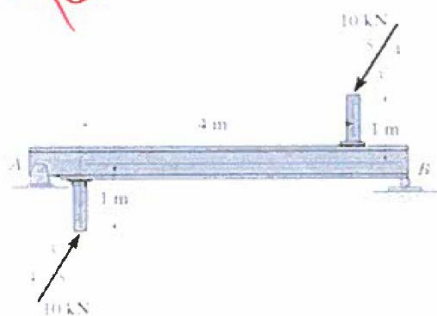
CVEG 2301 (Engineering Mechanics)

Full Points-10

Time -20 Minutes

1. Determine the couple moment acting on the beam.

4 Points



$$\sum F_x = 10 \text{ kN} = 10 \text{ F}$$

$$\sum F_y = 10 \text{ kN} = 8 \text{ F}$$

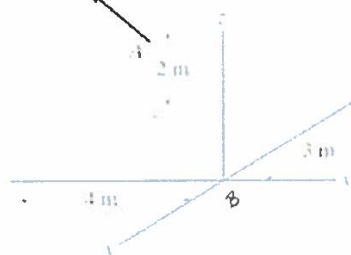
$$M = 6(1) + 8(4)$$

$$M = 38 \text{ kN}\cdot\text{m}$$

2. Determine the moment of the force about the origin. Express the result in the determinant form.

4 Points

$$F = [30i + 20j + 50k] \text{ N}$$



$$\vec{AB} = \vec{B} - \vec{A}$$

$$3i + 4j - 2k$$

$$\vec{A} = -3i - 4j + 2k$$

$$\vec{B} = 0i + 0j + 0k$$

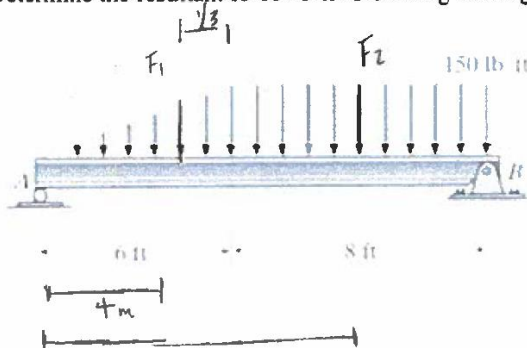
$$\begin{vmatrix} i & j & k \\ +3 & +4 & -2 \\ 30 & -20 & 50 \end{vmatrix} = \begin{vmatrix} i & j & k \\ +3 & +4 & -2 \\ 30 & -20 & 50 \end{vmatrix} = 200i - 60j - 60k$$

$$-40i - 150j - 120k$$

$$+160i - 210j + 180k$$

3. Determine the resultant force of the following loading diagram.

2 Points



$$F_1 = \frac{1}{2}(150)(6) = 450$$

$$F_2 = 150(8) = 1200 \text{ lb ft/m}$$

$$F_R = F_1 + F_2$$

$$F_R = 1650 \text{ lb ft/m}$$

$$(M_1) = 450(4) = 1800$$

$$(M_2) = 1200(10) = 12000$$

**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

Title of Assignment: Quiz 4

TOPICS COVERED IN QUIZ 4

- 1. Rigid body equilibrium**
- 2. Various types of support**
- 3. Support reaction**
- 4. Equation of equilibrium**

ABOVE AVERAGE

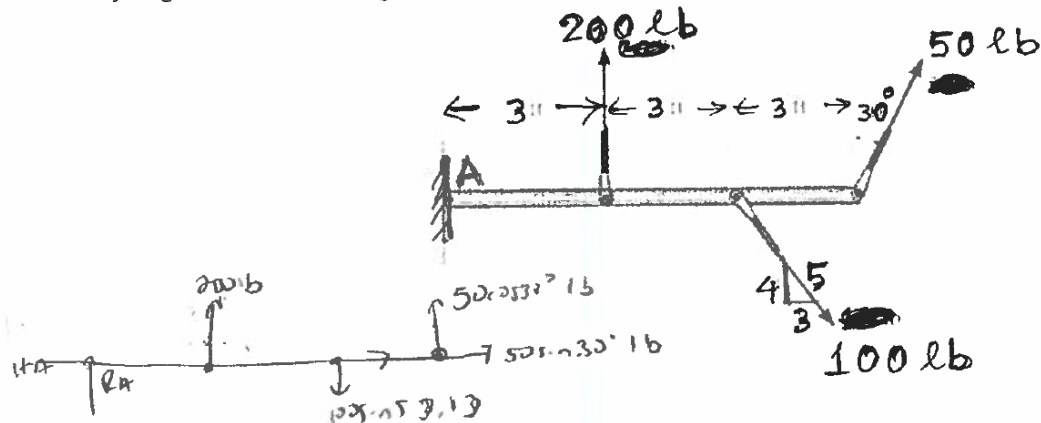
Name Kim BuiRoster # 410
10

QUIZ-4

CVEG 2043 (Engg Mech I)

Full Points-10 Time -15 Minutes

Draw the Free body diagram for the following beam and then find the support reactions: 2+8=10



$$\sum \text{Horizontal forces} = 0$$

$$H_A + 100 \cos(53.13) + 50 \sin 30 = 0$$

$$H_A = -85 \text{ lb}$$



$$\theta = \tan^{-1}\left(\frac{3}{4}\right)$$

$$\theta = 36.86^\circ$$

$$\theta' = 90 - 36.86 = 53.13^\circ$$

$$\theta' = 53.13^\circ$$

$$\sum \text{Vertical forces} = 0$$

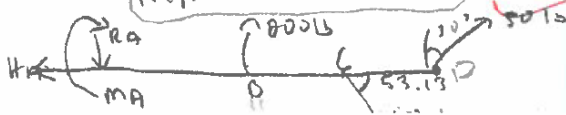
$$F_{Ay} + 200 - 80 + 47.3013 = 0$$

$$F_{Ay} = -163.3013 \text{ lb}$$

$$\sum M_A = 0$$

$$50 \cos 30^\circ \times 9 - 100 \sin 53.13 \times 6 + 200 \times 3 = M_A$$

$$M_A = -509.71 \text{ lb-ft}$$



AVERAGE

Name Chelsea Guidry Roster 7

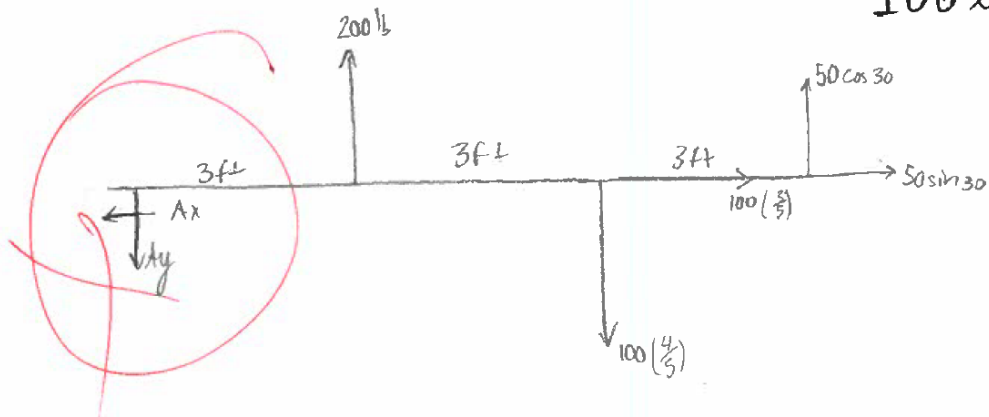
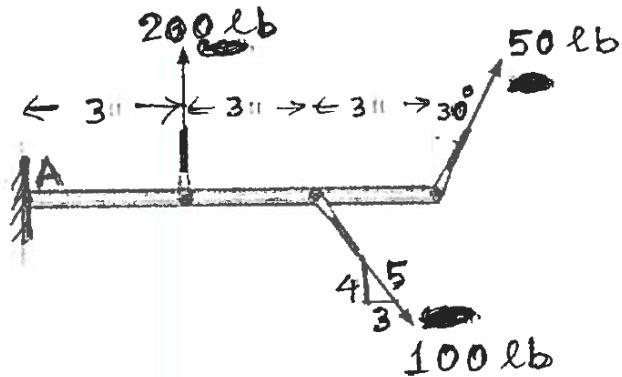
QUIZ-4

CVEG 2043 (Engg Mech I)

Full Points-10 Time -15 Minutes

Draw the Free body diagram for the following beam and then find the support reactions: 2+8=10

6/10



$$\uparrow + \sum F_y = 0$$

$$200 - 80 + 43.30 - A_y = 0$$

$$A_y = 163.30 \text{ lb } \uparrow$$

$$\rightarrow + \sum F_x = 0$$

$$25 + 60 - A_x = 0$$

$$A_x = 85 \text{ lb } \rightarrow$$

BELOW AVERAGE

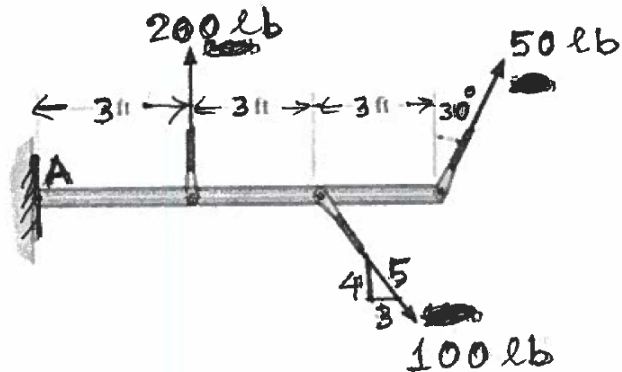
Name Daniel Benitez Roster # 2

QUIZ-4

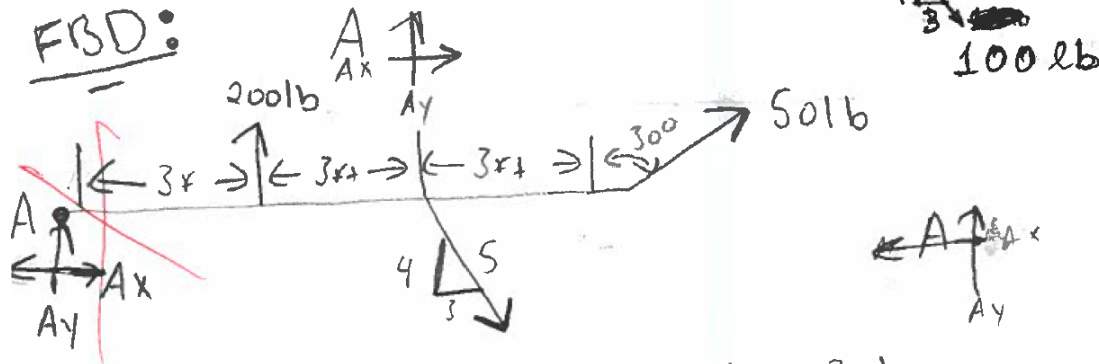
CVEG 2043 (Engg Mech I)

Full Points-10 Time -15 Minutes

Draw the Free body diagram for the following beam and then find the support reactions: 2+8=10



FBD:



$$\sum F_x = 0$$

$$50 \cos 30^\circ = 43.301$$

$$A_x - 100 \left(\frac{3}{5}\right) + 50 \sin 30^\circ = 0$$

$$-60 + 25 = 35$$

$$50 \sin 30^\circ = 25$$

$$\sum F_y = 0$$

$$A_x = 35 \text{ lb}$$

$$A_y + 200 + 50 \cos 30^\circ - 100 \left(\frac{4}{5}\right) = 0$$

$$200 + 43.301 - 80 = 0$$

$$A_y = 163.301 \text{ lb}$$

**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

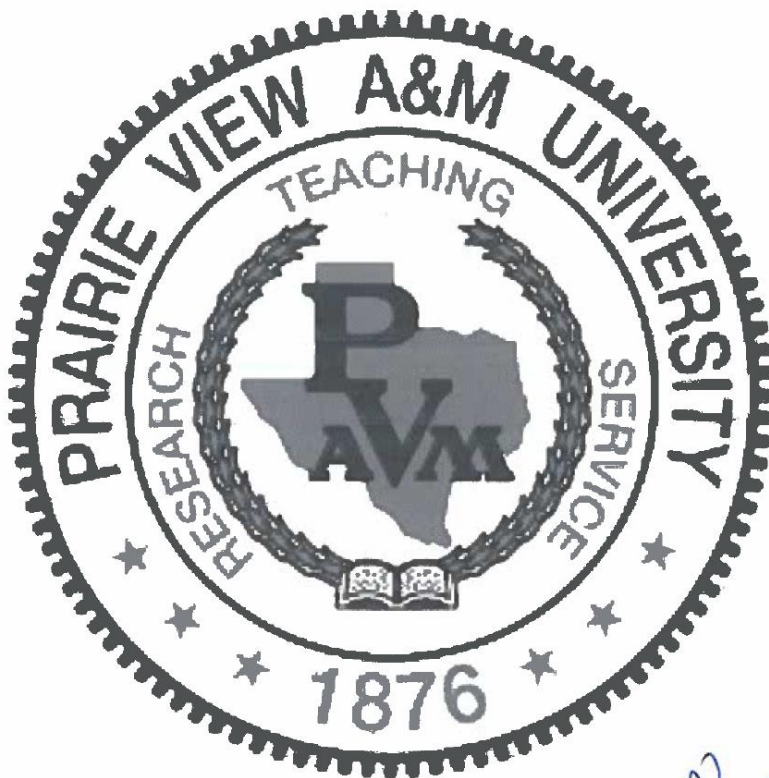
HOMEWORK 1

TOPICS COVERED IN HOMEWORK 1

- 1. 2D Vectors**
- 2. Triangular law of forces**
- 3. Parallelogram law of forces**
- 4. Addition of forces by scalar approach**
- 5. Addition of forces by vector approach**

ABOVE AVERAGE

Prairie View A&M University



CVEG 2301 P02

Engineering Mechanics HW# 1 (Ch. 2)

Problems: 2-10 (30), 2-11 (30), 2-41(41), 2-50(42) , 2-52(42).

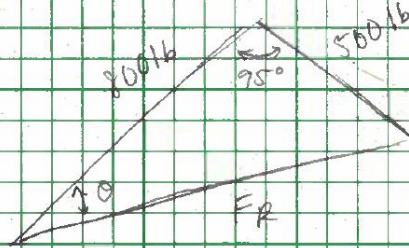
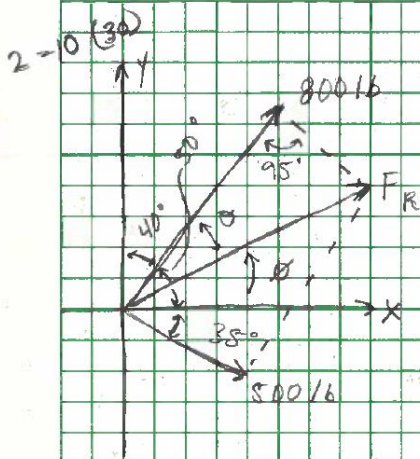
Assigned: September 11, 2021

Due: September 21, 2021

Submitted By: Clayton Stribling

Submitted To: Dr. Abdul M. Choudhury

100
100



$$F_R = \sqrt{800^2 + 800^2 - 2(800)(500) \cos 95^\circ}$$

$$F_R = 979.66 \text{ lb} = 980 \text{ lb}$$

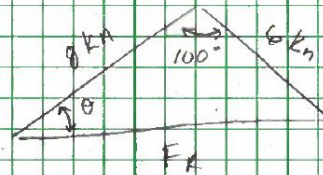
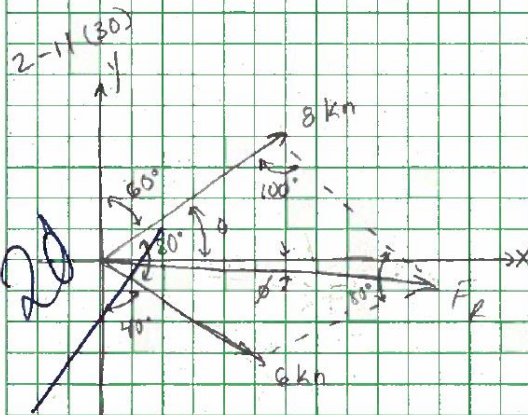
20

$$\frac{\sin \theta}{500} = \frac{\sin 95^\circ}{979.66} \Rightarrow 500 \sin 95^\circ = 979.66 \sin \theta$$

$$\theta = \sin^{-1} \left(\frac{500 \sin 95^\circ}{979.66} \right) = 30.56^\circ$$

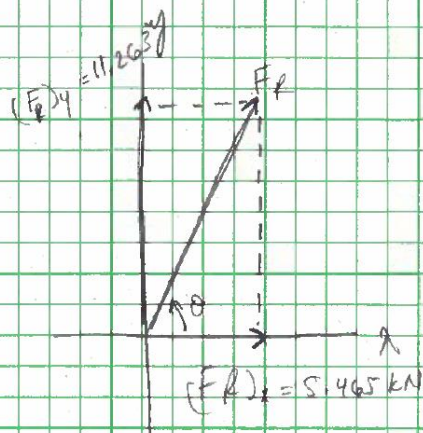
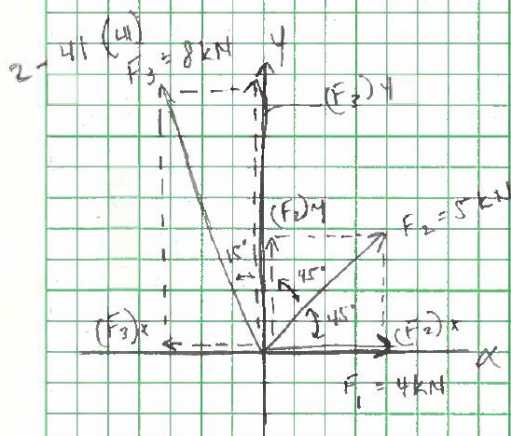
$$\theta = 50^\circ - 30.56^\circ$$

$$\theta = 19.4^\circ$$



$$F_R = \sqrt{8^2 + 6^2 - 2(8)(6) \cos 100^\circ}$$

$$F_R = 10.80 \text{ kN}$$



20

$$\rightarrow (F_R)_x = \sum F_{x_i} \quad (F_R)_x = 4 + 5 \cos 45^\circ - 8 \sin 15^\circ$$

$$= 5.465 \text{ kN} \rightarrow$$

$$\uparrow (F_R)_y = \sum F_{y_i} \quad (F_R)_y = 5 \sin 45^\circ + 8 \cos 15^\circ$$

$$= 11.263 \text{ kN} \uparrow$$

$$F_R = \sqrt{(F_R)_x^2 + (F_R)_y^2} = \sqrt{5.465^2 + 11.263^2}$$

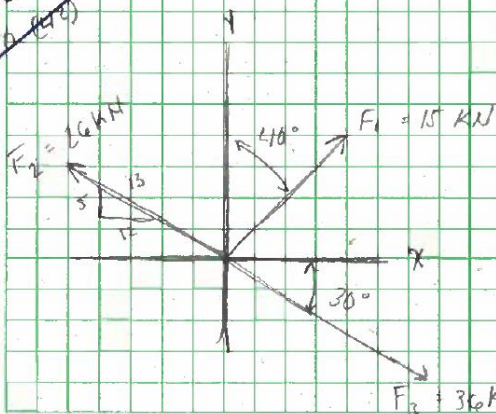
$$= 12.32 \text{ kN}$$

$$\theta = \tan^{-1} \left(\frac{(F_R)_y}{(F_R)_x} \right) = \tan^{-1} \left(\frac{11.263}{5.465} \right)$$

$$= 64.12^\circ$$

20

2-50 (40)



$$F_1 = (15 \times \sin 40^\circ \mathbf{i} + 15 \times \cos 40^\circ \mathbf{j}) \text{ kN}$$

$$= (9.64 \mathbf{i} + 11.50 \mathbf{j}) \text{ kN}$$

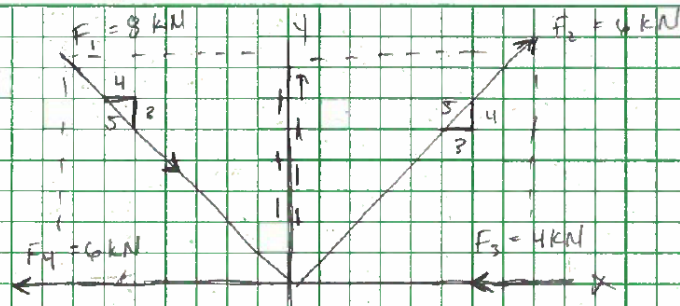
$$F_2 = \left(-26 \times \frac{12}{13} \mathbf{i} + 26 \times \frac{5}{13} \mathbf{j} \right) \text{ kN}$$

$$= (-24 \mathbf{i} + 10 \mathbf{j}) \text{ kN}$$

$$F_3 = (36 \times \cos 30^\circ \mathbf{i} - 36 \times \sin 30^\circ \mathbf{j}) \text{ kN}$$

$$= (31.2 \mathbf{i} - 18 \mathbf{j}) \text{ kN}$$

2-52 (42)



$$(F_1)_x = 8\left(\frac{4}{5}\right) = 6.40 \text{ kN} \rightarrow$$

$$(F_1)_y = 8\left(\frac{3}{5}\right) = 4.80 \text{ kN} \downarrow$$

$$(F_2)_x = 6\left(\frac{4}{5}\right) = 4.80 \text{ kN} \rightarrow$$

$$(F_2)_y = 6\left(\frac{3}{5}\right) = 3.60 \text{ kN} \uparrow$$

$$(F_3)_x = 4 \text{ kN} \leftarrow$$

$$(F_3)_y = 0$$

$$(F_4)_x = 6 \text{ kN} \leftarrow$$

$$(F_4)_y = 0$$

$$(F_R)_x = 6.40 + 4.80 - 4 - 6 = 0$$

$$(F_R)_y = 3.60 - 3.60 = 0$$

$$F_R = \sqrt{0^2 + 0^2} = 0$$

AVERAGE

Prairie View A&M University



Omar Sifuentes

Engineering Mechanics I

HW # ~~2~~ 1

CVEG 2301 P02

Date assigned: September 11, 2021

Date due: September 21, 2021

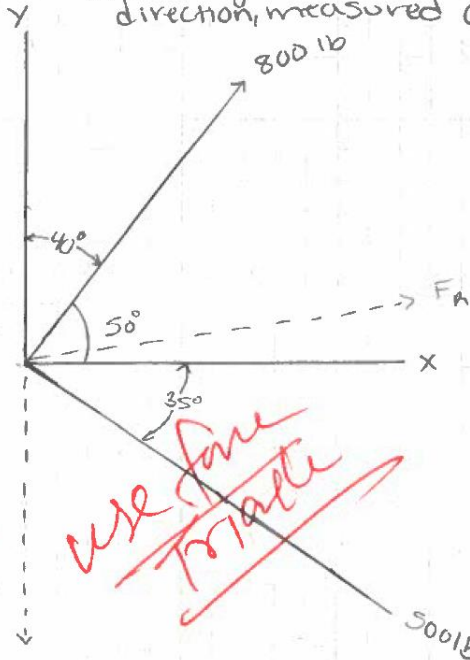
Submitted to: Dr. Abdul M. Choudhury

80
12/2

2-10 (30)

Omar Sifuentes

Determine the magnitude of the resultant force and its direction, measured counter clockwise from +x-axis.



$$F_{Rx} = 800 \cos 50 + 500 \cos 35$$

$$923.8 \text{ lb}$$

$$F_{Ry} = 800 \sin 50 - 500 \sin 35$$

$$326.05 \text{ lb}$$

$$|F| = \sqrt{923.8^2 + 326.05^2}$$

$$= 979.65 \text{ lb}$$

$$\theta = \tan^{-1} \left(\frac{326.05}{923.8} \right)$$

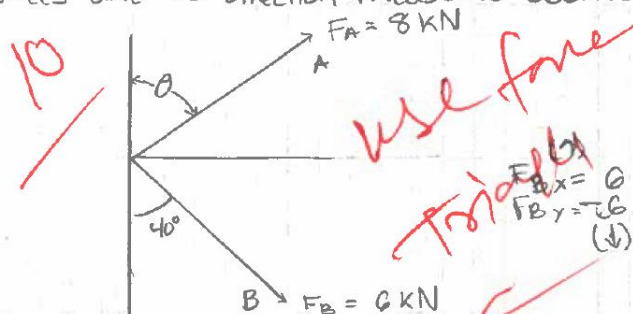
$$= 19.44^\circ$$

$$F = 980 \cdot 19.44^\circ$$

$$F = 980 \text{ at an angle of } 19.44^\circ$$

2-11 (30)

The plate is subjected to the two forces at A and B as shown. If $\theta = 60^\circ$, determine the magnitude of the resultant of these two forces and its direction measured clockwise from the horizontal.



$$F_{Ax} = 8 \sin 60 = 4\sqrt{3}$$

$$F_{Ay} = 8 \cos 60 = 4$$

$$F_{Bx} = 6 \sin 40 = 3.857$$

$$F_{By} = 6 \cos 40 = -4.596 \leftarrow \text{downward}$$

$$\sum F_x = 4\sqrt{3} + 3.857 = 10.785$$

$$\downarrow 6.928$$

$$\sum F_y = 4 - 4.596 = -0.596$$

$$F_{Ay} \quad F_{By}$$

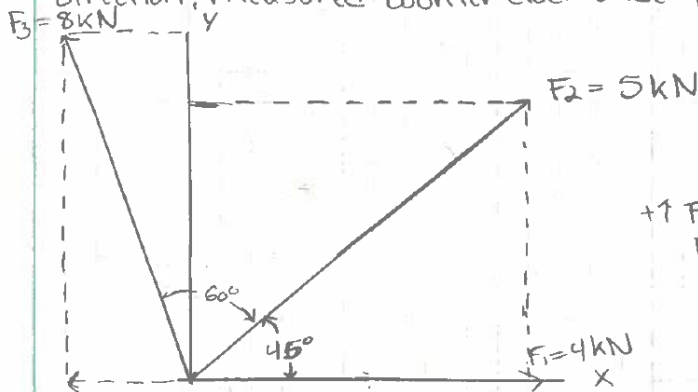
$$|F_R| = \sqrt{10.785^2 + (-0.596)^2} = 10.801$$

$$\theta = \tan^{-1} \left(\frac{-0.596}{10.785} \right) = -3.163$$

$$\frac{360}{-3.163} = 356.837^\circ$$

2-41

Determine the magnitude of the resultant force and its direction, measured counter clock wise from the positive x-axis.



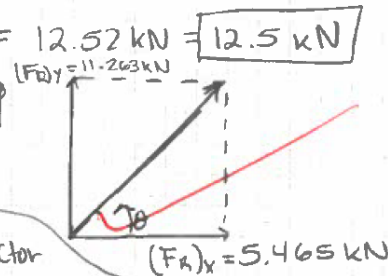
$$\begin{aligned} \rightarrow (F_R)_x &= \sum F_{xi} \\ (F_R)_x &= 4 + 5 \cos 45^\circ - 8 \sin 15^\circ \\ &= 5.465 \text{ kN} \rightarrow \end{aligned}$$

$$\begin{aligned} \uparrow (F_R)_y &= \sum F_{yi} \\ (F_R)_y &= 5 \sin 45^\circ + 8 \cos 15^\circ \end{aligned}$$

$$(F_R)_y = 11.263 \text{ kN} \uparrow$$

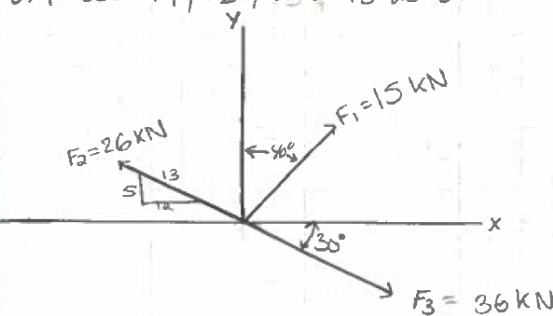
$$F_R = \sqrt{(F_R)_x^2 + (F_R)_y^2} = \sqrt{5.465^2 + 11.263^2}$$

$$\begin{aligned} \theta &= \tan^{-1} \left(\frac{11.263}{5.465} \right) = 64.116^\circ \rightarrow 64.12^\circ \\ &= 12.52 \text{ kN} = 12.5 \text{ kN} \end{aligned}$$



2-50

Express F_1 , F_2 , and F_3 as Cartesian Vector



$$F_1 = \{15 \sin 40^\circ i + 15 \cos 40^\circ j\} \text{ kN} = \{9.84i + 11.5j\} \text{ kN}$$

$$F_2 = \left\{ \frac{12}{13} (26) i + \frac{5}{13} (26) j \right\} \text{ kN} = \{-24i + 10j\} \text{ kN}$$

$$F_3 = \{36 \cos 30^\circ i - 36 \sin 30^\circ j\} \text{ kN} = \{31.2i - 18j\} \text{ kN}$$

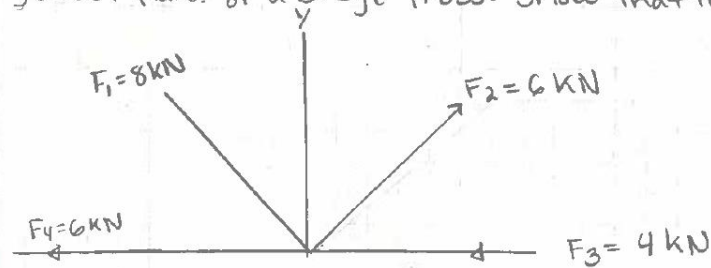
$$F_R = F_1 + F_2 + F_3$$

$$\begin{aligned} &= \{16.8i + 39.5j\} \text{ kN} \end{aligned}$$

2-52

Omar Sifuentes

Determine the x and y components of each force acting on the gusset plate of a bridge truss. Show that the resultant force is zero.



$$F_1 = 8 \text{ k} \cdot \frac{4}{5} \hat{i} - 8 \text{ k} \cdot \frac{3}{5} \hat{j} = 6.4 \text{ k} \hat{i} - 4.8 \text{ k} \hat{j}$$

$$F_2 = 6 \text{ k} \cdot \frac{3}{5} \hat{i} + 6 \text{ k} \cdot \frac{4}{5} \hat{j} = 3.6 \text{ k} \hat{i} + 4.8 \text{ k} \hat{j}$$

$$F_3 = -4 \text{ k} \hat{i}$$

$$+ F_4 = -6 \text{ k} \hat{i}$$

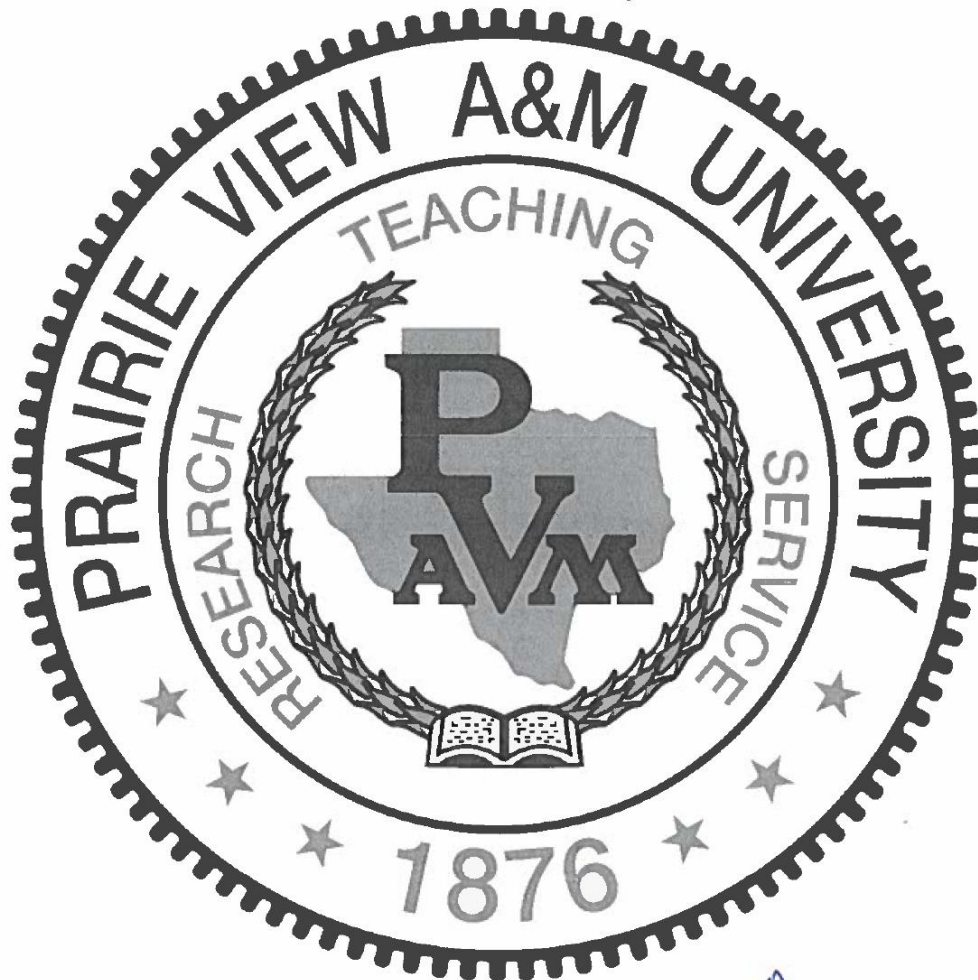
$$\boxed{F_R = 0 \hat{i} + 0 \hat{j}}$$

20



BELOW AVERAGE

Prairie View A&M University



CVEG 2301 P02
Engineering Mechanics HW#1
Assigned : ~~August 31, 2021~~
Due date : September 7, 2021
Submitted by : Alexxis Sterling
Submitted to: Dr. Choudhury

50
100



2-10

$$\Sigma F_x = 800 \sin 40 + 500 \cos 35^\circ$$

$$= 923.816$$

$$\Sigma F_y = 800 \cos 40 + 500 \sin 35^\circ$$

$$= 326.16$$

$$R = \sqrt{(923.8)^2 + (326)^2}$$

$$= 976.16$$

10

$$\theta = \tan^{-1} \left(\frac{\Sigma F_y}{\Sigma F_x} \right) = \tan^{-1} \left(\frac{326}{923.8} \right)$$

$$= 19.4$$

Fig 7

Use force Triangle

2-11

Law of cosines

$$F_R = \sqrt{(F_A)^2 + (F_B)^2 - 2 F_A F_B \cos B}$$

$$F_R = (8)^2 + (6)^2 - 2(8)(6) \cos 100^\circ$$

$$F_R = 10.8 \text{ kN}$$

10

Law of sines

$$\frac{\sin \theta}{4} = \frac{\sin 100^\circ}{10.8} \rightarrow \sin \theta = 0.567$$

$$\theta = 33.16$$

$$\theta = 33.16 - 30^\circ = 3.16$$

Fig 7

Force Triangle

Alexxis Sterling

2.41

$$F_x = F_1 \cos 0 + F_2 \cos 45 + F_3 \cos(105)$$

$$F_x = 4 + 5 \times \frac{1}{2} + 8 \times (-0.2598)$$

$$F_y = 5.46 \text{ kN}$$

$$F_y = F_1 \sin 0 + F_2 \sin 45 + F_3 \sin(105)$$

$$F_y = 0 + 5 \times \frac{1}{2} + 8 \times 0.965$$

$$= F_y = 11.26 \text{ kN}$$

$$F_R = \sqrt{F_x^2 + F_y^2}$$

$$F_R = \sqrt{(5.46)^2 + (11.26)^2}$$

$$F_R = 12.51 \text{ N}$$

$$\tan \theta = \frac{F_y}{F_x} = \frac{11.26}{5.46}$$

$$\theta = 64.2$$

2.50

??

Alexxis Sterling

2.52

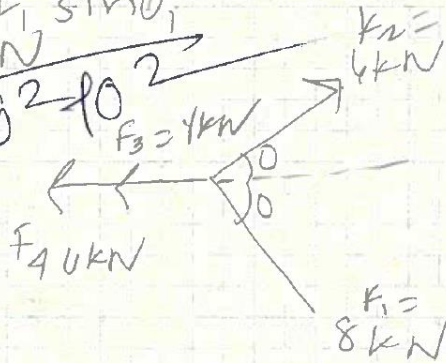
$$F_x = -4 - 6 + 10 \cos 62^\circ + 8 \cos 39^\circ$$

$$F_x = 0 \text{ kN}$$

$$F_y = F_2 \sin 62^\circ - F_1 \sin 39^\circ$$

$$F_y = 0 \text{ kN}$$

$$F_R = 0 \text{ kN}$$



**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

HOMEWORK 2

TOPICS COVERED IN HOMEWORK 2

- 1. 3D vectors**
- 2. Direction cosine**
- 3. Position vector**
- 4. Dot product of two vectors**

ABOVE AVERAGE



100
100

CVEG 2301 P02

Engineering Mechanics – HW 2 CH.2

Problems: 2-60(52), 2-72 (54), 2-92 (65), 2-95 (66) & 2-114 (77).

Assigned: September 16 ,2021

Due: September 23, 2021

Submitted by: Craig Rothschild, Roster #19

Submitted to: Dr.Abul M. Choudhury

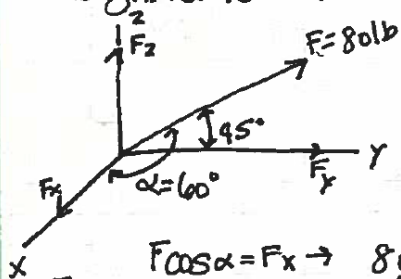
Craig Rothschild

HWd - CUEG
2301

9/23/21

HW Qs: 2-60(52), 2-72(54), 2-92(65), 2-95(66)
2-144(17)

2-60 The force F has a magnitude of 80 lb and acts within the octant shown. Determine the magnitudes of the x , y , z components of F .



$$\cos \alpha = \frac{A_x}{A}, \cos \beta = \frac{A_y}{A}, \cos \gamma = \frac{A_z}{A}$$

$$*A = F$$

$$F = F_x + F_y + F_z \quad F = \sqrt{F_x^2 + F_y^2 + F_z^2}$$

$$F \cos \alpha = F_x, F \cos \beta = F_y, F \cos \gamma = F_z$$

$$F = 80 \quad \Delta F, F_x \dots (\text{all given})$$

$$\alpha = 60^\circ \quad \beta = 45^\circ$$

$$F \cos \alpha = F_x \rightarrow 80 \cos(60^\circ) = 40 \text{ lb}$$

$$F \cos \beta = F_y \rightarrow 80 \cos(45^\circ) = 56.57 \text{ lb}$$

$$80^2 = (40)^2 + (56.57)^2 + F_z^2$$

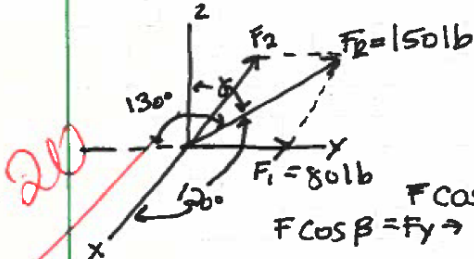
$$6400 = 1600 + 3200.16 + F_z^2$$

$$-(+1111) = 2^2$$

$$\sqrt{1600} = 40 = F_z$$

$$F = (40)_x + (56.57)_y + (40)_z$$

2-72 Determine the magnitude of F_2 and its coordinate direction angles.



$$F_2 = \sqrt{F_{2x}^2 + F_{2y}^2 + F_{2z}^2}$$

$$F \cos \alpha = F_x, F \cos \beta = F_y, F \cos \gamma = F_z$$

$$F_2 = F_1 + F_2$$

$$F_2 = F_2 - F_1 \quad (\text{Given})$$

$$F_2 = 150 \text{ lb} \quad F_1 = 80 \text{ lb}$$

$$\alpha = 120^\circ, \beta = 180^\circ - 80^\circ = 50^\circ$$

$$F \cos \alpha = F_x \rightarrow 150 \cos(120^\circ) = -75 \text{ lb}$$

$$F \cos \beta = F_y \rightarrow 150 \cos(50^\circ) = 96.41 \text{ lb}$$

$$F_1 = 0i + 80j + 0k \quad F_2 = -75i + 96.41j + F_{2z}k$$

$$150^2 = (-75)^2 + (96.41)^2 + (F_{2z})^2$$

$$\sqrt{22500} = 149.17.96 + \sqrt{F_{2z}^2}$$

$$87.11 \text{ lb} = (F_{2z})k$$

$$F_2 = -75i + 96.41j + 87.11k$$

$$F_1 = (0i + 80j + 0k)$$

$$F_2 = -75i + 96.41j + 87.11k$$

$$|F_2| = \sqrt{(-75)^2 + (96.41)^2 + (87.11)^2}$$

$$|F_2| = 116.07 = F_2$$

$$\alpha_x = \cos^{-1}(x/F_2)$$

$$= 49.72^\circ$$

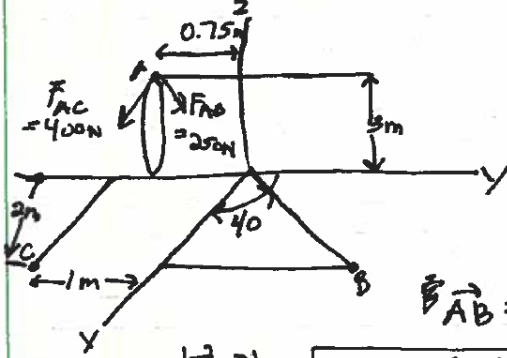
$$\beta_y = \cos^{-1}(y/F_2)$$

$$= 81.9^\circ$$

$$\gamma_z = \cos^{-1}(z/F_2)$$

$$= 41.33^\circ$$

2-92 Express each of the forces in Cartesian vector form and determine the magnitude and coordinate direction angles of the resultant force.



F_{AB} [Given]

$$F_{AB} = 250 \text{ N} ; F_{AC} = 400 \text{ N}$$

$$\vec{F}_{AB} = F_{AB} \cdot \hat{u}_{AB}$$

$$A = 0\mathbf{i} + (-0.75)\mathbf{j} + 3\mathbf{k}$$

$$B = 2(\cos 40^\circ)\mathbf{i} + 2(\sin 40^\circ)\mathbf{j} + 0\mathbf{k}$$

$$\vec{AB} = (1.632)\mathbf{i} + (1.285)\mathbf{j} + (-3)\mathbf{k} \text{ m}$$

$$|\vec{AB}| = \sqrt{(1.632)^2 + (1.285)^2 + (-3)^2} \text{ m}$$

$$AB = 3.935$$

$$\hat{u}_{AB} = \frac{\vec{AB}}{AB} = \frac{1.632}{3.935}\mathbf{i} + \frac{1.285}{3.935}\mathbf{j} + \left(-\frac{3}{3.935}\right)\mathbf{k}$$

$$= 0.415\mathbf{i} + 0.327\mathbf{j} - 0.762\mathbf{k}$$

$$\vec{F}_{AB} = \hat{u}_{AB} \cdot F_{AB} = 250(0.415\mathbf{i} + 0.327\mathbf{j} - 0.762\mathbf{k}) \text{ N}$$

$$= 103.75\mathbf{i} + 81.75\mathbf{j} - 190.5\mathbf{k} \text{ N}$$

$$C = 2\mathbf{i} + (-1)\mathbf{j} + 0\mathbf{k} \quad \vec{AC} = C - A$$

$$\vec{AC} = (2\mathbf{i} - 0\mathbf{i}) + (-1 - (-0.75))\mathbf{j} + (0 - 3)\mathbf{k}$$

$$= 2\mathbf{i} - 0.25\mathbf{j} - 3\mathbf{k}$$

$$|\vec{AC}| = \sqrt{2^2 + (-0.25)^2 + (-3)^2}$$

$$= 3.614 \text{ m}$$

$$\hat{u}_{AC} = \frac{\vec{AC}}{|\vec{AC}|} = \frac{2}{3.614}\mathbf{i} - \frac{0.25}{3.614}\mathbf{j} - \frac{3}{3.614}\mathbf{k}$$

$$= 0.553\mathbf{i} - 0.069\mathbf{j} - 0.832\mathbf{k}$$

$$\vec{F}_{AC} = \hat{u}_{AC} \cdot F_{AC} = 400(0.553\mathbf{i} - 0.069\mathbf{j} - 0.832\mathbf{k})$$

$$= 221.2\mathbf{i} - 27.6\mathbf{j} - 332.8\mathbf{k} \text{ N}$$

$$\vec{F}_R = \vec{F}_{AB} + \vec{F}_{AC}$$

$$= (103.75 + 221.2)\mathbf{i} + (81.75 - 27.6)\mathbf{j} + (-190.5 - 332.8)\mathbf{k}$$

$$= 324.95\mathbf{i} + 54.15\mathbf{j} - 523.3\mathbf{k}$$

$$|F_R| = \sqrt{324.95^2 + 54.15^2 + (-523.3)^2}$$

$$= 620.28 \text{ N}$$

$$\cos^{-1}\left(\frac{F_x}{F_R}\right) = 59.1^\circ = \alpha$$

$$\cos^{-1}\left(\frac{F_y}{F_R}\right) = 80.57^\circ = \beta$$

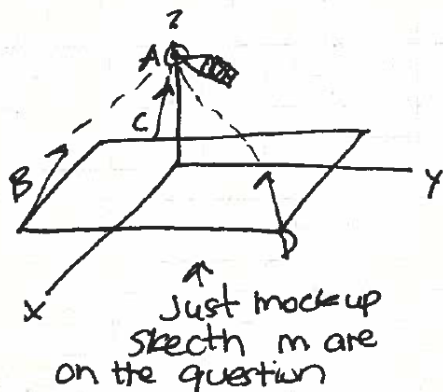
$$\cos^{-1}\left(\frac{F_z}{F_R}\right) = 32.61^\circ = \gamma$$

Craig Rothschild

HW-Week
2301

9/23/21

2-95 Express each force as a Cartesian Vector.



Given
 $F_{BA} = 350 \text{ lb}$, $F_{CA} = 500 \text{ lb}$
 $F_{DA} = 400 \text{ lb}$

$$\vec{B} = 5\mathbf{i} - 6\mathbf{j} + 14\mathbf{k}$$

$$\vec{C} = 3\mathbf{i} + 3\mathbf{j} + 14\mathbf{k}$$

$$\vec{D} = -2\mathbf{i} - 6\mathbf{j} + 14\mathbf{k}$$

$$\left(\frac{\vec{u}}{u} \right) \cdot F_A = \underline{16}$$

$$F_{BA} = 350 \left\{ \frac{5\mathbf{i} - 6\mathbf{j} + 14\mathbf{k}}{\sqrt{(5)^2 + (-6)^2 + (14)^2}} \right\} = \boxed{109\mathbf{i} + 131\mathbf{j} + 306\mathbf{k} \text{ lb}}$$

$$|CA| = 3 \quad |CA| = \sqrt{3^2 + 3^2 + 14^2}$$

$$= 5.656$$

$$F_{CA} = 500 \left\{ \frac{3}{5.656}\mathbf{i} + \frac{3}{5.656}\mathbf{j} + \frac{14}{5.656}\mathbf{k} \right\}$$

$$= \boxed{\{103\mathbf{i} + 103\mathbf{j} + 479\mathbf{k}\} \text{ lb}}$$

$$DA = \sqrt{(-2)^2 + (-6)^2 + (14)^2}$$

$$= 15.362$$

$$F_{DA} = 400 \left\{ \frac{-2}{15.362}\mathbf{i} - \frac{6}{15.362}\mathbf{j} + \frac{14}{15.362}\mathbf{k} \right\}$$

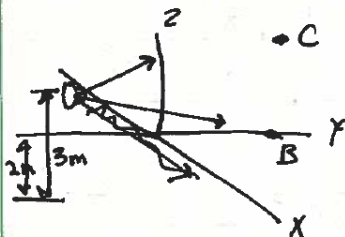
$$= \boxed{\{-52.1\mathbf{i} - 156\mathbf{j} + 365\mathbf{k}\}}$$

20

Craig Kethschild

HW2-CVEG
2301

9/23/21

2-144 Determine the angle θ between the two cables

Given

$$F_1 = 70 \text{ N} \quad F_2 = 40 \text{ N}$$

$$A = (2, -3, 3) \text{ m}$$

$$B = (0, 3, 0) \text{ m}$$

$$C = (-2, 3, 4) \text{ m}$$

$$\vec{AB} = \vec{AC} = |\vec{AB}| |\vec{AC}| \cos \theta$$

$$\theta = \cos^{-1} \left(\frac{\vec{AB} \cdot \vec{AC}}{|\vec{AB}| |\vec{AC}|} \right)$$

$$\vec{AB} = \{ (0-2)\mathbf{i} + (3-(-3))\mathbf{j} + (0-3)\mathbf{k} \} \text{ m}$$

$$\vec{AB} = \{ -2\mathbf{i} + 6\mathbf{j} - 3\mathbf{k} \} \text{ m} \quad |\vec{AB}| = \sqrt{2^2 + 6^2 + 3^2} = 7$$

$$\vec{AC} = \{ (-2-2)\mathbf{i} + (3-(-3))\mathbf{j} + (4-3)\mathbf{k} \} \text{ m}$$

$$\vec{AC} = \{ -4\mathbf{i} + 6\mathbf{j} + 1\mathbf{k} \}$$

$$|\vec{AC}| = \sqrt{4^2 + 6^2 + 1^2} = 7.28 \text{ m}$$

$$\vec{AB} \cdot \vec{AC} = (-2)(-4) + (6)(6) + (-3)(1)$$

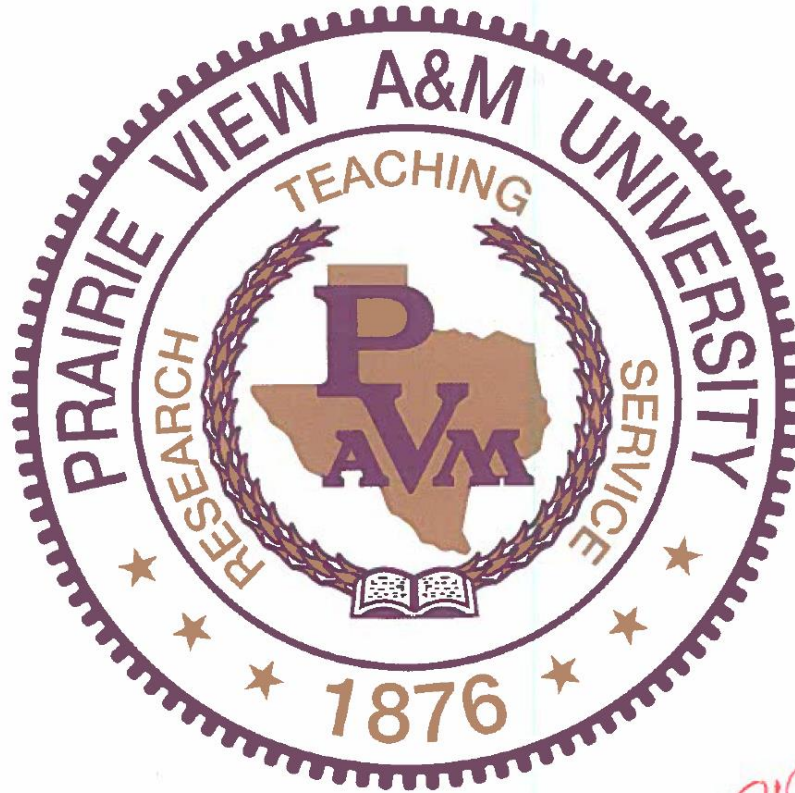
$$= 41$$

$$\cos^{-1} \left(\frac{41}{(7)(7.28)} \right) = \boxed{36.43^\circ}$$

20

AVERAGE

Prairie View A&M University



CVEG 2043 PO2

Engineering Mechanics HW #3

Problems: 2.60, 2.72, 2.92, 2.95, 2.114

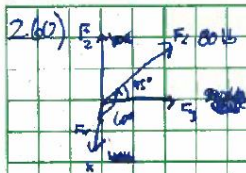
Assigned: September 14, 2021

Due: September 23, 2021

Submitted by: Zachary Taylor

Submitted to: Dr. Abdul M. Choudhury

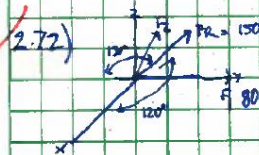
85
100



$$\begin{aligned} F_x &= 40 \text{ lb} \\ F_y &= 56.6 \text{ lb} \\ F_z &= 40 \text{ lb} \end{aligned}$$

$$\begin{aligned} \cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma &= 1 \\ \cos^2 60 + \cos^2 45 + \cos^2 \gamma &= 1 \\ \cos^2 \gamma &= 0.25 \\ \gamma &= \cos^{-1}(0.5) \\ \gamma &= 60^\circ \end{aligned}$$

$$\begin{aligned} F_x &= F \cos \alpha = 80 \cos 60 = 80 \left(\frac{1}{2} \right) = 40 \text{ lb} \\ F_y &= F \cos \beta = 80 \cos 45 = 80 \left(\frac{1}{\sqrt{2}} \right) = 56.6 \text{ lb} \\ F_z &= F \cos \gamma = 80 \cos 60 = 80 \left(\frac{1}{2} \right) = 40 \text{ lb} \end{aligned}$$

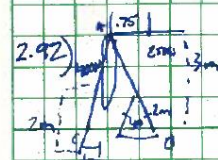


$$\begin{aligned} F_2 &= -75i + 96.42j + 87.06k \\ \alpha &= 130.24^\circ \\ \beta &= 81.87^\circ \\ \gamma &= 41.42^\circ \end{aligned}$$

$$\begin{aligned} 1 &= \sqrt{\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma} \\ &= \sqrt{\cos^2 120 + \cos^2 130 + \cos^2 \gamma} \\ &= 54.82 \end{aligned}$$

$$\begin{aligned} F_x &= 150 \cos(120^\circ) = -75 \text{ lb} \\ F_y &= 150 \cos(130^\circ) = 96.42 \\ F_z &= 150 \cos(54.52^\circ) = 87.06 \\ F_2 &= -75i + 96.42j + 87.06k \end{aligned}$$

$$\begin{aligned} \alpha &= \cos^{-1} \left(\frac{-75}{150} \right) = 120.24 \\ \beta &= \cos^{-1} \left(\frac{96.42}{150} \right) = 81.87 \\ \gamma &= \cos^{-1} \left(\frac{87.06}{150} \right) = 41.42 \end{aligned}$$



$$\begin{aligned} AB &= 97.5i + 130j - 190k \\ AC &= 221.36i - 27.68j - 332k \\ \text{mag: } 620.18 \text{ N} \\ \alpha &= 59.059^\circ \\ \beta &= 80.50^\circ \\ \gamma &= 117.32^\circ \end{aligned}$$

$$\begin{aligned} r_{AB} &= (x_B - x_A)i + (y_B - y_A)j + (z_B - z_A)k \\ &= (-5 - 0)i + (10 - 10)j + (0 - 3)k \\ &= -5i + 0j - 3k \\ r_{AB} &= \sqrt{(-5)^2 + 0^2 + (-3)^2} = 5.83 \end{aligned}$$

$$\begin{aligned} r_{AC} &= (x_C - x_A)i + (y_C - y_A)j + (z_C - z_A)k \\ &= (221.36 - 0)i + (-27.68 - 0)j + (-332 - 0)k \\ &= 221.36i - 27.68j - 332k \\ r_{AC} &= \sqrt{(221.36)^2 + (-27.68)^2 + (-332)^2} = 420 \end{aligned}$$

$$\begin{aligned} F_R &= \sqrt{(97.5i + 130j + 190k)^2 + (221.36i - 27.68j - 332k)^2} \\ F_R &= 620.18 \text{ N} \end{aligned}$$

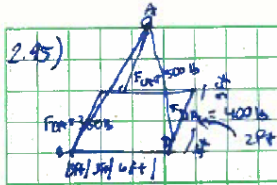
$$\begin{aligned} \alpha &= \cos^{-1} \left(\frac{97.5}{620.18} \right) = 59.059 \\ \beta &= \cos^{-1} \left(\frac{130}{620.18} \right) = 80.50 \\ \gamma &= \cos^{-1} \left(\frac{-190}{620.18} \right) = 117.32 \end{aligned}$$

20

15

20

write one problem in one page



$$\vec{F}_{BA} = (109.2\mathbf{i} + 131\mathbf{j} + 305.7\mathbf{k}) \text{ lb}$$

$$\vec{F}_{CA} = (102.5\mathbf{i} + 102.5\mathbf{j} + 428.5\mathbf{k}) \text{ lb}$$

$$\vec{F}_{DA} = (-52.2\mathbf{i} - 156.2\mathbf{j} + 364.6\mathbf{k}) \text{ lb}$$

$$\vec{BA} = (0-5)\mathbf{i} + (0+6)\mathbf{j} + (14-0)\mathbf{k}$$

$$= -5\mathbf{i} + 6\mathbf{j} + 14\mathbf{k}$$

$$|\vec{BA}| = \sqrt{(-5)^2 + 6^2 + 14^2} = 16.03$$

$$\left(\frac{-5\mathbf{i} + 6\mathbf{j} + 14\mathbf{k}}{16.03} \right) 500 = (109.2\mathbf{i} + 131\mathbf{j} + 305.7\mathbf{k})$$

$$\vec{DA} = -2\mathbf{i} - 6\mathbf{j} + 14\mathbf{k}$$

$$|\vec{DA}| = \sqrt{(-2)^2 + (-6)^2 + 14^2} = 15.36$$

$$\left(\frac{-2\mathbf{i} - 6\mathbf{j} + 14\mathbf{k}}{15.36} \right) 400 = (-52.2\mathbf{i} - 156.2\mathbf{j} + 364.6\mathbf{k})$$

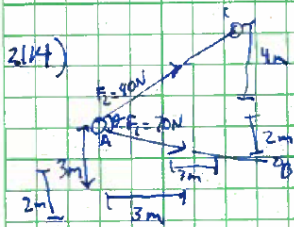
$$\vec{CA} = (0-3)\mathbf{i} + (0-3)\mathbf{j} + (14-0)\mathbf{k}$$

$$= -3\mathbf{i} - 3\mathbf{j} + 14\mathbf{k}$$

$$|\vec{CA}| = \sqrt{(-3)^2 + (-3)^2 + 14^2} = 14.63$$

$$= \left(\frac{-3\mathbf{i} - 3\mathbf{j} + 14\mathbf{k}}{14.63} \right) 500$$

$$= (102.5\mathbf{i} + 102.5\mathbf{j} + 428.5\mathbf{k})$$



$$\vec{AC} = -4\mathbf{i} - 6\mathbf{j} + \mathbf{k}$$

$$|\vec{AC}| = \sqrt{(-4)^2 + (-6)^2 + 1^2} = 7$$

$$\theta = \cos^{-1} \left(\frac{|\vec{r}_{AC} \cdot \vec{r}_{AB}|}{|\vec{r}_{AC}| |\vec{r}_{AB}|} \right)$$

$$= \cos^{-1} \left(\frac{(1+4-2) + (-6+6) + (1+1)}{7.28(7)} \right)$$

$$= 36.43$$

$$\theta = 36.43^\circ$$

BELOW AVERAGE

Prairie View A&M University



CVEG 2301 P02

HW-2 Chap-2

Engineering ~~Mechanics~~ Essay #1

Assigned: September 21, 2021

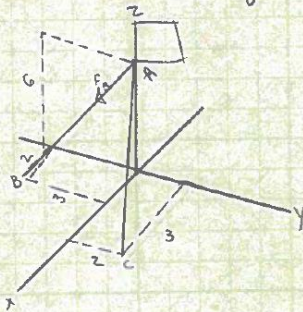
Due: September 23, 2021

Submitted by: Tyson Morris, Roster #?

Submitted to: Dr. Abdul M. Choudhury

TH
tw

2-92(65): If $F_B = 700\text{ N}$ and $F_C = 560\text{ N}$, determine magnitude and coord direction angles of the resultant force acting on the flag pole.



$$2\mathbf{i} + 3\mathbf{j} - 6\mathbf{k}$$

$$F_{AB} = \sqrt{2^2 + (-3)^2 + (-6)^2}$$

$$\sqrt{49}$$

$$F_{AB} = 7$$

$$F_B = 700 \frac{2}{7}\mathbf{i} - 700 \frac{3}{7}\mathbf{j} - 700 \frac{6}{7}\mathbf{k}$$

$$200\mathbf{i} - 300\mathbf{j} - 600\mathbf{k}$$

$$F_C = 560 \frac{4}{7}\mathbf{i} + 560 \frac{-3}{7}\mathbf{j} - 560 \frac{6}{7}\mathbf{k}$$

$$320\mathbf{i} + 160\mathbf{j} - 480\mathbf{k}$$

$$F_R = 440\mathbf{i} - 140\mathbf{j} - 1080\mathbf{k}$$

$$F_R = \sqrt{440^2 + (-140)^2 + (-1080)^2}$$

$$F_R = 1174.56\text{ N}$$

$$\cos \alpha = \frac{440}{1174.56}$$

$$\alpha = 68^\circ$$

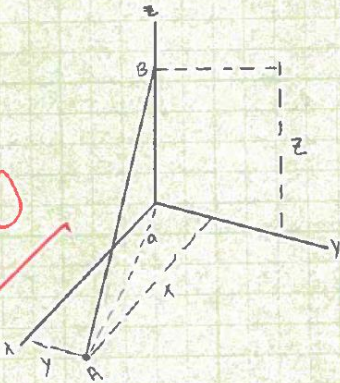
$$\cos \beta = \frac{-140}{1174.56}$$

$$\beta = 96.85^\circ$$

$$\cos \gamma = \frac{-1080}{1174.56}$$

$$\gamma = 156.85^\circ$$

2-95(66): The 8m-long cable is anchored to the ground at A. If $z = 5\text{ m}$, determine the location x, y of point A. Choose a value such that $x = y$.



$$8^2 = a^2 + 5^2$$

$$a^2 = 8^2 - 5^2$$

$$a = \sqrt{39}$$

$$\sqrt{39} = \sqrt{x^2 + x^2}$$

$$39 = x^2 + x^2$$

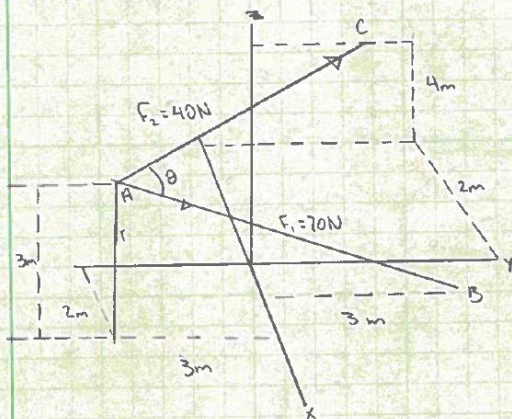
$$39 = 2x^2$$

$$\sqrt{19.5} = x$$

$$4.12 = x$$

$$x \text{ and } y = 4.12\text{ m}$$

2-114(77): Determine the angle θ between the two cables.



$$A = 2\hat{i} - 3\hat{j} + 3\hat{k}$$

$$B = 0\hat{i} + 3\hat{j} + 0\hat{k}$$

$$C = -2\hat{i} + 3\hat{j} + 4\hat{k}$$

$$B - A = -2\hat{i} + 6\hat{j} - 3\hat{k}$$

$$r_{AB} = \sqrt{(-2)^2 + 6^2 + (-3)^2}$$

$$= 7$$

$$u_{AB} = \frac{-2}{7}\hat{i} + \frac{6}{7}\hat{j} - \frac{3}{7}\hat{k}$$

$$C - A = -4\hat{i} + 6\hat{j} - 1\hat{k}$$

$$r_{AC} = \sqrt{(-4)^2 + 6^2 + (-1)^2}$$

$$= \sqrt{53}$$

$$u_{AC} = \frac{-4}{\sqrt{53}}\hat{i} + \frac{6}{\sqrt{53}}\hat{j} - \frac{1}{\sqrt{53}}\hat{k}$$

$$u_{AB} \cdot u_{AC} = \left(\frac{-2}{7}\right)\left(\frac{-4}{\sqrt{53}}\right) + \left(\frac{6}{7}\right)\left(\frac{6}{\sqrt{53}}\right) + \left(\frac{-3}{7}\right)\left(\frac{-1}{\sqrt{53}}\right)$$

$$\frac{41}{7\sqrt{53}}$$

$$\theta = \cos^{-1}(u_{AB} \cdot u_{AC})$$

$$\theta = \cos^{-1}\left(\frac{41}{7\sqrt{53}}\right)$$

$$\theta = 36.43^\circ$$

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**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

HOMEWORK 3

TOPICS COVERED IN HOMEWORK 3

- 1. Free body diagram**
- 2. Point equilibrium**
- 3. Equation of equilibrium**
- 4. Free body diagram of spring**

ABOVE AVERAGE

Prairie View A&M University



CVEG 2301 P02

Engineering Mechanics HW#3 (Ch. 3)

Problems: 3-2, 3-3, 3-6, 3-19 & 3-30

Assigned: October 7, 2021

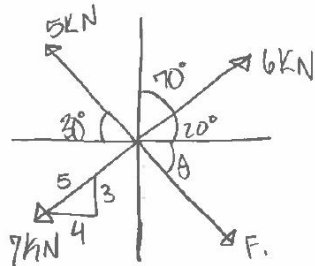
Due: October 14, 2021

Submitted by: Haley Moses, Roster #13

Submitted to: Dr. Abdul M. Choudry

100
/ 100

3-2



$$\sum \vec{F} = 0$$

$$\begin{aligned}\sum F_x &= -5\cos(30^\circ) - 7\left(\frac{4}{5}\right) + 6\cos(20^\circ) + F_1\cos(\theta) = 0 \\ &= -4.33 - 5.6 + 5.64 + F_1\cos(\theta) = 0 \\ &= -4.29 + F_1\cos(\theta) = 0 \\ &\quad +4.29 \quad +4.29 \\ F_1\cos(\theta) &= 4.29\end{aligned}$$

$$\begin{aligned}\sum F_y &= 5\sin(30^\circ) - 7\left(\frac{3}{5}\right) + 6\sin(20^\circ) - F_1\sin(\theta) = 0 \\ &= 0.352 - F_1\sin(\theta) = 0 \\ F_1\sin(\theta) &= 0.352\end{aligned}$$

$$\tan \theta = \frac{F_1\sin(\theta)}{F_1\cos(\theta)}$$

$$\tan \theta = \frac{0.352}{4.29}$$

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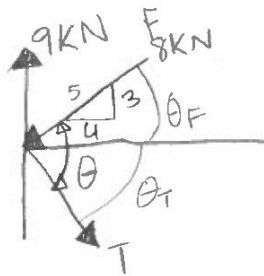
$$\theta = \tan^{-1}\left(\frac{0.352}{4.29}\right) = 4.69^\circ$$

$$F_1\cos(4.69^\circ) = 4.29$$

$$F_1 = \frac{4.29}{\cos(4.69^\circ)} = 4.3 \text{ kN}$$



3-6



$$\begin{aligned}\sum F_x &= 0 - 8\left(\frac{4}{5}\right) + T\cos(\theta) = 0 \\ &= -6.4 + T\cos(\theta) \\ T\cos(\theta) &= 6.4\end{aligned}$$

$$\begin{aligned}\sum F_y &= 9 - 8\left(\frac{3}{5}\right) - T\sin(\theta) = 0 \\ &= 4.2 - T\sin(\theta) = 0 \\ T\sin(\theta) &= 4.2\end{aligned}$$

$$\theta_T = \tan^{-1}\left(\frac{4.2}{6.4}\right) = 33.28^\circ$$

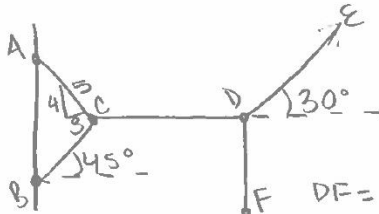
$$T = \frac{6.4}{\cos(33.28^\circ)} = 7.66 \text{ kN}$$

$$\theta_F = \tan^{-1}\left(\frac{3}{4}\right) = 36.87^\circ$$

$$\theta = 33.28^\circ + 36.87^\circ = 70.15^\circ$$

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3-30



$$DF = (9.81)(m) = 9.81m \text{ (S)}$$

$$\sum F_y = -9.81m + DE \sin(30^\circ) = 0$$

$$DE \sin(30^\circ) = 9.81m$$

$$DE = \frac{9.81m}{\sin(30^\circ)}$$

$$DE = 19.62m \text{ (1)}$$

$$\sum F_x = DE \cos(30^\circ) - CD = 0$$

$$CD = DE \cos(30^\circ)$$

$$CD = (19.62m)(\cos(30^\circ))$$

$$CD = 16.99m \text{ (2)}$$

$$\sum F_x = -CA \left(\frac{3}{5}\right) - CB \cos(45^\circ) + CD$$

$$-CD = -CA \left(\frac{3}{5}\right) - CB \cos(45^\circ)$$

$$16.99m = +0.6CA + 0.707CB$$

$$\sum F_y = CA \left(\frac{4}{5}\right) - CB \sin(45^\circ) = 0$$

$$= 0.8CA - 0.707CB = 0$$

$$0.8CA - 0.707CB = 0$$

$$+ 0.6CA + 0.707CB = 16.99m$$

$$CA = \frac{16.99m}{1.4} = 12.136m \text{ (4)}$$

$$(0.6)(12.136m) + (0.707)(CB) = 16.99m$$

$$CB = 13.73m \text{ (5)}$$

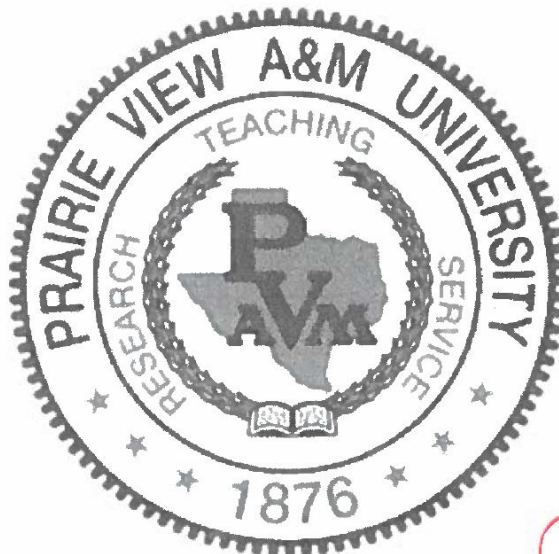
$$DE > CD > CB > CA > DF$$

$$DE = 19.62m = 400N$$

$$m = \frac{400}{19.62} = 20.38kg$$

AVERAGE

Prairie View A&M University
College of Engineering
Department of Civil & Environmental Engineering



CVEG 2301: Engineering Mechanics

Submitted by: Jacorian Lovall

Submitted to: Dr. Abdul Choudhury

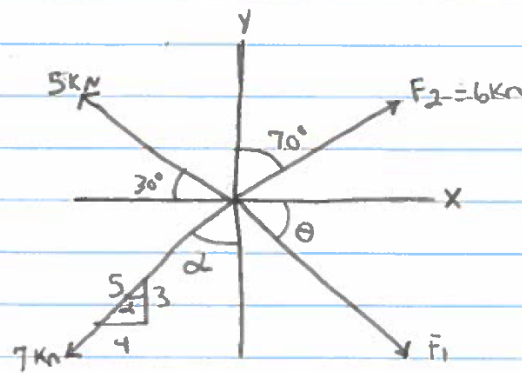
Date Assigned: October 7, 2021

Submitted on: October 14, 2021

Homework #3 Problems: 3-2, 3-3, 3-6, 3-19, 3-30

93/
low
Roster?

3-2



$$\tan \alpha = 4/3$$

$$\alpha = \tan^{-1}(4/3) = 53.13^\circ$$

5 for eng 89 paper

$$F_2 \sin 70^\circ + F_1 \cos \theta = 5 \cos 30^\circ + 7 \sin 53.13$$

$$6 \sin 70^\circ + F_1 \cos \theta = 9.930$$

$$F_1 \cos \theta = 4.29 \quad \text{--- (1)}$$

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$$F_2 \cos 70^\circ + 5 \sin 30^\circ = F_1 \sin \theta + 7 \cos 53.13$$

$$F_1 \sin \theta = 0.35 \quad \text{--- (2)}$$

$$\frac{F_1 \sin \theta}{F_1 \cos \theta} = \frac{0.35}{4.29} = 0.0816 \quad \tan \theta = 0.0816$$

$$F_1 \cos \theta = 4.29$$

$$\theta = \tan^{-1}(0.0816)$$

$$\theta = 4.66^\circ$$

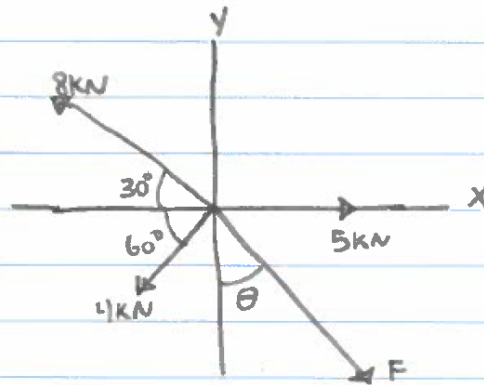
$$F_1 \sin \theta = 0.35$$

$$F_1 \sin(4.66) = 0.35$$

$$F_1 = 4.308 \text{ kN}$$

✓

3-3



$$\sum F_x = 0; 5 + F \sin \theta = 8 \cos 30^\circ + 4 \cos 60^\circ$$

$$F \sin \theta = 3.928 \quad \text{--- ①}$$

$$\sum F_y = 0; F \cos \theta + 4 \sin 60^\circ = 8 \sin 30^\circ$$

$$F \cos \theta = 0.535 \quad \text{--- ②}$$

$$\frac{F \sin \theta}{F \cos \theta} = \frac{3.928}{0.535} = \tan \theta = 7.342 \rightarrow \theta = \tan^{-1}(7.342)$$

$$\boxed{\theta = 82.243}$$

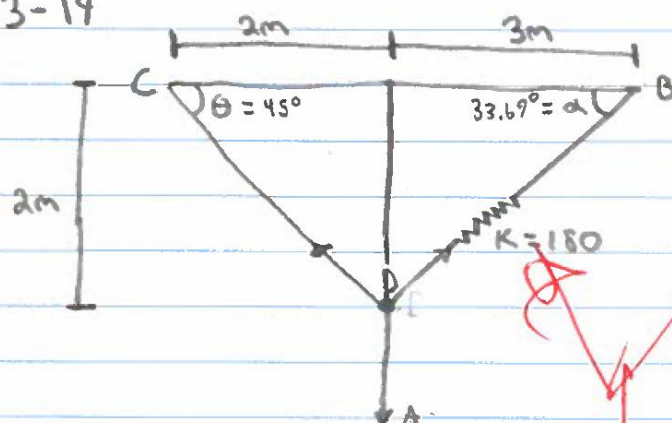
$$F^2 (\sin^2 \theta + \cos^2 \theta) =$$

$$F^2 (3.928^2 + 0.535^2) = 15.715$$

$$F = \sqrt{15.715}$$

$$\boxed{F = 3.964}$$

3-19



$$\theta = \tan^{-1}(2/3)$$

$$= 45^\circ$$

$$\alpha = \tan^{-1}(2/3)$$

$$= 33.69^\circ$$

$$40 \times 9.81 = 392.4 \text{ N}$$

$$\sum F_x = 0; -F_{DC} \cos 45^\circ + F_{DB} \cos 33.69^\circ = 0 \quad \text{--- ①}$$

$$\sum F_y = 0; F_{DC} \sin 45^\circ + F_{DB} \sin 33.69^\circ = 392.4 \quad \text{--- ②}$$

$$1.386 F_{DB} = 392.4$$

$$F_{DB} = 282.9 \text{ N}$$

$$F_{DB} = \text{change in length} \times K$$

$$282.9 = (L - L_0) \times K$$

$$L - L_0 = 1.572 \text{ m}$$

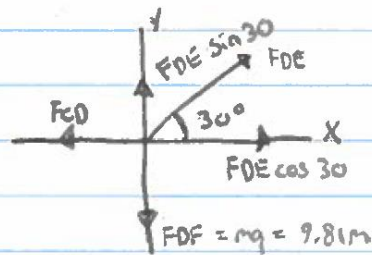
$$L = \sqrt{2^2 + 3^2}$$

$$= 3.605$$

$$L_0 = 3.605 - 1.572$$

$$L_0 = 2.033 \text{ m}$$

3-30



SDH
EAM
TGA

$$\sum F_y = 0; F_{DE} \sin 30 - 9.81 = 0$$

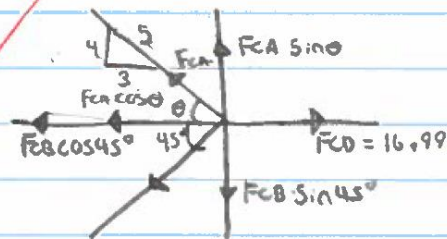
$$F_{DE} = 19.62 \text{ --- } ①$$

$$\sum F_x = 0; F_{DE} \cos 30 - F_{CD} = 0$$

$$19.62 \cos 30 - F_{CD} = 0$$

$$F_{CD} = 16.99 \text{ m --- } ②$$

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$$\cos \theta = 3/5 \quad \sin \theta = 4/5$$

$$\sum F_x = 0; 16.99 - F_{CA} \cos \theta - F_{CB} \cos 45 = 0$$

$$16.99 - F_{CA} \cdot 3/5 - F_{CB} \cos 45 = 0$$

$$F_{CB} = 13.73 \text{ m --- } ③$$

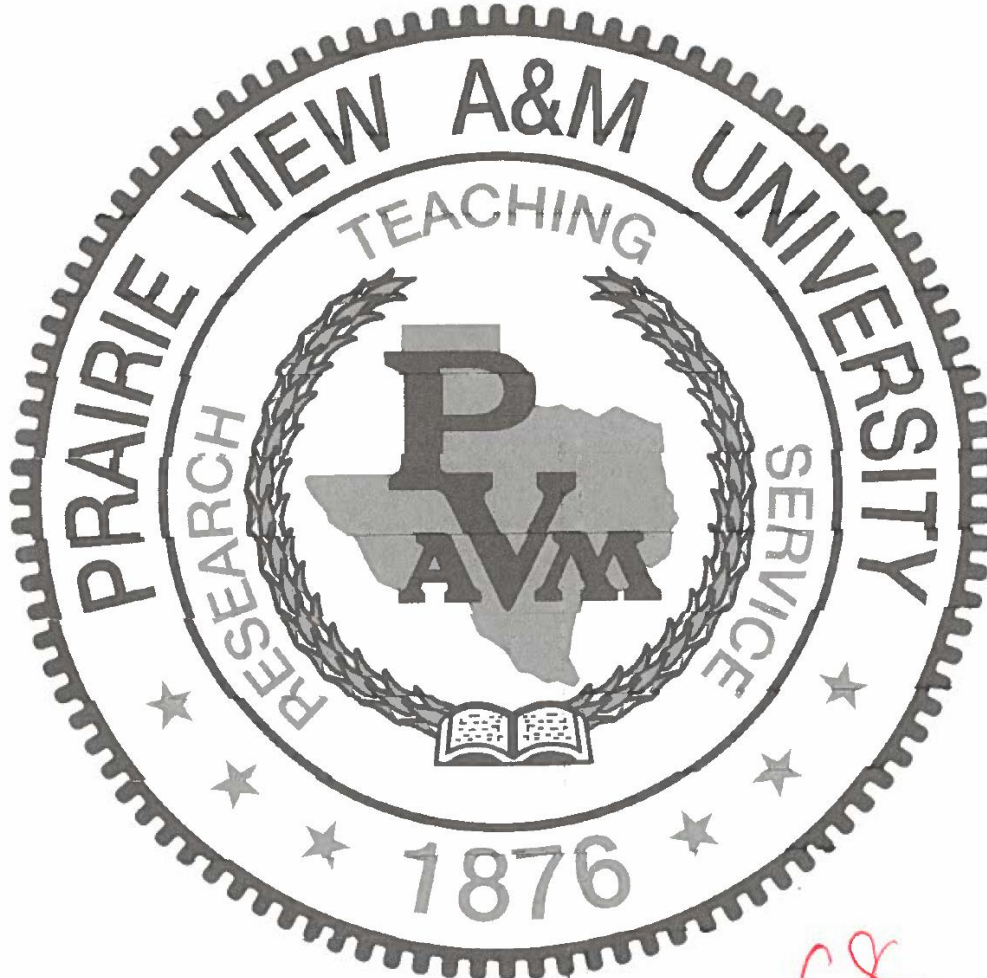
$$\sum F_y = 0; F_{CA} \cdot 4/5 - F_{CB} \sin 45 = 0$$

$$F_{CA} = 12.14 \text{ m --- } ④$$

$F_{DE} = 400 = 19.62$ $m = 20.387$
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BELOW AVERAGE

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CVEG 2301 P02

Engineering Mechanics HW

Due date : October 14, 2021

Submitted by : Alexxis Sterling

Submitted to: Dr. Choudhury

68
100
Roster

02

3-3

$$\sum F_y = 0$$

$$F \cos \theta + 4 \text{ kN} \sin 60^\circ = 8 \text{ kN} \sin 30^\circ$$

$$F \cos \theta = 0.5358 \text{ kN}$$

$$\sum F_x = 0$$

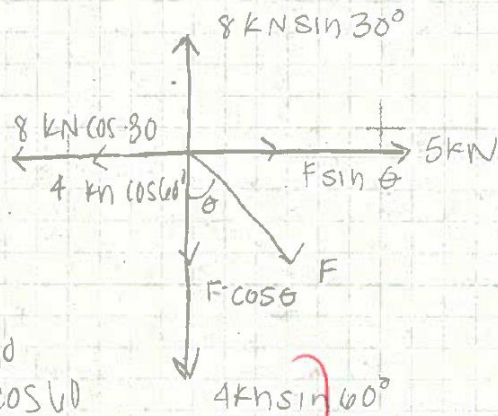
$$F \sin \theta + 5 \text{ kN} = 8 \text{ kN} \cos 30^\circ + 4 \text{ kN} \cos 60^\circ$$

$$F \sin \theta = -0.07179 \text{ kN} \quad (-2)$$

$$\tan \theta = \frac{-0.07179}{0.5358}$$

$$\theta = -7.63^\circ$$

$$F = \frac{0.5358 \text{ kN}}{\cos(-7.63^\circ)}$$



Not assigned

3-2

$$\tan x = \frac{4}{3}$$

$$\tan\left(\frac{4}{3}\right) = 53.13^\circ$$

$$F_2 \sin 70^\circ + F_1 \cos \theta = 5 \cos 30^\circ + 7 \sin 53.13^\circ$$

$$6 \sin 70^\circ + F_1 \sin \theta = 9.9301$$

$$F_1 \cos \theta = 4.29196$$

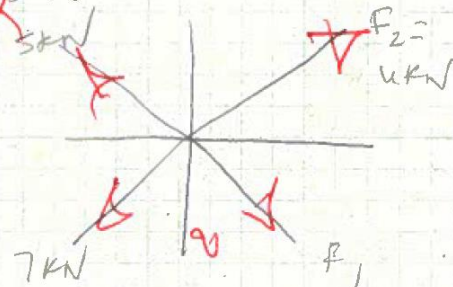
$$F_2 \cos 70^\circ + 5 \sin 30^\circ = F_1 \sin \theta + 7 \cos 53.13^\circ$$

$$F_1 \sin \theta = 6.35211$$

$$\frac{F_1 \sin \theta}{F_1 \cos \theta} = \frac{6.35211}{4.29196} = 1.4820$$

$$\tan \theta = 1.4820 \quad \theta = 4.69^\circ$$

$$F_1 = 4.3063$$



**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

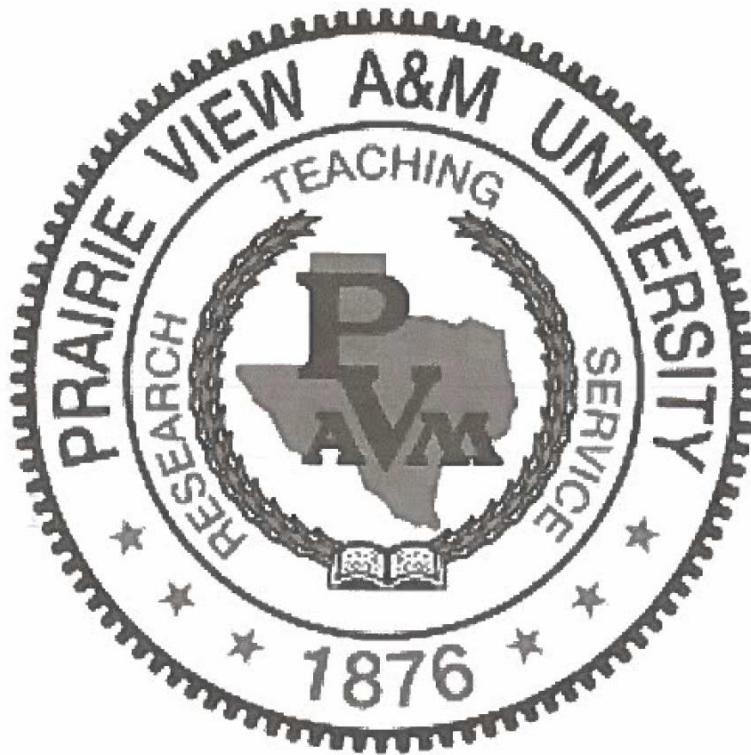
HOMEWORK 4

TOPICS COVERED IN HOMEWORK 4

- 1. Moment of a 2D force**
- 2. Moment of a 3D force, vector approach by cross product**
- 3. Moment of a couple**
- 4. Replacement of force and couple**
- 5. Replacement of distributed force**

ABOVE AVERAGE

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CVEG 2301 P02

Engineering Mechanics HW#4(Ch.4)

Problems: 4-5(pg138); 4-33(pg 142); 4-77(pg163); 4-103(pg174); 4-118(pg186);
4-151(pg198); 4-153(pg198); 4-157(pg199)

Assigned: October 26 , 2021

Due: November 2, 2021

Submitted by: Erika Rivera, Roster #17

Submitted to: Dr. Abdul M. Choudhury

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Frika Rivera

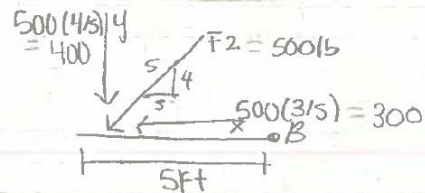
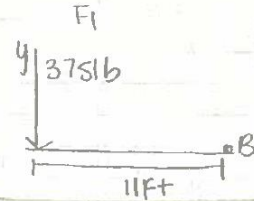
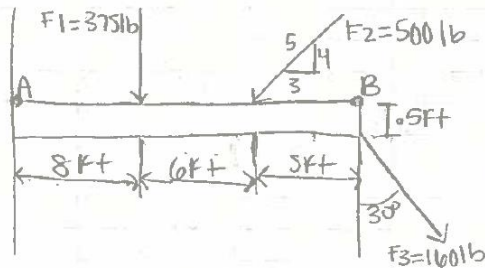
HWK 4- LVEG
2301

DUE: NOV. 2. 2021

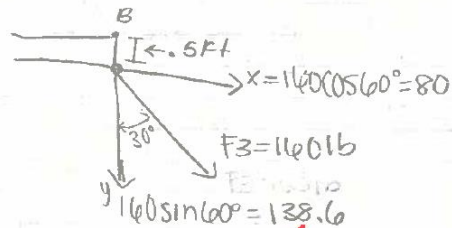
HOMEWORK Questions: 4-5 (pg 138); 4-33 (pg 142); 4-77 (pg 163);
4-103 (pg 174); 4-118 (pg 186); 4-151 (pg 178); 4-153 (pg 198);
4-157 (pg 199)

4-5:

Determine the moment about Point B of each of the three forces on the beam.



FORCE	distance	moment	sign
$F_1 = 375 \text{ lb}$	11 ft	$4125 \text{ ft}\cdot\text{lb}$	+
$F_2 y = 400 \text{ lb}$	5 ft	$2000 \text{ ft}\cdot\text{lb}$	+
$F_3 x = 80 \text{ lb}$	.5 ft	$40 \text{ ft}\cdot\text{lb}$	+



$$(\sum M)_1 = 4125 \text{ ft}\cdot\text{lb} \uparrow$$

$$= 4.125 \text{ k}\cdot\text{ft} \uparrow$$

$$(\sum M)_2 = 2000 \text{ ft}\cdot\text{lb}$$

$$= 2.0 \text{ k}\cdot\text{ft} \uparrow$$

$$(\sum M)_3 = 40 \text{ ft}\cdot\text{lb} \uparrow$$

✓
10

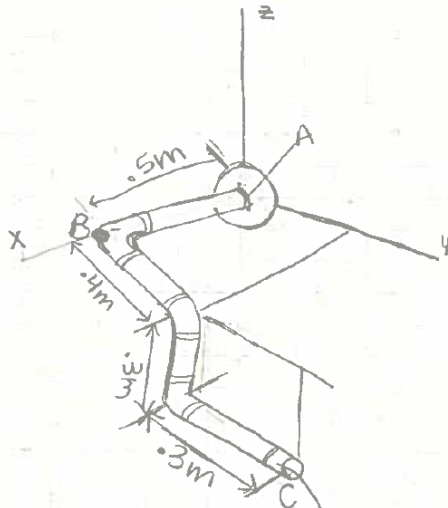
Erika Rivera

CUEG2301-HW4

Due: NOV. 2. 2021

4-33:

The pipe assembly is subjected to the force of $F = \{600i + 800j - 500k\} \text{ N}$. Determine the moment of this force about point B.



$$B = \{0.5m i + 0j + 0k\}$$

$$C = \{0.5m i + 0.7m j - 0.3m k\}$$

$$\Sigma (M_F)_B = \vec{r}_{BC} \times \vec{F}$$

$$\vec{r}_{BC} = \{0i + 0.7j - 0.3k\}$$

$$\vec{r}_{BC} = \{0i + 0.7j - 0.3k\}$$

$$F = \{600i + 800j - 500k\}$$

$$\begin{bmatrix} i & j & k \\ 0 & 0.7 & -0.3 \\ 600 & 800 & -500 \end{bmatrix}$$

$$M_B = [(0.7 \cdot 500) - (-0.3 \cdot 800)]i - [(0 \cdot 500) - (600 \cdot -0.3)]j + [(0 \cdot 800) - (600 \cdot 0.7)]k$$

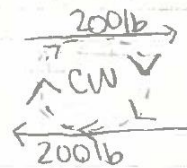
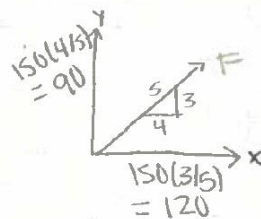
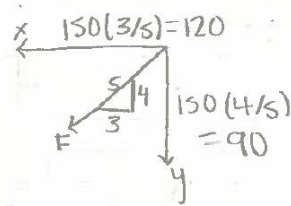
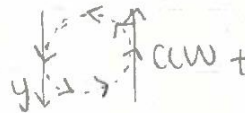
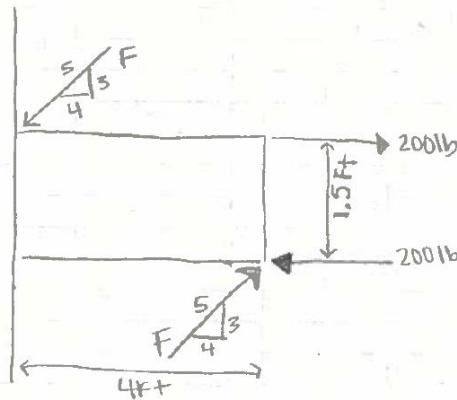
$$[-350 + 240]i + [0 + 180]j + [0 - 420]k$$

$$M_B = \{-110i - 180j - 420k\} \text{ N}\cdot\text{m}$$

10

4-77

TWO COUPLES act on the beam as shown.
 IF $F = 150 \text{ lb}$, determine the resultant couple moment



FORCE	distance	moment	sign
$x = 120$	1.5	180	+
$y = 90$	4	360	+
200	1.5	300	-

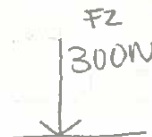
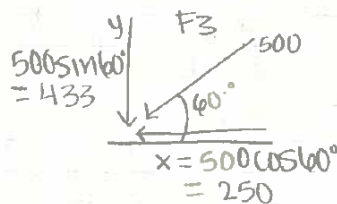
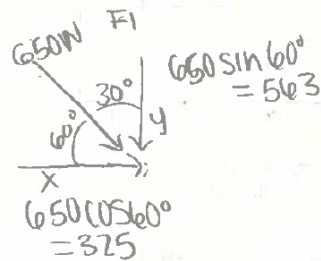
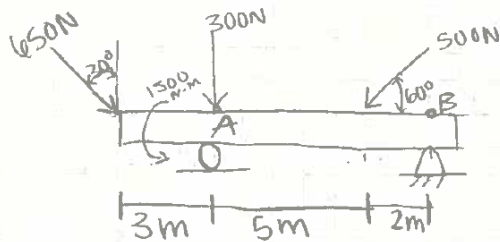
$$\sum M = 180 + 360 - 300$$

10

$$\sum M = 240 \text{ ft} \cdot \text{lb} \circlearrowleft$$

4-103

Replace the loading system acting on the post by an equivalent resultant force and couple moment at Point B.



$$\Sigma F = F_1 + F_2 + F_3$$

$$F_1 = 325i - 563j$$

$$F_2 = 0i - 300j$$

$$F_3 = -250i - 433j$$

+

$$F = 75i - 1296j$$

couple moment

$$G^+(m)_B = (563) + (300) + (433) + (1500)$$

$$= 10096 \text{ N}\cdot\text{m}$$

$$G^+(m)_B = 10.1 \text{ k}\cdot\text{N}\cdot\text{m}$$

Resultant force:

$$F_R = \sqrt{(75)^2 + (-1296)^2}$$

$$= 1298 \text{ N}$$

$$F_R = 1.3 \text{ kN}$$

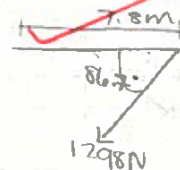
Angle:

$$\theta = \tan^{-1}\left(\frac{1296}{75}\right)$$

$$\theta = 86.7^\circ$$

$$\bar{x} = \frac{10096}{-1296} = 7.8 \text{ m}$$

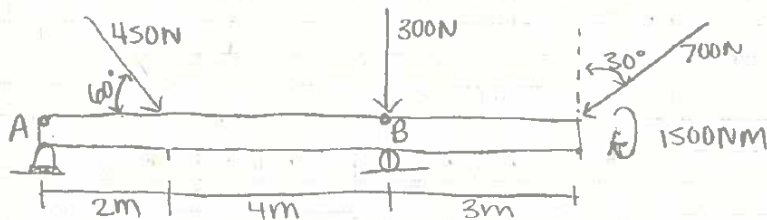
to the left



10

4-118:

Replace the loading acting on the beam by a single resultant force. Specify where the force acts, measured from B.



$$F_1 = 450 \sin 60^\circ = 389.71$$

$$450 \cos 60^\circ = 225$$

$$F_2 = 300$$

$$F_3 = 700 \sin 30^\circ = 350$$

$$x = 700 \cos 30^\circ = 606.2$$

$$\Sigma F = F_1 + F_2 + F_3$$

$$F_1 = (225i - 390j)$$

$$F_2 = (-300j)$$

$$F_3 = (-350i - 606.2j)$$

$$F = (-125i - 1296j)$$

Resultant Force:

$$F_R = \sqrt{(-125)^2 + (-1296)^2}$$

$$F_R = 1302 \text{ N}$$

Angle:

$$\theta = \tan^{-1}\left(\frac{-1296}{-125}\right)$$

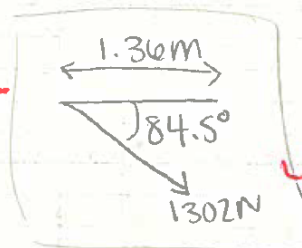
$$\theta = 84.5^\circ$$

Force	distance	Moment	Sign
389.71	4m	1560	+
606.2	3	1819	-
		1500	-
		$\Sigma (M)_B = -1758.9 \text{ N}\cdot\text{m}$	

$$\text{distance } \bar{x} = \frac{-1759}{-1296}$$

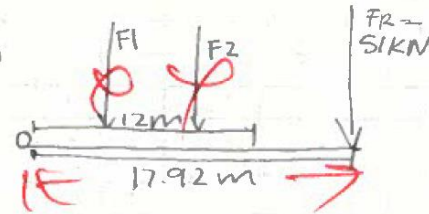
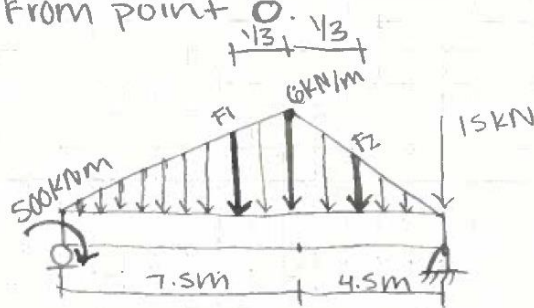
$$\bar{x} = 1.36 \text{ m to the right}$$

15



4-151

Replace the loading by a single resultant force and specify the location of the force measured from point O.

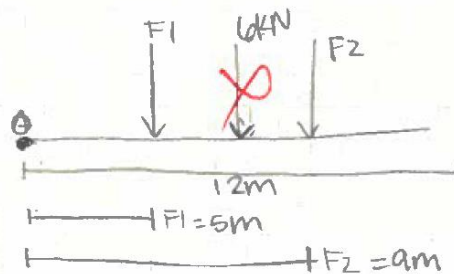


$$F_1 = 7.5 - \left(\frac{1}{3} \text{ of } 7.5\right)$$

$$7.5 - 2.5 = 5\text{m}$$

$$F_2 = 7.5 + \left(\frac{1}{3} \text{ of } 4.5\right)$$

$$7.5 + 1.5 = 9\text{m}$$



$$F_1 = \frac{6(7.5)}{2} = 22.5\text{ kN}$$

$$F_2 = \frac{6(4.5)}{2} = 13.5\text{ kN}$$

$$F_3 = 15\text{ kN}$$

$$F = 22.5 + 13.5 + 15$$

$$F = 51\text{ kN}$$

Force	distance	moment	sign
500		500	-
$F_1 = 22.5$	5m	112.5	-
$F_2 = 13.5$	9m	121.5	-
$F_3 = 15$	12	180	-

$$(M)_O = -500 - 112.5 - 121.5 - 180$$

$$(M)_O = -914 = 914.2$$

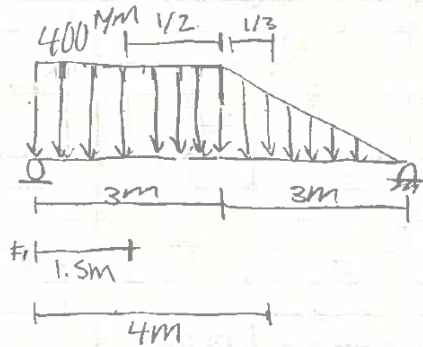
$$M = F \cdot d$$

$$d = \frac{-914}{51} = -17.92\text{m}$$

$$d = 17.92\text{m}$$

4-153

Replace the loading by a single resultant force, and specify its location on the beam measured from point A



distance

$$F1 = 3 - (1/2 \text{ of } 3) \\ 3 - 1.5 = 1.5 \text{ m}$$

$$F2 = 3 + (1/3 \text{ of } 3) \\ 3 + 1 = 4 \text{ m}$$

FORCE

$$F1 = (400)(3) \\ = 1200 \text{ N}$$

$$F2 = \frac{(400)(3)}{2} = 600 \text{ N}$$

moment due to A
FORCE distance moment sign

$$1200 \text{ N} \quad (1.5) \quad 1800 \quad -$$

$$600 \text{ N} \quad (4) \quad 2400 \quad -$$

$$(M)_A = -1800 - 2400$$

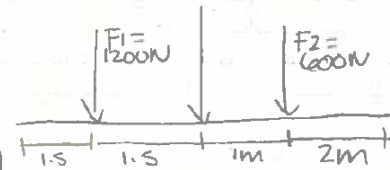
$$(M)_A = -4200 \text{ N}\cdot\text{m}$$

$$(C)_M_A = 4.2 \text{ kNm} \downarrow$$

$$F = (1200) + (600)$$

$$F = 1800 \text{ N}$$

$$F = 1.8 \text{ kN}$$



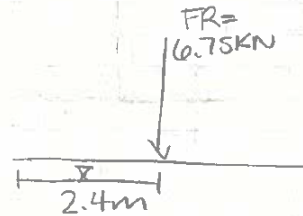
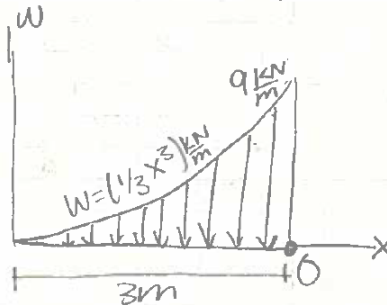
$$M_A = F_R \cdot d$$

$$4200 = 1800 \cdot d$$

$$d = \frac{4200}{1800} = 2.33 \text{ m}$$

4-157

Determine the equivalent resultant force and couple moment at point O.



$$F = \int_0^3 w dx = \int_0^3 \frac{1}{3} x^3 = \frac{1}{3} \left[\frac{1}{4} x^{4+3} \right]_0^3 = \frac{x^4}{12} \Big|_0^3$$

$$\frac{(3)^4}{12} - \frac{(0)^4}{12} = \boxed{6.75 \text{ kN}}$$

$$\bar{x} = \frac{\int_0^3 x \cdot w dx}{\int_0^3 w \cdot dx} = \frac{\int_0^3 x \cdot \left(\frac{1}{3} x^3\right) dx}{6.75 \text{ kN}} = \frac{16.2}{6.75} = 2.4 \text{ m}$$

$$\int_0^3 x \cdot w dx = \int_0^3 \frac{1}{3} x^4 = \frac{1}{3} \left[\frac{1}{5} x^{4+1} \right]_0^3 = \frac{x^5}{15} \Big|_0^3 = \frac{(3)^5}{15} - \frac{(0)^5}{15} = 16.2$$

$$\boxed{\bar{x} = 2.4 \text{ m}}$$

$$d = 3 - 2.4 = 0.6 \text{ m}$$

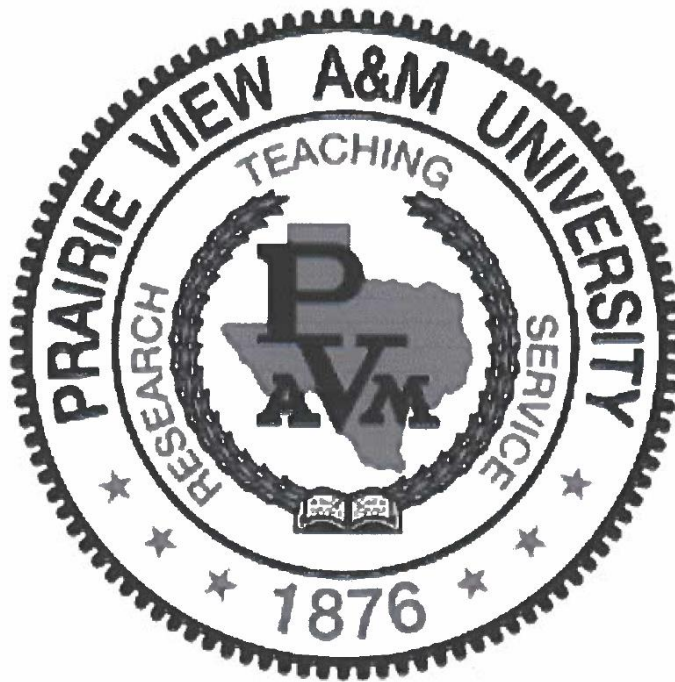
$$15 \quad M = F \cdot d$$

$$M = (6.75)(0.6 \text{ m})$$

$$\boxed{M = 4.05 \text{ kNm} \hookrightarrow}$$

AVERAGE

Prairie View A&M University



CVEG 2301 P02

Engineering Mechanics HW #4

Assigned: October 28, 2021

Due: November 2, 2021

Roster #25

Submitted by: Jayden Williams

Submitted to: Dr. Abdul M. Choudhury

92
TW

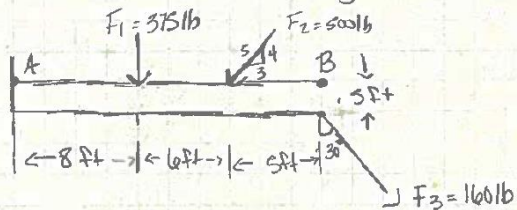
Jayden Williams

Hw 4

CVEG 2301

11/2/2021

4-5(135) Determine the moment about point B of each of the three forces acting on the beam



$$F_{2y} = 500 \frac{4}{5} = 400 \text{ lb}$$

$$F_{3y} = 160 \sin 30 = 80 \text{ lb}$$

~~Resolve~~

$$\begin{aligned} \uparrow (\sum M_1)_B &= +375(11) \\ &= +4125 \text{ ft}\cdot\text{lb} \end{aligned}$$

$$\begin{aligned} \uparrow (\sum M_2)_B &= +400(5) \\ &= +2,000 \text{ ft}\cdot\text{lb} \end{aligned}$$

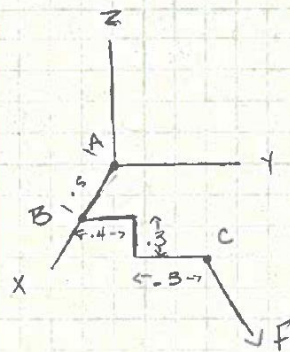
$$\uparrow (\sum M_3)_B = +80(5)$$

$$= +400 \text{ ft}\cdot\text{lb}$$

~~Σ~~



4-33(142) The pipe assembly is subjected to the force of $F = \{600i + 800j - 500k\}$ N. Determine the moment of this force about point B.



$$\vec{BC} = \vec{C} - \vec{B}$$

$$0i + 0.7j - 0.3k$$

$$\vec{B} = 0.5i + 0j + 0k$$

$$\vec{C} = 0.5i + 0.7j - 0.3k$$

$$(\sum M)_B = \vec{BC} \times \vec{F} = \begin{vmatrix} i & j & k \\ 0 & 0.7 & -0.3 \\ 600 & 800 & -500 \end{vmatrix} = \begin{vmatrix} i & j \\ 0 & 0.7 \\ 600 & 800 \end{vmatrix} - \begin{vmatrix} i & j \\ 0 & -0.3 \\ 400 & 800 \end{vmatrix}$$

$$= -360i - 180j + 0k$$

$$+240i - 0j - 420k$$

$$\boxed{-110i - 180j - 420k}$$

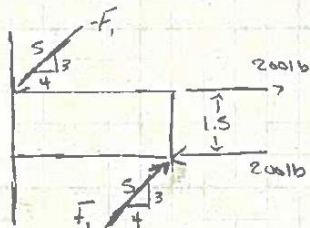
$$\vec{A} = 0i + 0j + 0k$$

$$\vec{B} = 0.5i + 0j + 0k$$

$$\vec{C} = 0.5i + 0.7j - 0.3k$$

10

4-77 (163) Two couples act on the beam as shown. If $F = 150 \text{ lb}$, determine the resultant couple moment.



$$F_x = 4/5(150) = .8F$$

$$F_y = 3/5(150) = .6F$$

$$\sum (\sum M) = F(4) + F_x(1.5) - 200(1.5)$$

$$= .6F(4) + .8F(1.5) - 200(1.5)$$

$$\sum M = 3.6F - 300$$

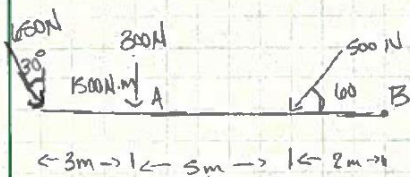
$$\sum M = 3.6(150) - 300$$

$$\boxed{\sum M = 240 \text{ ft}\cdot\text{lb}}$$

Resolve

8

4-103 (174) Replace the loading system acting on the post by an equivalent resultant force and couple moment at point B.



$$\vec{F} = F_1 + F_2 + F_3$$

$$F_1 = 325i - 562.9j$$

$$F_{1x} = 680 \sin 30 = 325$$

$$F_{1y} = 680 \cos 30 = -562.9$$

$$F_2 = -300j$$

$$F_3 = -250i - 433j$$

$$F_{3x} = -500 \cos 60 = -250$$

$$F_{3y} = -500 \sin 60 = -433$$

$$\vec{F} = 75i - 1295.9j$$

$$|\vec{F}| = 1298 \text{ N}$$

$$\theta = 86.7^\circ$$

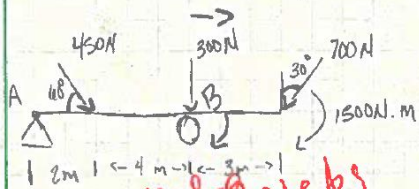
$$(\vec{M})_B = F_{1y}(10) + F_{2y}(7) + F_{3y}(2) + 1500$$

$$(\vec{M})_B = 10095 \text{ Nm}$$

Resolve

8

4-118 (136) Replace the loading acting on the beam by a single resultant force. Specify where the force acts, measured from B.



$$\sum F_y = -450 \sin 40 - 300 \text{ N} - 700 \cos 30$$

$$\sum F_y = -1295.93 \text{ N}$$

Resolve steps

$$F = M/d$$

$$\zeta (\sum M)_B = 4(450 \sin 40) - 3(700 \cos 30) - 1500$$

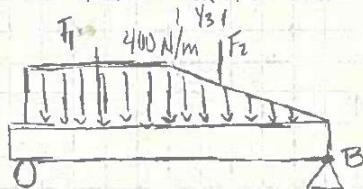
$$\zeta (\sum M)_B = -1759.81 \text{ N}\cdot\text{m}$$

$$d = \frac{1759.81 \text{ N}\cdot\text{m}}{1295.93 \text{ N}}$$

$$d = 1.358 \text{ m}$$

12

4-133(198) Replace the loading by a single resultant force, and specify its location on the beam measured from point A.



$$F_1 = 400(3) = 1200 \text{ N}$$

$$F_2 = \frac{400(3)}{2} = 600 \text{ N}$$

$$1 \leftarrow 3 \text{ m} \rightarrow 1 \leftarrow 3 \text{ m} \rightarrow 1$$

$$1 \leftarrow 1.5 \text{ m} \rightarrow 1$$

$$1 \leftarrow 4 \text{ m} \rightarrow 1$$

$$F_R = F_1 + F_2$$

$$F_R = 1800 \text{ N}$$

$$\sum (M_A) = F_1(1.5) + F_2(4)$$

$$(1200)$$

$$(600)$$

$$\sum (M_A) = 4200 \text{ N} \cdot \text{m}$$

15

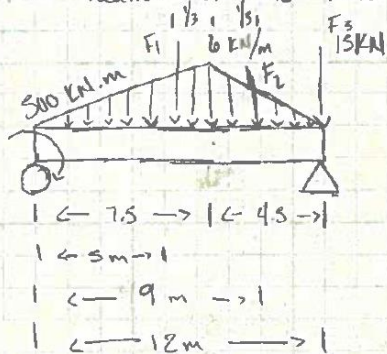
$$M_A = F_R \cdot d$$

$$4200 = 1800 \cdot d$$

$$d = 2.33 \text{ m}$$



4-151 (198) Replace the loading by a single resultant force, and specify the location of the force measured from point O.



$$F_1 = \frac{1}{2}(7.5)(6) = 22.5 \text{ kN}$$

$$F_2 = \frac{1}{2}(4.5)(6) = 13.5 \text{ kN}$$

$$F_3 = 15 \text{ kN}$$

$$F_R = F_1 + F_2 + F_3$$

$$F_R = 51 \text{ kN}$$

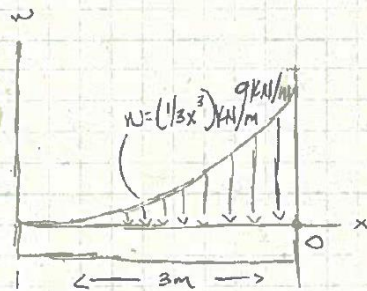
$$+\circlearrowleft M_O = 500 \text{ kN} \cdot \text{m} + F_1(5) + F_2(9) + F_3(12)$$

$$+\circlearrowleft M_O = 914 \text{ kN} \cdot \text{m}$$

$$914 = 51 \text{ kN} \cdot d$$

$$d = 17.92 \text{ m}$$

4-157 (199) Determine the equivalent resultant force and couple moment at point O.



$$F = \int_0^3 w dx = \int_0^3 \frac{1}{3}x^3 dx = \left[\frac{x^4}{12} \right]_0^3$$

$$\bar{x} = \frac{\int_0^3 x \cdot w dx}{\int_0^3 w dx} = \frac{\int_0^3 \frac{x^4}{3} dx}{6.75} = 6.75 \text{ kN}$$

$$= \frac{\frac{x^5}{5}}{6.75} \Big|_0^3 = 2.4 \text{ m}$$

$$M = F \cdot d$$

$$\boxed{F \cdot M = 6.75 (3 - 2.4) = 4.05 \text{ kNm}}$$

15

BELOW AVERAGE

Prairie View A & M University

CVEG 2301 P02

Engineering Mechanics I HW 4

Problems: 4-5, 4-33, 4-77, 4-103, 4-118, 4-151, 4-153, 4-157

Assigned October 28, 2021

Due November 2, 2021

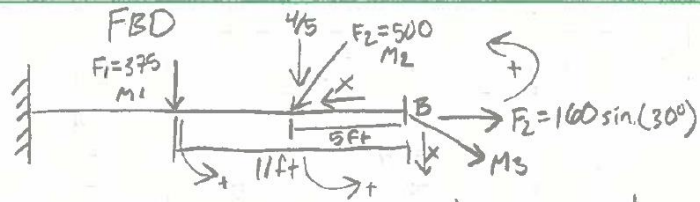
Submitted by: Manuel Reyes #16

Submitted to: Dr. Abdul M. Choudhury

78
100

Manuel Reyes #16

HW#4 4-5

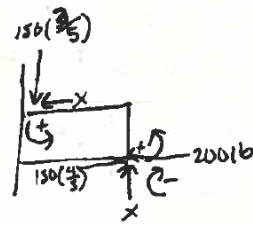
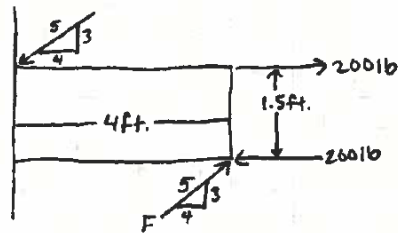


Force	Distance	Moment	Sign
$M_1 / 375\text{lb}$	11ft	4125lbft	$\curvearrowleft +$
$M_2 / 500(\frac{4}{5})\text{lb}$	5ft	2000lbft	$\curvearrowleft +$
$M_3 / 160 \sin(30^\circ)$	0.5ft	40lbft	$\curvearrowleft +$

10

Manuel Reyes #16

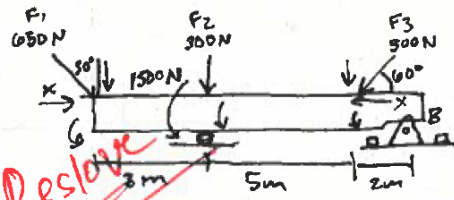
HW #4 4-77



$$(M)_R = 150\left(\frac{4}{5}\right)(1.5) + 150\left(\frac{3}{5}\right)(4) - 200(1.5)$$

$$\boxed{\sum M = 240 \text{ lb}\cdot\text{ft}}$$

10



~~Resolva~~

$$|\Sigma F| = 75\uparrow - 1295.9\downarrow$$

$$\sqrt{(75)^2 + (1295.9)^2} = \Sigma F = 1298\text{ N}$$

$$\theta = \tan^{-1}\left(\frac{-1295.9}{75}\right) = 86.7^\circ$$

$$\Sigma F = F_1 + F_2 + F_3$$

$$F_{1x} = 650 \sin 30^\circ = 325\uparrow$$

$$F_{1y} = 650 \cos 30^\circ = -562.9\downarrow$$

$$F_2$$

$$F_{2y} = -300\downarrow$$

$$F_3$$

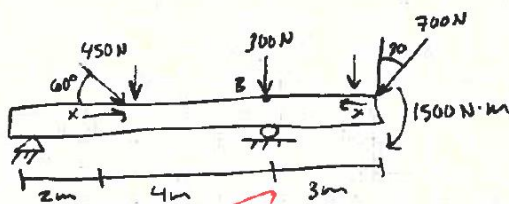
$$F_{3x} = -500 \cos 60^\circ = -250\downarrow$$

$$F_{3y} = -500 \sin 60^\circ = -433\downarrow$$

~~8~~

$$\Sigma (M)_B = +562.9(10) + (1300(7)) + (1433(2)) + 1500 = 10,095\text{ N}\cdot\text{m}$$

ΣM



Resolve

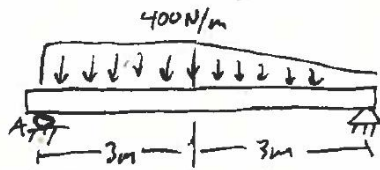
$$+\uparrow \sum F_y = -450 \sin 60^\circ - 300 - 700 \cos 30^\circ$$

$$\sum F_y = -1295.93 \text{ N}$$

$$\sum \mathcal{M}_B = 4 \cdot (450 \sin 60^\circ) - 5(700 \cos 30^\circ) - 1500 = -1759.81 \text{ N}\cdot\text{m}$$

$$\text{point} = \frac{1759.81}{1295.93} = 1.358 \text{ m to the right of B}$$

12



FRY =

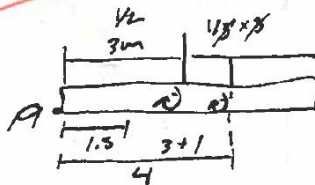
$$P_1 = 400 \times 3 = 1200 \text{ kN} \quad P_2 = \frac{1}{2} \times 3 \times 400 = 600 \text{ kN}$$

$$3 + \frac{2}{3} \times 3 = 5$$

$$F_R = 1200 + 600 = 1800 \text{ kN}$$

$$600 \times \frac{2}{3} = 400$$

$$\bar{x} = \frac{(1200 \times 3) + (600 \times 5)}{1800} = 3.67 \text{ m}$$



Moments			
Force	Distance	Moment	Sign
P1 1200	(1.5)	1800	-
P2 600	(4)	2400	-

$$\sum M_A = -1800 - 2400 = -4200 \text{ kN}\cdot\text{m}$$

$$\bar{x} = F_R \cdot d$$

$$\frac{4200}{1800} = \frac{1800 \cdot d}{1800} = 2.33 \text{ m}$$

**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

HOMEWORK 5

TOPICS COVERED IN HOMEWORK 5

- 1. Rigid body equilibrium**
- 2. Support reaction**
- 3. Simple truss**
- 4. Method of joints**
- 5. Method of section**

ABOVE AVERAGE



CVEG 2301 P02

Engineering Mechanics HWK – CH.5-6

Assigned: November 9, 2021

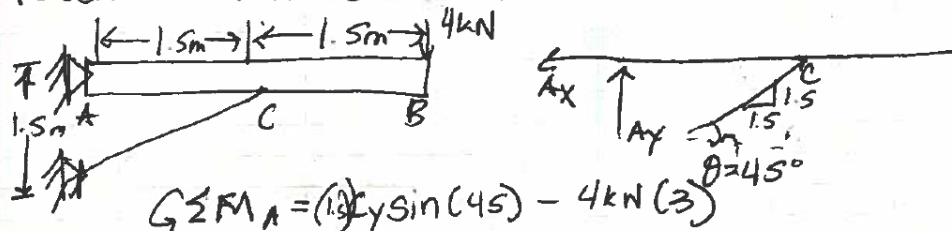
Due: November 11, 2021

Submitted by: Craig Rothschild, Roster #18

Submitted to: Dr. Abul M. Choudhury

100
/w

F2-2 (233) Determine the horizontal and vertical components of reaction at the pin A and the reaction on the beam at C.



$$\sum \mathcal{M}_A = (1.5) C_y \sin(45^\circ) - 4 \text{ kN} (3)$$

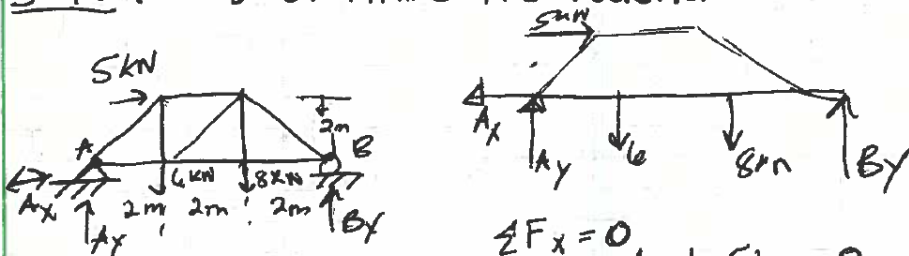
$$C_y = \frac{12 \text{ kN}}{(1.5) \sin(45^\circ)} = 8 \text{ kN}$$

$$\sum F_y = 0 \quad A_y + 8 \text{ kN} - 4 \text{ kN} = A_y = 4 \text{ kN}$$

$$\begin{aligned} \sum F_x = 0 \\ A_x + C_x = 0 \\ A_x + 8 \text{ kN} = 0 \\ A_x = -8 \text{ kN} \end{aligned}$$

$$\begin{aligned} C_y &= 8 \text{ kN} = 6.85 \cdot 65 \text{ kN} \\ C_x &= 5.65 \text{ kN} \\ A_x &= -8 \text{ kN} \\ A_y &= 4 \text{ kN} \end{aligned}$$

5-15 (234) Determine the reactions at the supports



$$\begin{aligned} \sum F_x = 0 \\ -A_x + 5 \text{ kN} = 0 \\ A_x = 5 \text{ kN} \end{aligned}$$

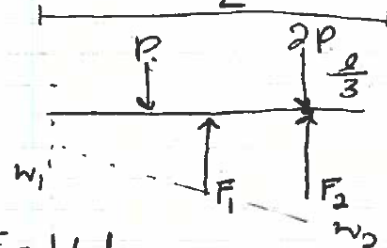
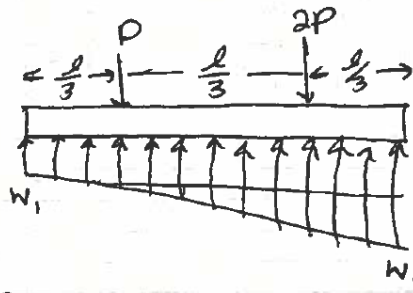
$$\begin{aligned} \sum \mathcal{M}_A = 0 \\ -(5 \text{ kN})(2 \text{ m}) - (6 \text{ kN})(2 \text{ m}) - (8 \text{ kN})(4 \text{ m}) + (B_y)(6 \text{ m}) = 0 \end{aligned}$$

$$B_y = \frac{10 + 12 + 32}{6} = \frac{54}{6} = 9 \text{ kN}$$

$$\begin{aligned} \sum F_y = 0 \\ A_y - 6 \text{ kN} - 8 \text{ kN} + 9 = 0 \\ A_y = 5 \text{ kN} \end{aligned}$$

$$\begin{aligned} A_x &= 5 \text{ kN} \\ A_y &= 5 \text{ kN} \\ B_y &= 9 \text{ kN} \end{aligned}$$

5-58(287) determine the load intensities w_1 and w_2 for equilibrium in terms of the parameters shown.



$$F_1 = w_1 L$$

$$F_2 = (w_2 - w_1) L/2$$

$$\sum \tau = 0$$

$$\frac{1}{2} - \frac{1}{3}$$

$$-(+F_1)(L/2) + P(L/3) = 0$$

$$= -w_1 L (L/2) + P(L/3)$$

$$= -w_1 L (0.1667) + P(0.3333)$$

$$2P = w_1 L$$

$$w_1 = 2P/L$$

$$P = (w_2 - 2P/L) L/2$$

$$\frac{2P}{L} = w_2 - \frac{2P}{L}$$

$$w_2 = 4P/L \quad w_1 = \frac{2P}{L}$$

$$\begin{aligned} F_1 &= w_1 L \\ F_2 &= 2P \end{aligned}$$

$$\sum F_x = 0$$

$$F_1 + F_2 - P - 2P = 0$$

$$F_1 + 2P - P - 2P = 0$$

$$F_1 - P = 0$$

$$F_1 = P$$

$$\sum F_y = 0$$

$$F_1 + F_2 - 3P = 0$$

$$2P + F_2 - 3P = 0$$

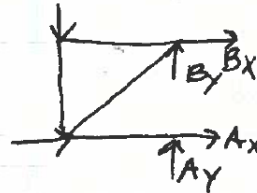
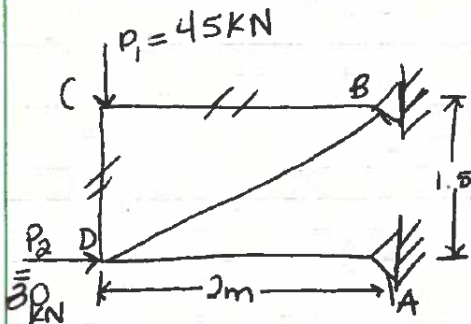
$$F_2 = P$$

Craig Rothschild

HW#-5
CVEG 2301

11/09/21

6.2 (237) Determine the force in each member of the truss and state if the members are in tension or compression. Set $P_1 = 45 \text{ kN}$, $P_2 = 30 \text{ kN}$.



Joint C



$$\sum F_x = 0, F_{CB} = 0$$

$$\sum F_y = 0, 45 \text{ kN} - F_{CD} = 0$$

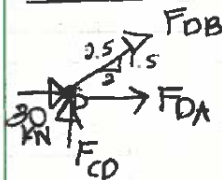
$$F_{CD} = -45 \text{ kN}$$

$$F_{CB} = 0, F_{CD} = -45 \text{ kN (compression)}$$

$$F_{DB} = 75 \text{ kN (tension)}$$

$$F_{DA} = -90 \text{ kN (compression)}$$

Joint D



$$\sum F_y = 0, F_{CD} + \frac{1.5}{2.5} F_{DB} = 0$$

$$F_{DB} = (-F_{CD}) \left(\frac{2.5}{1.5} \right)$$

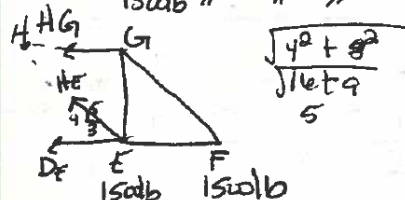
$$= (-45) \left(\frac{2.5}{1.5} \right)$$

$$= 75 \text{ kN}$$

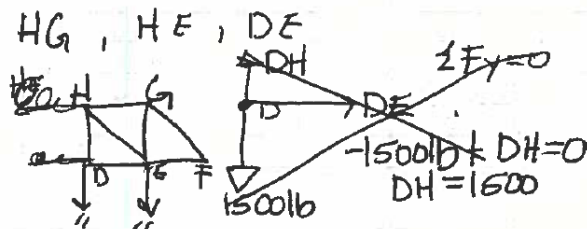
$$\sum F_x = 0, 30 + F_{DA} + \frac{2}{2.5} (F_{DB}) = 0$$

$$30 + F_{DA} + \left(\frac{2}{2.5} \right) (75) = 0$$

$$F_{DA} = -90 \text{ kN}$$

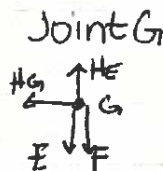


$$\frac{\sqrt{4^2 + 9^2}}{\sqrt{16+9}}$$



$$\begin{aligned} \sum M_E &= 0 \\ 4HG - 1500(3\text{ft}) &= 0 \\ HG &= \frac{1500(3)}{4} \\ &= +1125\text{ lb (Tension)} \end{aligned}$$

Joint H $\sum M_H = 0$ $\sum F = +11257 \text{ lb}$
 $-DE(4) - 1500 \text{ lb}(3) - 1500 \text{ lb}(6) = 0$
 $-DE = \frac{1500 \text{ lb} + 1500 \text{ lb}}{4}$
 $DE = -3375 \text{ lb (compression)}$



$$\sum F_y = 0$$

$$\left(\frac{2}{5}\right) H_E - E - F = 0$$

" $H_E = 3750.06$ (Tension)

$$\begin{aligned} H_G &= 1125 \text{ lb (T)} \\ H_E &= 3750 \text{ lb (T)} \\ D_E &= 3375 \text{ lb (C)} \end{aligned}$$



AVERAGE

Prairie View A&M University



CVEG 2301 P02

Engineering Mechanics HW #5

Assigned: October 2, 2021

Due: November 11, 2021

Submitted by: Tyson Morris, Roster #12

Submitted to: Dr. Abdul M. Choudhury

85
/w

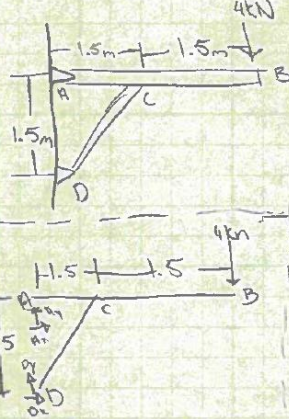
Tyson Morris

HW 5

11/10/2021

Questions: F5-2(233), 5-15(234), 5-58(243), 6-2(257), 6-29(260)

F5-2(233):



$$\sum M_A = -4(3) + R_{CD} \sin 45^\circ (1.5) = 0$$

$$R_{CD} = 11.314 \text{ kN/m}$$

$$\sum F_y = 0 = A_y - R_{CD} \sin 45^\circ - 4 = 0$$

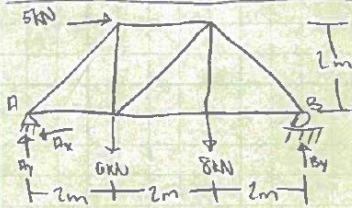
$$11.2 \text{ kN} = A_y$$

$$\sum F_x = A_x - 11.314 \cos 45^\circ = 0$$

$$A_x = 8 \text{ kN}$$

Determine the horizontal & vertical components of Reaction A and the reaction on the beam C

5-15(234): Determine the reactions at the supports.



$$\sum F_x = -A_x + 5 = 0$$

$$A_x = 5 \text{ kN}$$

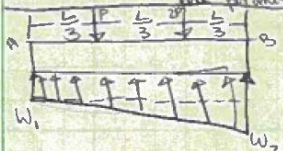
$$\sum M_B = 0 = -5(2) - A_y(6) + 6(4) + 8(2)$$

$$A_y = 5 \text{ kN}$$

$$\sum F_y = 0 = 5 - 6 - 8 + B_y$$

$$B_y = 9 \text{ kN}$$

5-58(243): The beam is subjected to the two concentrated loads. Assuming that the foundation exerts a linearly varying load distribution on its bottom, determine the load intensities, w_1 & w_2 for equilibrium in terms of the parameters shown.



$$w_1 L = F_1 \quad \frac{1}{2}(w_2 - w_1)L = F_2$$

$$\sum M_A = 0 = -F_1 \left(L \left(\frac{1}{2} - \frac{1}{3} \right) \right) + P \frac{L}{3}$$

$$w_1 = \frac{F_1}{L}$$

$$w_1 = \frac{2P}{L}$$

$$\sum F_y = 0 = 2P - F_2 - 3P$$

$$F_2 = P$$

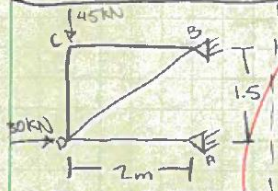
$$P = \frac{1}{2}(w_2 - w_1)L$$

$$P = \frac{1}{2} \left(w_2 - \frac{2P}{L} \right) L$$

$$P = \frac{L w_2}{2} - P$$

$$2P = \frac{L w_2}{2}$$

$$\frac{4P}{L} = w_2$$



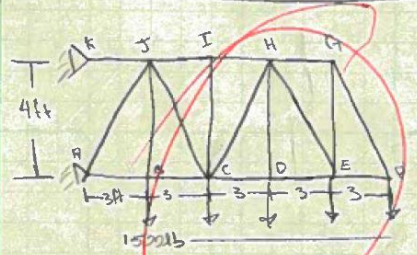
$$\sum F_{CD} = 45 \text{ kN compressive}$$

$$\begin{aligned} F_{CD} &= F_{DB} \sin 56.87^\circ \\ 45 &= F_{DB} (0.6) \\ \boxed{75} &= F_{DB} \text{ tensile} \end{aligned}$$

$$\Sigma F_x = 0 = 30 - DA + 75 \cos 36.87^\circ$$

$$DA = 30 + 60$$

$$DA = 90 \text{ KN compressive}$$



$$\sum M_B = 0 = A_G(4) - 1500(3)$$

$$A_G = 1125 \text{ lb tensile}$$

$$\circlearrowleft M_A = 0 = -(1500 \times 3) - (1500 \times 6) + (DE \times 4)$$

$$DE = 3375 \text{ lb compressive}$$

$$\Sigma F_x = 0 = DE - HG - HE \cos 53.13$$

$$3375 - 1125 - HE(0.6)$$

$$HE = 3750 \text{ lb tensile}$$

$$\tan^{-1}\left(\frac{4}{3}\right) = 53.13^\circ$$

10

BELOW AVERAGE

Prairie View A&M University



CVEG 2043 PO2

Engineering Mechanics HW #5

Problems: F5-2 (233), 5-15(234), 5-58(243), 6-2(287) & 6-29(298)

Assigned: November 4, 2021

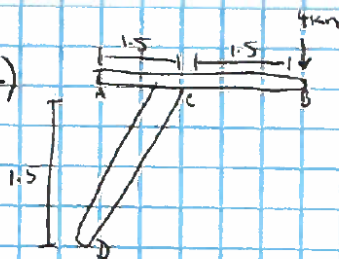
Due: November 11, 2021

Submitted by: Zachary Taylor

Submitted to: Dr. Abdul M. Choudhury

Handwritten signature in red ink, possibly reading "ZT" over "1/200".

F5-2)



$$\rightarrow \sum F_x = 0 \quad \Delta H + R_{CD} \cos 45 = 0$$

$$\rightarrow \sum F_y = 0 \quad A_V + R_{CD} \sin 45 = 4$$

$$\rightarrow \sum M_A = 0 \quad R_{CD} \sin 45 (1.5) = 4(3)$$

$$R_{CD} = \frac{12}{\sin 45 (1.5)} = \boxed{11.315 \text{ kN}}$$

$$\Delta V = -11.315 \sin 45 + 4$$

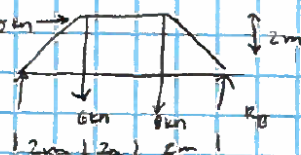
$$\Delta V = -4 \text{ kN}$$

$$\Delta V = 4 \text{ kN compression}$$

$$\Delta H = -11.315 \cos 45 = -8 \text{ kN}$$

$$\Delta H = -8 \text{ kN compression}$$

5-15)



$$R_A (2+2+2) + 5(2) - 6 \times (2+2) - 8(2) = 0$$

$$\frac{6R_A}{6} = \frac{30}{6}$$

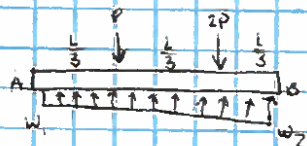
$$\boxed{R_A = 5 \text{ kN}}$$

$$R_A + R_B = 6 + 8$$

$$\frac{5 \text{ kN}}{-5} + R_B = \frac{14}{-5}$$

$$\boxed{R_B = 9 \text{ kN}}$$

5-58)



$$\sum F_y = 0$$

$$w_1 \times L + \frac{1}{2} \times (w_2 - w_1) \times L = P + 2P$$

$$w_1 L + \frac{w_2 L}{2} - \frac{w_1 L}{2} = 3P$$

$$\frac{w_1}{2} + \frac{w_2}{2} = \frac{3P}{L} \rightarrow w_1 + w_2 = \frac{6P}{L}$$

$$w_1 = \frac{2P}{L} = \frac{2(500)}{12} = w_1 = \boxed{83.31 \text{ lb/ft}}$$

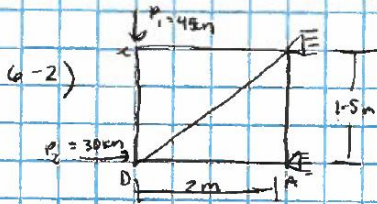
$$w_2 = \frac{4P}{L} = \frac{4(500)}{12} = w_2 = \boxed{166.66 \text{ lb/ft}}$$

$$\frac{w_1 L^2}{2} + \frac{w_2 L^2}{6} - \frac{w_1 L^2}{4} = \frac{4PL}{3}$$

$$\frac{3w_1 + w_2 - w_1}{4} = \frac{4P}{3L}$$

$$2w_1 + w_2 = \frac{8P}{L}$$

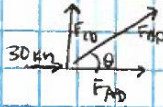
$$w_2 = \frac{6P}{L} - \frac{2P}{L} = \frac{4P}{L}$$



Joint C $\sum F_y = 0 \rightarrow P_2 + F_{CD} = 0$

$F_{CD} = -P_2 = -45 \text{ kN}$
compression

Joint D



$\theta = \tan^{-1}\left(\frac{1.5}{2}\right)$

$\sin \theta = 0.6$
 $\cos \theta = 0.8$

$F_{CD} + F_{BD} \sin \theta = 0$

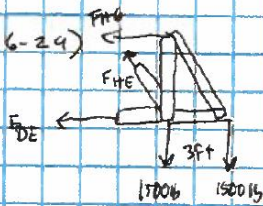
$F_{BD} = \frac{-F_{CD}}{\sin \theta} = \frac{-(-45)}{0.6} = 75 \text{ kN}$
tension

$\sum F_x = 0$

$F_{BD} \cos \theta + F_{DA} + 30 = 0$

$F_{DA} = -75 \times 0.8 - 30 = -90 \text{ kN}$

90 kN compression



$\sum M_E = 0$

$(F_{HG} \times 4) - (1500 \times 3) = 0$

$F_{HG} = 1125 \text{ lb}$ tension

$\sum F_y = 0$

$F_{FE} \left(\frac{4}{\sqrt{3^2+4^2}} \right) - (1500 \times 2) = 0$

$F_{FE} = 3750 \text{ lb}$ tension

$\sum F_x = 0$

$F_{HG} + F_{DE} + F_{FE} \left(\frac{3}{\sqrt{3^2+4^2}} \right) = 0$

$F_{DE} = 3375 \text{ lb}$
compression

$-F_{DE} = 0.6(3750) + 1125$

**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

HOMEWORK 6

TOPICS COVERED IN HOMEWORK 6

- 1. Internal forces**
- 2. Shear force diagram (SFD)**
- 3. Bending Moment Diagram**

ABOVE AVERAGE

Prairie View A&M University



CVEG 2301 P02

Engineering Mechanics HW#6 (Ch. 7)

Problems: 7-2(353), 7-7(354), 7-15(355), 7-47(366), 7-56(367)

Assigned: November 18, 2021

Due: November 23, 2021

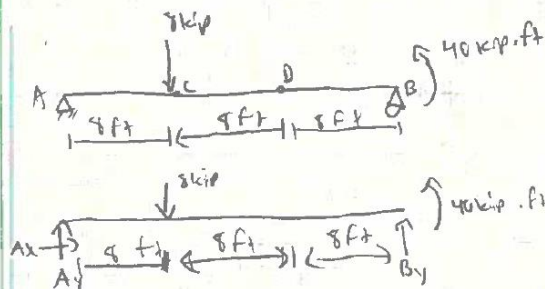
Submitted by: Michael Bogues, Roster #3

Submitted to: Dr. Abdul M. Choudhury

100
100

Michael Boquios

7-2 (pg. 353) Determine the internal normal force and shear force, and the bending moment in the beam at points C and D. Assume the support at B is a roller. Point C is located just to the right of the 8-kip load.

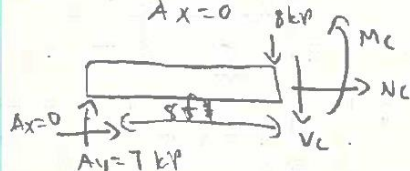


$$\begin{aligned} \sum \curvearrowright M_A &= 0 \\ B_y \times 24 + 40 - 8 \times 8 &= 0 \\ B_y &= 1 \text{ kip} \end{aligned}$$

$$\begin{aligned} \sum \uparrow F_y &= 0 \\ A_y + 1 - 8 &= 0 \\ A_y &= 7 \text{ kip} \end{aligned}$$

$$\sum \rightarrow F_x = 0$$

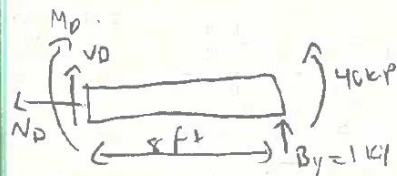
$$A_x = 0$$



$$\begin{aligned} \sum \rightarrow F_x &= 0 \\ N_c + 0 &= 0 \rightarrow N_c = 0 \end{aligned}$$

$$\sum \uparrow F_y = 0; 7 - 8 - V_c = 0 \rightarrow V_c = -1 \text{ kip}$$

$$\sum \curvearrowright M_C = 0; M_c - 7(8) = 0 \rightarrow M_c = 56 \text{ kip-ft}$$



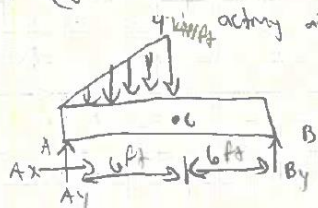
$$\begin{aligned} \sum \rightarrow F_x &= 0 \\ N_D + 0 &= 0 \rightarrow N_D = 0 \end{aligned}$$

$$\sum \uparrow F_y = 0; V_D + 1 = 0 \rightarrow V_D = -1 \text{ kip}$$

$$\sum \curvearrowright M_D = 0; 1 \times 8 + 40 - M_D = 0 \rightarrow M_D = 48 \text{ kip-ft}$$

Michael B-gues

7-7 (pg. 354) Determine the internal shear force and moment acting at point C in the beam.



$$+\uparrow \sum F_y = 0$$

$$A_y + B_y - \frac{1}{2}(6)(4) = 0$$

$$A_y + B_y = 12 \text{ kV} \quad \text{--- ①}$$

$$(\rightarrow) \sum M_A = 0$$

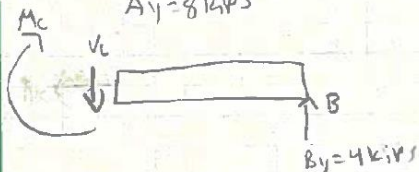
$$B_y \times 12 - \frac{1}{2}(6)(4) \left(\frac{2}{3} \right)(6) = 0$$

$$12B_y - 48 = 0$$

$$B_y = 4 \text{ kips}$$

$$A_y + 4 = 12$$

$$A_y = 8 \text{ kips}$$



$$+\uparrow \sum F_y = 0$$

$$B_y - V_c = 0$$

$$V_c = B_y = 4 \text{ kips}$$

$$(\rightarrow) \sum M_c = 0$$

$$B_y(6) - M_c = 0$$

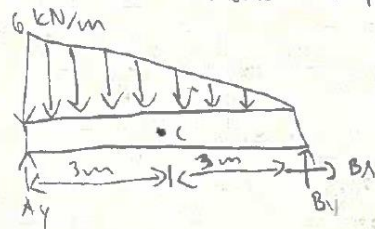
$$4(6) - M_c = 0$$

$$M_c = 24 \text{ kip}\cdot\text{ft}$$



Michael Bagues

7-15 (Pg. 355) Determine the internal normal force, shear force, and moment at point C.



$$\sum M_A = 0$$

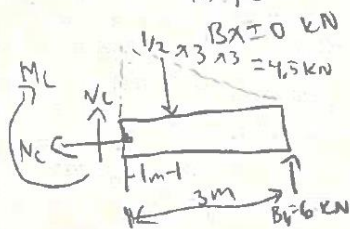
$$B_y \times 6 - \frac{1}{2} (6) (6) \times \frac{1}{3} (6) = 0$$

$$B_y \times 6 - 18 (2) = 0$$

$$B_y = 6 \text{ kN}$$

$$\sum F_x = 0$$

$$B_x + 0 = 0$$



$$\sum F_x = 0$$

$$-N_C + 0 = 0$$

$$N_C = 0$$

$$\sum F_y = 0$$

$$V_C - 4.5 + 6 = 0$$

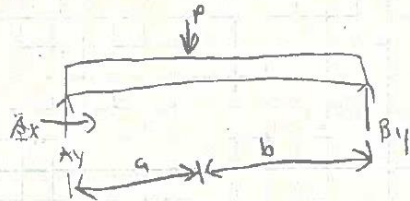
$$V_C = -1.50 \text{ kN}$$

$$-M_C - 4.5 \times 1 + 6(3) = 0$$

$$M_C = 13.50 \text{ kN}\cdot\text{m}$$

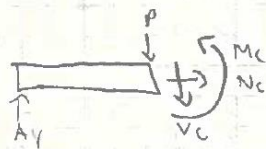
Michael Bogues

7-47 (pg. 366) Draw the shear and moment diagrams for the beam (a) in terms of the parameters shown; (b) set $P = 600 \text{ lb}$, $a = 5 \text{ ft}$, $b = 7 \text{ ft}$.



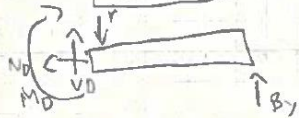
$$\begin{aligned} \sum M_B &= 0 \\ -A_y \times 12 + 600 \times 7 &= 0 \\ A_y &= 350 \text{ lb} \end{aligned}$$

$$\begin{aligned} \sum M_A &= 0 \\ B_y \times 12 - 600 \times 5 &= 0 \\ B_y &= 250 \text{ lb} \end{aligned}$$



$$\begin{aligned} \sum F_y &= 0 \\ 350 - 600 - V_c &= 0 \\ V_c &= -250 \text{ lb} \end{aligned}$$

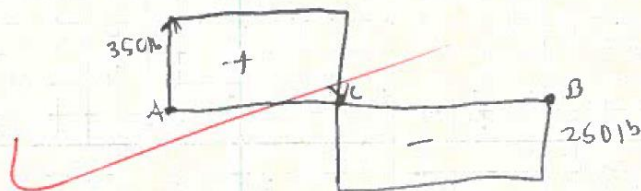
$$\begin{aligned} \sum M_c &= 0 \\ -350 \times 5 + M_c &= 0 \\ M_c &= 1750 \text{ lb}\cdot\text{ft} \end{aligned}$$



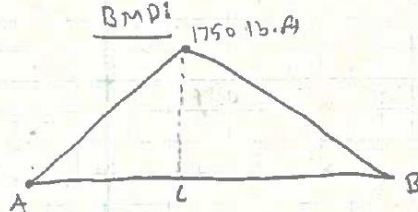
$$\begin{aligned} \sum F_y &= 0 \\ 250 - 600 + V_D &= 0 \\ V_D &= 350 \text{ lb} \end{aligned}$$

$$\begin{aligned} \sum M_D &= 0 \\ 250 \times 7 - M_D &= 0 \\ M_D &= 1750 \text{ lb}\cdot\text{ft} \end{aligned}$$

SFD:

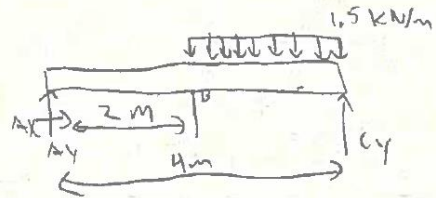


BMD:



Michael Bogues

7-56 (Pg. 367) Draw the shear and moment diagrams for the beam.



$$\sum \circlearrowleft M_A = 0$$

$$C_y \times 4 - 1.5 \times 2 \times \left(2 + \frac{2}{2}\right) = 0$$

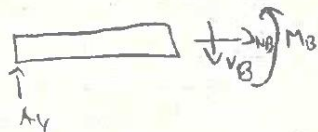
$$C_y = 2.25 \text{ kN}$$

$$\sum \rightarrow F_x = 0$$

$$A_y + C_y - 1.5 \times 2 = 0$$

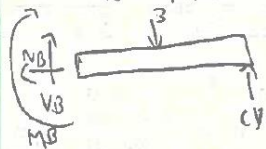
$$A_y + 2.25 - 3 = 0$$

$$A_y = 0.75 \text{ kN}$$



$$V_B = A_y = 0.75 \text{ kN}$$

$$M_B = A_y \times x = 0.75 \times 2 = 1.5 \text{ kNm}$$



$$\sum \rightarrow F_x = 0$$

$$V_B + C_y - 3 = 0$$

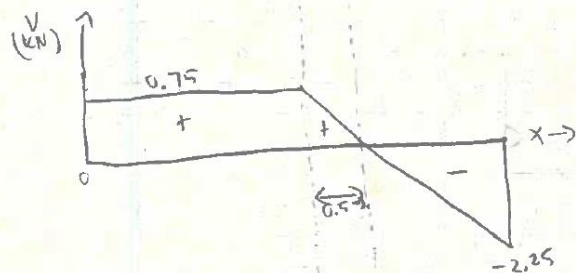
$$V_B = 3 - 2.25 = 0.75 \text{ kN}$$

$$-M_B + 2.25 \times 2 - 3 \times 1 = 0$$

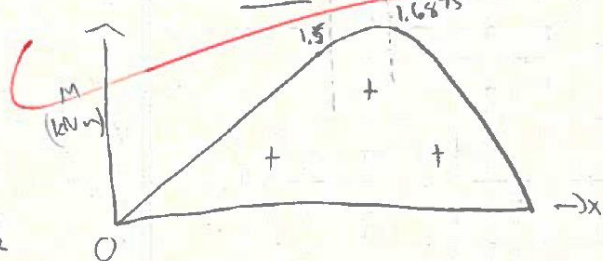
$$M_B = 1.5 \text{ kNm}$$

$$\begin{aligned} M_{\text{max}} &= 0.75 \times (x) - 1.5 \frac{(x-2)^2}{2} \\ &= 0.75 \times (2.5) - 1.5 \frac{(2.5-2)^2}{2} \\ &= 1.875 - 0.1875 \\ &= 1.6875 \text{ kNm} \end{aligned}$$

SFD:

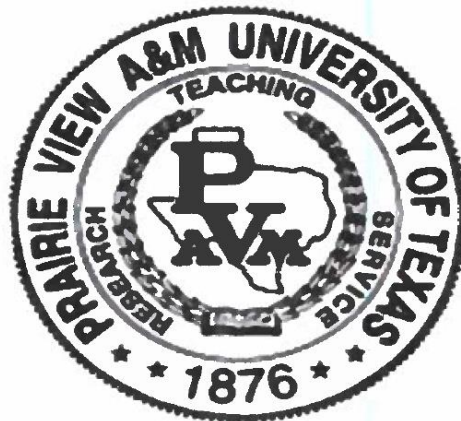


BMD:



AVERAGE

Prairie View A&M University



CVEG 2301 P01

Engineering Mechanics HW#6

Assigned: November 16, 2021

Due: November 23, 2021

Submitted by: Daniel Benitez Roster:#2

Submitted to Dr. Abdul M. Choudhury

85
100

Daniel Benitez

HW #6

7-2 (353)

$$\sum M_A = 0$$

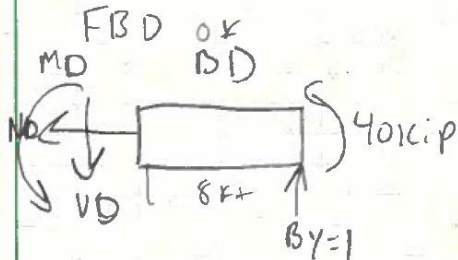
$$-8(8) + B_y(24) + 40 = 0$$

$$B_y = 1$$

$$\sum F_y = 0$$

$$A_y - 8 + 1 = 0$$

$$A_y = 7$$



$$\sum F_x = 0$$

$$N_D = 0$$

$$\sum F_y = 0$$

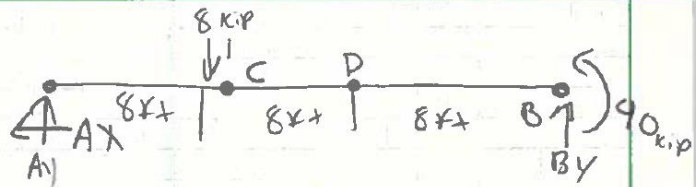
$$1 - V_D = 0$$

$$V_D = 1 \text{ kip}$$

$$\sum M_D = 0$$

$$-1(8) - 40 - M_D = 0$$

$$\sum M_D = -48 \text{ kip-ft}$$

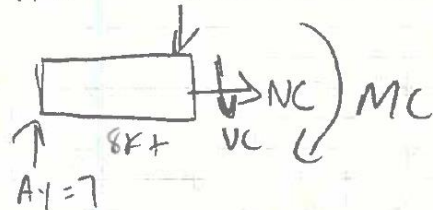


$$\sum F_x = 0$$

$$A_x = 0$$

FBD

AC



$$\sum F_x = 0$$

$$N_C = 0$$

$$\sum F_y = 0$$

$$7 - 8 - V_C = 0$$

$$V_C = -1 \text{ kip}$$

$$\sum M_C = 0$$

$$7(8) - M_C = 0$$

$$M_C = 56 \text{ kip-ft}$$

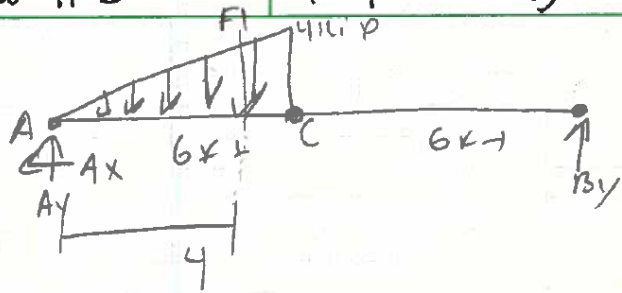


Daniel Benitez

HW #6

7-7 (384)

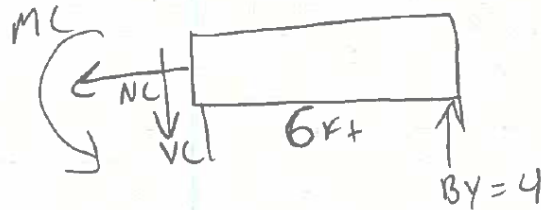
$$F_1 = 12$$



$$\sum M_A = 0$$

$$B_y(12) - 12(4) = 0$$

$$B_y = 4$$

FBD
BC

$$\sum F_x = 0$$

$$N_c = 0$$

$$\sum F_y = 0$$

$$4 - V_c = 0$$

$$V_c = 4$$

$$\sum M_c = 0$$

$$4(6) - M_c = 0$$

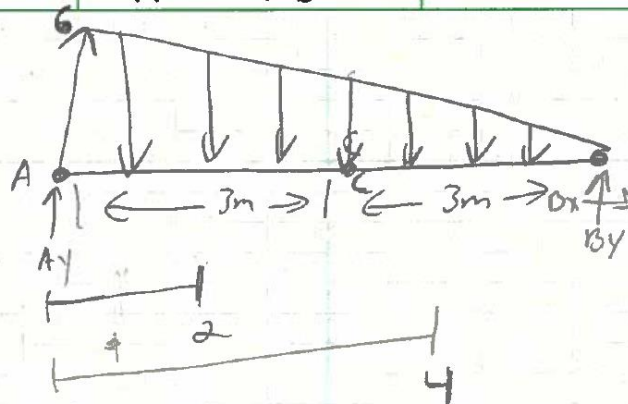
$$M_c = 24 \text{ } \curvearrowright$$

Daniel Benitez

HW #6

7-15 (355)

$$F_1 = \frac{6 \times 6}{2} = 18$$



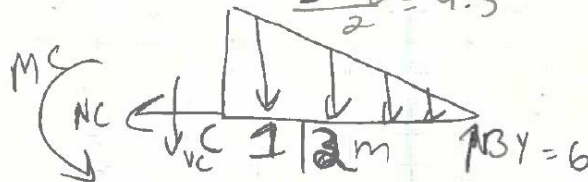
$$\sum M_A = 0$$

$$B_y(6) - 18(2) = 0$$

$$B_y = 6$$

FBD of BC

$$\frac{6 \times 3}{2} = 4.5$$



$$\sum F_x = 0$$

$$N_C = 0$$

$$\sum F_y = 0$$

$$6 - 4.5 - V_C = 0$$

$$V_C = 1.5 \text{ kN}$$

$$\sum M_C = 0$$

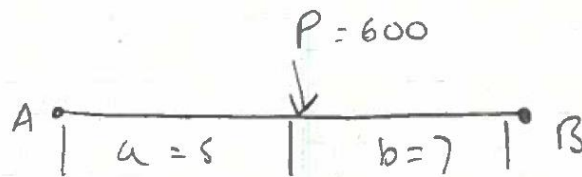
$$6(3) - 4.5(1) - M_C = 0$$

$$M_C = 13.5 \text{ kN}\cdot\text{m}$$

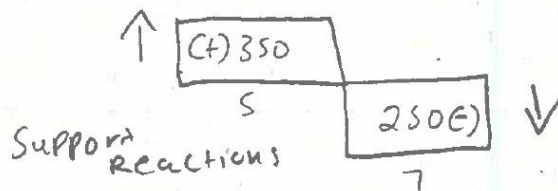
Daniel Benitez

HW #6

7-47(366)



FBD

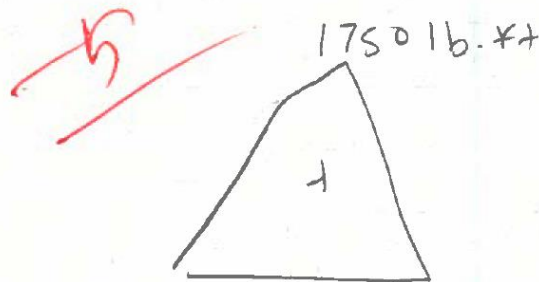


$$R_A = \frac{600 \times 7}{12} = 350 \text{ lb}$$

$$R_B = \frac{600 \times 5}{12} = 250 \text{ lb}$$

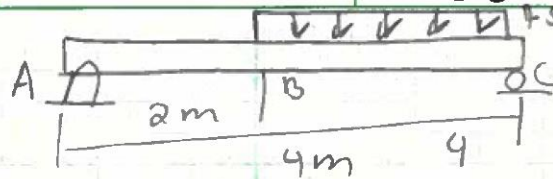
Bending moment

$$M_S = R_A \times 5 = 0 = 350 \times 5 = 1,750$$

Equal

Daniel Benitez HW #6

7-56 (367)



$$A_x = 0$$

$$\sum M_A = 0$$

$$C_y(4) - (1.5)(2)(3) = 0$$

$$C_y = 2.25$$

$$\sum F_y = 0$$

$$A_y + C_y = (1.5)(2)$$

$$A_y = (3) - 2.25$$

$$A_y = 0.75$$

$$\sum M_A = 0$$

$$0.75 \times 0$$

$$= 0 \text{ kN}$$

BC

$$\sum F_y = 0$$

$$A_y - 1.5(x-2) - V = 0$$

$$0.75 - 1.5(x-2) - V = 0$$

$$V = (3.75 - 1.5x)$$

$$\sum M = 0$$

$$M + \left(\frac{1.5}{2}\right)(x-2)^2 - 0.75 = 0$$

$$M = (-0.75x^2 + 3.75x - 3)$$

B

$$M = (-0.75(4)^2 + 3.75(4) - 3)$$

$$= 1.5$$

$$M_{max} = (-0.75(2.5)^2 + 3.75(2.5) - 3)$$

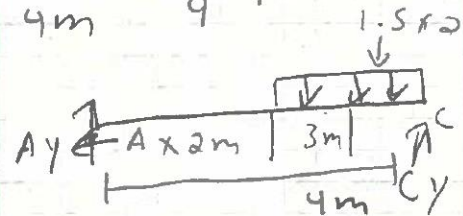
$$= 1.6875$$

$$M_{max} = 0$$

$$-0.75x^2 + 3.75x - 3 = 0$$

$$-1.5x + 3.75 = 0$$

$$x = 2.5$$



$$\sum F_x = 0$$

$$A_x - V = 0$$

$$V = 0.75$$

$$\sum M_B = 0$$

$$0.75(2) = 1.5$$

B

$$V = (3.75 - 1.5x) \times 2$$

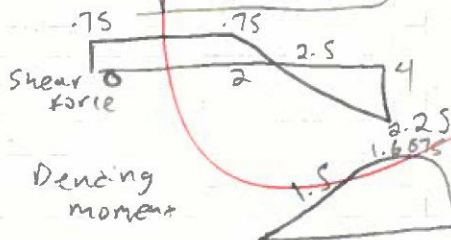
$$V = 2.25$$

$$C_y = (3.75 - 1.5) \times 4$$

$$V = 0.75$$

$$M = (-0.75(4)^2 + 3.75(4) - 3)$$

$$= 0$$



BELOW AVERAGE

Prairie View A&M University



Omar Sifuentes

Engineering Mechanics I

Homework # 6

CVEG 2301 P02

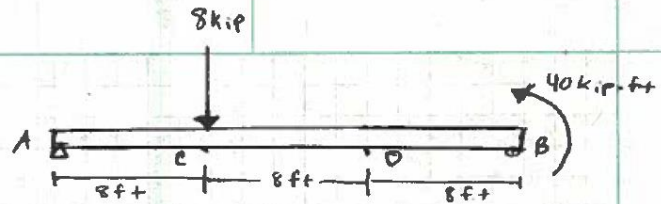
Date assigned: November 16, 2021

Date due: November 23, 2021

Submitted to: Dr. Abdul M. Choudhury

70/100

7-2 (353)



① $\sum M_A = 0$
 $8k(8) - 40 - B_y(24) = 0$
 $B_y = 1 \text{ kip}$ ✓

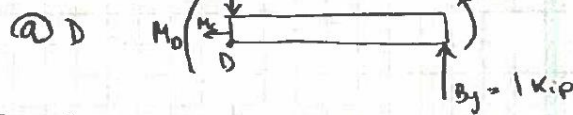
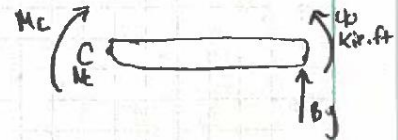
$\sum F_y = 0$
 $-V_c + B_y = 0$

$V_c = -1 \text{ kip}$ ✓

$\sum F_x = 0$
 $N_c = 0$ ✓

② $\sum M_c = 0$
 $M_c - 40 - 16(1)$

$M_c = 56 \text{ kip-ft}$ ✓



$\sum F_y = 0$
 $-V_c + B_y = 0$

$V_c = 1 \text{ kip}$ ✓

③ $\sum M_D = 0$
 $M_D - 40 - B_y(8) = 0$

$M_D = 48 \text{ kip-ft}$ ✓

$\sum F_x = 0$

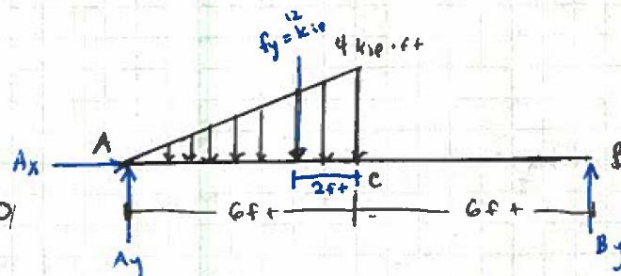
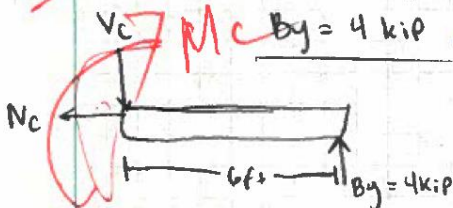
$N_D = 0$ ✓

7-7 (354)

$\frac{1}{2} 4 \cdot 6 \text{ ft} = 12 \text{ kip-ft}$
 $f_y = 12 \text{ kip}$

① $\sum M_A = 0$; $4 \cdot 12 - B_y \cdot 12 = 0$

$B_y = 4 \text{ kip}$ ✓



$\sum F_x = 0$; $-N_c = 0$

$N_c = 0$ ✓

② $\sum M_c = 0$; $M_c - 4 \text{ kip} \cdot 6 \text{ ft} = 0$

$M_c = 24 \text{ k-p-ft}$ ✓

$\sum F_y = 0$

$-V_c + 4 = 0$

$V_c = 4 \text{ kip}$ ✓

7-15 (355)

$$\sum M_A = 0;$$

$$B_y(6) = \frac{1}{2}(6)(6)\left(\frac{1}{3} \cdot 6\right)$$

$$B_y(6) = 36$$

$$B_y = 6 \text{ kN} \checkmark$$

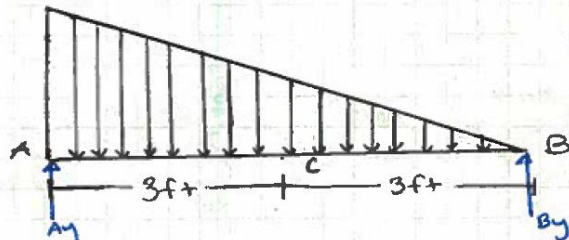
$$\sum V = 0$$

$$A_y + B_y = \frac{1}{2}(6)(6)$$

$$A_y = 18 - 6$$

$$A_y = 12 \text{ kN} \checkmark$$

0 kN/m



$$SF_c = B_y - \frac{1}{2}(3)(3) = 6 - 4.5$$

$$SF_c = 1.5 \text{ kN} \checkmark$$

$$NF_c = 0 \checkmark$$

$$M_c = B_y(3) - \frac{1}{2}(3)(3)\left(\frac{1}{3} \cdot 3\right) = 6 \cdot 3 - 4.5$$

$$M_c = 13.5 \text{ kN}\cdot\text{m} \checkmark$$

7-47 (366)

$$B_y \cdot 12 = 600 \cdot 15$$

$$B_y = 250 \text{ lb} \checkmark$$

Upward = downward

$$A_y + B_y = 600$$

$$A_y = 600 - 250$$

$$A_y = 350 \text{ lb} \checkmark$$

Finding Bending Moment

$$\text{At point B, } M_B = 0 \checkmark$$

$$\text{At point C, } M_c = 250 \cdot 7 = 1750 \text{ lb}\cdot\text{ft} \checkmark$$

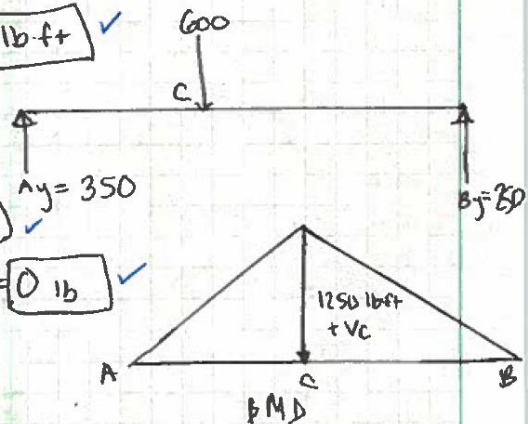
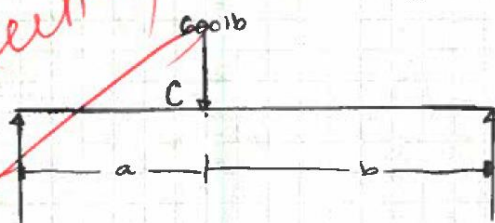
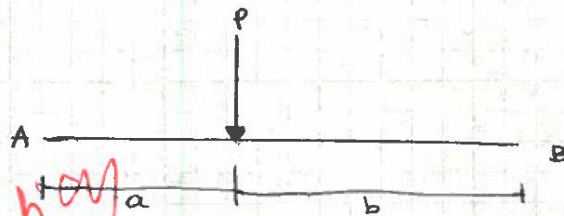
$$\text{At point A, } M_A = 250 \cdot 12 - 600 \cdot 5 = 0 \text{ lb}\cdot\text{ft} \checkmark$$

Finding Shear Force

$$\text{At point B, } S_B = -250 \text{ lb} \checkmark$$

$$\text{At point C, } S_c = 600 - 250 = 350 \text{ lb} \checkmark$$

$$\text{At point A, } S_A = S_A = 350 - 350 = 0 \text{ lb} \checkmark$$



7-56(367)

$$\sum M_A = 0$$

$$C_y(4) - (1.5)(2)(3) = 0$$

$$C_y = 2.25 \text{ kN}$$

$$\sum F_y = 0$$

$$A_y + C_y = (1.5)(2)$$

$$A_y = 3 \text{ kN} - 2.25 \text{ kN}$$

$$A_y = 0.75 \text{ kN}$$

$$\sum F_y = 0$$

$$A_y - V = 0$$

$$V = 0.75 \text{ kN}$$

$$\sum M = 0$$

$$M - 0.75x = 0$$

$$M = (0.75x) \text{ kN}\cdot\text{m}$$

$$M_A = (0.75)(0)$$

$$= 0 \text{ kN}$$

$$M_B = (0.75)(2)$$

$$= 1.5 \text{ kN}\cdot\text{m}$$

$$\sum F_y = 0$$

$$A_y - 1.5(x-2) - V = 0$$

$$0.75 - 1.5(x-2) - V = 0$$

$$V = (3.75 - 1.5x) \text{ kN}$$

At point B

$$V = \cancel{0.75 \text{ kN}} (3.75 - 1.5(2))$$

$$V = 0.75 \text{ kN}$$

$$\sum M = 0$$

$$M + (1.5/2)(x-2)^2 - 0.75x = 0$$

$$M = (-0.75x^2 + 3.75x - 3) \text{ kN}\cdot\text{m}$$

At point B,

$$M = (-0.75)(2)^2 + 3.75(2) - 3$$

$$= 1.5 \text{ kN}\cdot\text{m}$$

At point C,

$$M = (-0.75)(4)^2 + 3.75(2) - 3$$

$$= \cancel{1.5 \text{ kN}\cdot\text{m}} = 0 \text{ kN}\cdot\text{m}$$

$$(M_{max}) = 0$$

$$\frac{d}{dx}(M) = \frac{d}{dx}(-0.75x^2 + 3.75x - 3)$$

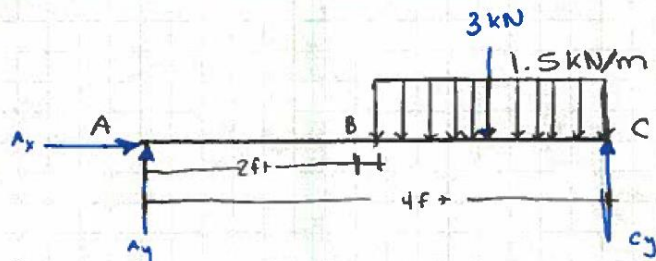
$$= -1.5x + 3.75 = 0$$

$$x = 2.5 \text{ m}$$

$$M_{max} = (-0.75)(2.5)^2 + 3.75(2.5) - 3$$

$$= 1.6875 \text{ kN}\cdot\text{m}$$

$$\boxed{1.6875 \text{ kN}\cdot\text{m}}$$



Section

Diagram

10

**CVEG 2301 ENGINEERING MECHANICS I
FALL 2021**

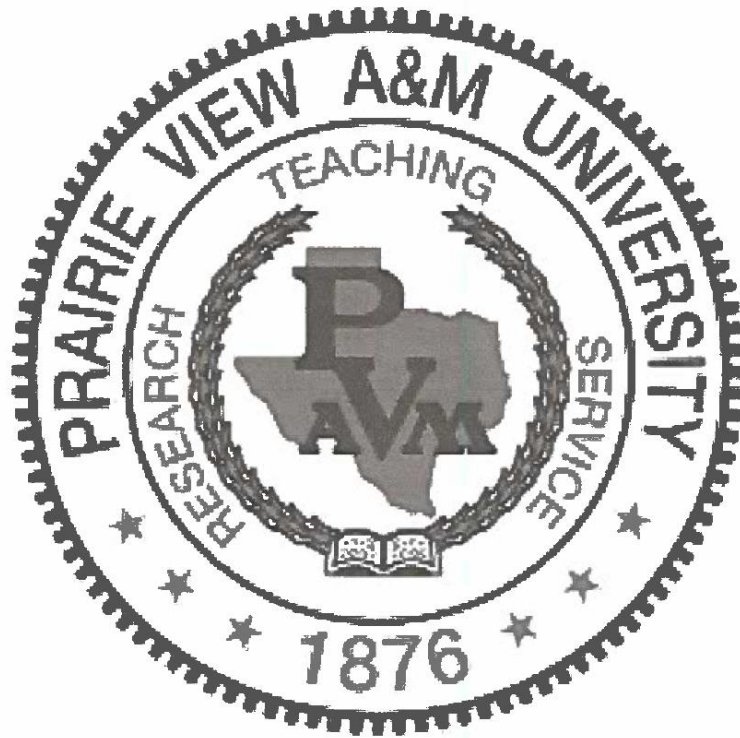
HOMEWORK 7

TOPICS COVERED IN HOMEWORK 7

- 1. Centroid of a composite body**
- 2. Moment of Inertia**
- 3. Parallel axis theorem**
- 4. Radius of gyration**

ABOVE AVERAGE

Prairie View A&M University



CVEG 2301 P02

Engineering Mechanics HW#7(Ch.9 & Ch.10)

Problems: 9-11(482), 9-61(496), 9-62(496), 10-34(545), 10-35(545)

Assigned: November 25 , 2021

Due: November 30, 2021

Submitted by: Erika Rivera, Roster #17

Submitted to: Dr. Abdul M. Choudhury

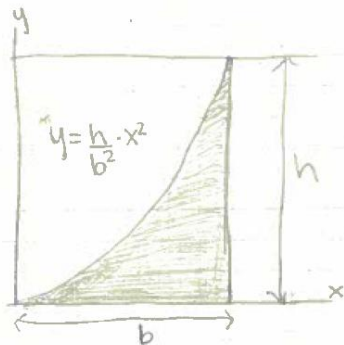
A

Enika Rivera

CUEG 2301-HW#7

Due: 11-30-2021

9-11 (482)

locate the centroid $\bar{x}$ of the area

$$\bar{x} = \frac{\int_0^b x \cdot [y] \, dx}{\int_0^b [y] \, dx}$$

$$\bar{x} = \frac{\int_0^b x \cdot \left[\frac{h}{b^2} \cdot x^2\right] \, dx}{\int_0^b \left[\frac{h}{b^2} \cdot x^2\right] \, dx}$$

$$\frac{\frac{h}{b^2} \int_0^b [x^3] \, dx}{\frac{h}{b^2} \int_0^b [x^2] \, dx} = \frac{\left[\frac{x^4}{4}\right]_0^b}{\left[\frac{x^3}{3}\right]_0^b}$$

$$= \frac{\left[\frac{b^4}{4} - \frac{0^4}{4}\right]}{\left[\frac{b^3}{3} - \frac{0^3}{3}\right]} = \left[\frac{b^4}{4}\right] \cdot \left[\frac{3}{b^3}\right] = \frac{3}{4}b$$

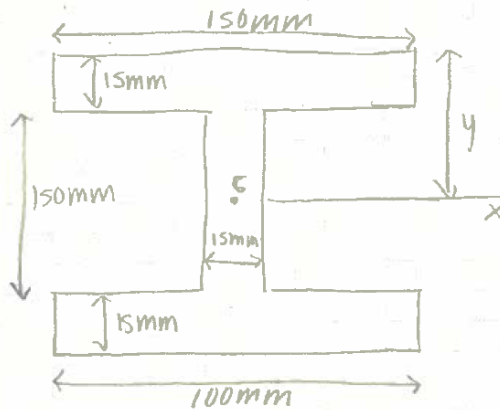
$$\boxed{\bar{x} = \frac{3}{4}b}$$

Erika Rivera

CUEG2301-HW#7 Due: 11-30-2021

9-61 (496)

Determine the location $\bar{y}$ of the centroid C of the beam having the cross-sectional area shown.

Section 1

$$A_1 = b_1 \cdot h_1$$

$$= 150\text{mm} \cdot 15\text{mm}$$

$$A_1 = 2250\text{mm}^2$$

$$y_1 = \frac{15}{2}$$

Section 2

$$A_2 = b_2 \cdot h_2$$

$$= 15 \cdot 150$$

$$A_2 = 2250\text{mm}^2$$

$$y_2 = \left[15 + \frac{150}{2} \right]$$

Section 3

$$A_3 = b_3 \cdot h_3$$

$$(100)(15)$$

$$A_3 = 1500\text{mm}^2$$

$$y_3 = \left[15 + 150 + \frac{15}{2} \right]$$

$$\bar{y} = \frac{A_1 y_1 + A_2 y_2 + A_3 y_3}{A_1 + A_2 + A_3}$$

$$\bar{y} = \frac{(2250)\left(\frac{15}{2}\right) + (2250)\left(15 + \frac{150}{2}\right) + (1500)\left(15 + 150 + \frac{15}{2}\right)}{2250 + 2250 + 1500}$$

$$\bar{y} = 79.69\text{mm}$$

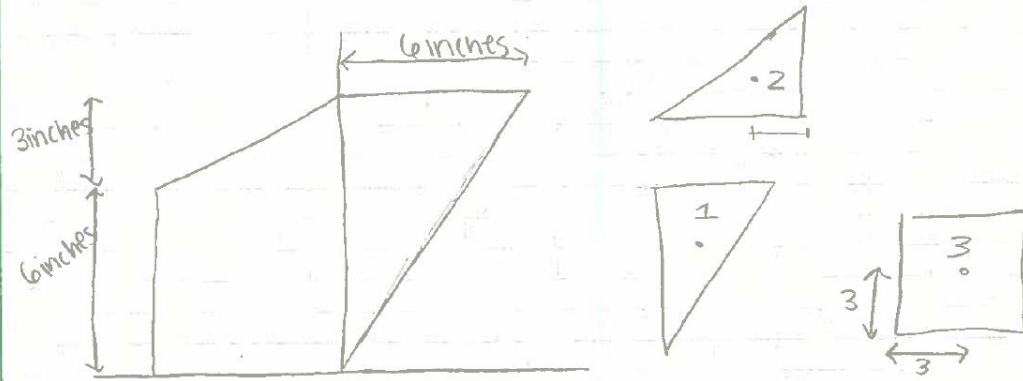
Frika Rivera

CEG 2301-HW#7

Due: 11-30-2021

9-62 (496)

Locate the centroid $(\bar{x}, \bar{y})$ of the shaded Area



Segment	Area	Centroid $\bar{x}$	Centroid $\bar{y}$	$\bar{x} \cdot A$	$\bar{y} \cdot A$
1	$(\frac{1}{2})(9)(6)$ $= 27$	2	6	54	162
2	$(\frac{1}{2})(6)(3)$ $= 9$	2	7	-18	63
3	$(6)(6)$ $= 36$	-3	3	-108	108
	$\Sigma A = 72$			$\Sigma \bar{x} \cdot A =$ -72	$\Sigma \bar{y} \cdot A =$ 333

$$\bar{x} = \frac{\Sigma \bar{x} \cdot A}{\Sigma A} = \frac{-72}{72} = -1$$

$$\bar{x} = -1 \text{ inc.}$$

$$\bar{y} = \frac{\Sigma \bar{y} \cdot A}{\Sigma A} = \frac{333}{72} = 4.63$$

$$\bar{y} = 4.63 \text{ inc.}$$

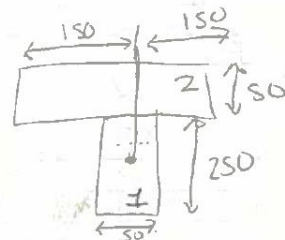
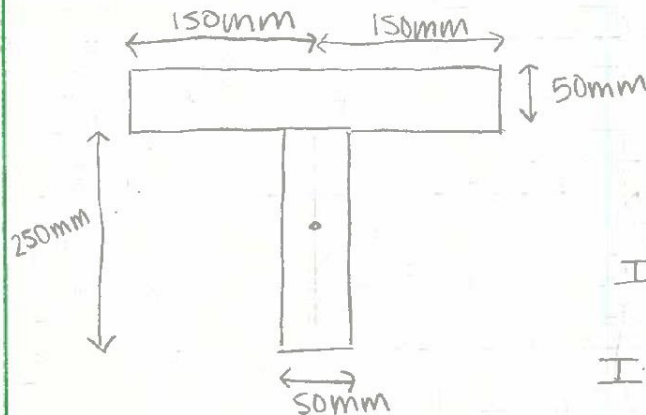
Erica Rivera

CVE62301-HW#7

Due: 11-30-2021

10-34 (545)

Determine the moment of inertia of the beams cross-sectional area about y-axis



$$I_y = \frac{b \cdot h^3}{12}$$

$$I_y = I_{y1} + I_{y2}$$

$$\text{Section 1} = \frac{(250)(50)^3}{12} = 2604166.67 \text{ mm}^4$$

$$\text{Section 2} = \frac{(50)(300)^3}{12} = 112500000 \text{ mm}^4$$

$$I_y = 2604166.67 + 112500000$$

$$I_y = 115104166.7 \text{ mm}^4$$

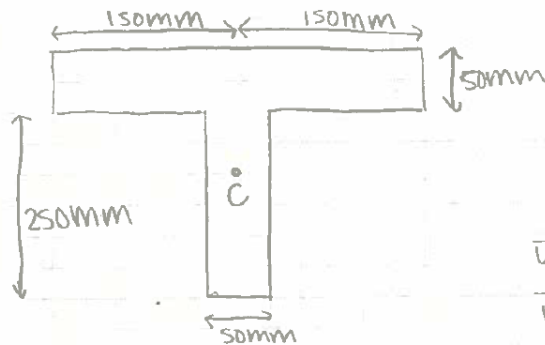
$$I_y = 115(10)^6 \text{ mm}^4$$

Erika Rivera

CUEG 2301-HW#7 Due: 11-30-2021

10-35 (545)

Determine $\bar{y}$, which locates the centroidal axis x' for the cross-section area of the T-beam and then find the moment of inertia about the x' axis.



$$A_1 = (300 \times 50) \text{ mm}^2$$

$$A_2 = (50 \times 250) \text{ mm}^2$$

$$\bar{y}_1 = \left(250 + \frac{50}{2} \right)$$

$$\bar{y}_2 = \left(\frac{250}{2} \right)$$

$$\bar{y} = \frac{\bar{y}_1 \cdot A_1 + \bar{y}_2 \cdot A_2}{A_1 + A_2} = \frac{(250 + \frac{50}{2})(300 \cdot 50) + (\frac{250}{2})(50 \cdot 250)}{(300 \cdot 50) + (50 \cdot 250)}$$

$$\bar{y} = 206.82 \text{ mm}$$

Moment of Inertia x' axis

$$I_T = I_{x-x} + A_T (d_1)^2$$

$$I = \left[\frac{(300 \cdot 50^3)}{12} + (300 \cdot 50) \left[\left(250 + \frac{50}{2} \right) - (206.82) \right]^2 \right] + \left[\frac{(50 \cdot 250^3)}{12} + [(50 \cdot 250) \left[206.82 - \frac{250}{2} \right]^2] \right]$$

$$I = \left[(3125000) + (15000)(68.18)^2 \right] + \left[(65104166.67) + (12500)(81)^2 \right]$$

$$I = (72852686) + (148785571.7)$$

$$I = 221638257.7$$

$$I = 2.22(10)^8 \text{ mm}^4$$

AVERAGE

Prairie View A&M University



CVEG 2301 P02

Engineering Mechanics HW7 (Ch.9&10)

9-11 (482), 9-61(496), 9-62(496), 10-34(545) & 10-35(545)

Assigned: November 23, 2021

Due: November 30, 2021

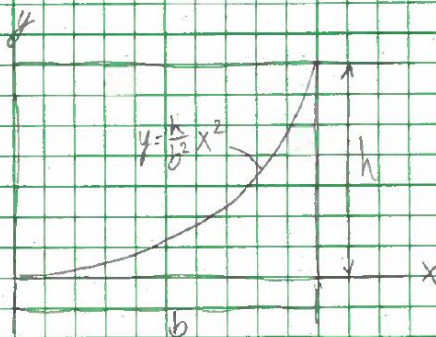
Submitted by: Chelsea Guidry, Roster #7

Submitted to: Dr. Abdul M. Choudhury

B ✓

Chelsea University
9-11 (492), 9-61 (496), 9-62 (496), 10-34 (545), 10-35 (545)

9-11 Locate the centroid $\bar{x}$ of the area



$$dA = \frac{b}{h} x^2 dx$$

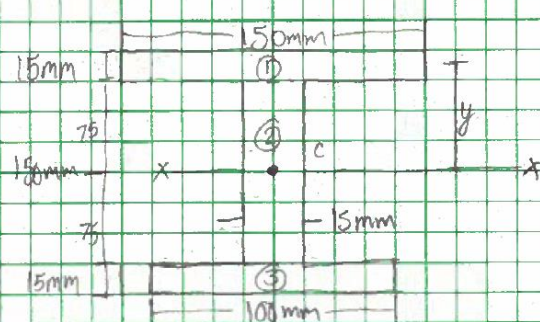
$$\bar{x} = \frac{\int \bar{x} dA}{\int dA}$$

$$\bar{x} = \frac{\int_0^b \left(\frac{h}{b^2}\right) x^2 (x) dx}{\int_0^b \left(\frac{h}{b^2}\right) x^2 dx} = \frac{\int_0^b x^3 dx}{\int_0^b x^2 dx}$$

$$\bar{x} = \frac{\frac{1}{4} x^4 \Big|_0^b}{\frac{1}{3} x^3 \Big|_0^b} = \frac{\frac{1(b^4)}{4} - \frac{1(0^4)}{4}}{\frac{1(b^3)}{3} - \frac{1(0^3)}{3}} = \frac{b^4}{b^3} \cdot \frac{3}{4} = \frac{3}{4} b$$

$$\bar{x} = \frac{b^4}{4} \cdot \frac{3}{b^3} = b \frac{3}{4} = \boxed{\frac{3}{4} b}$$

9-61 Determine the location $\bar{y}$ of the centroid C of the beam having the cross-sectional area shown



$$\textcircled{1} = 150/2 = 75$$

$$\textcircled{2} = 150/2 = 75 + 15 = 90$$

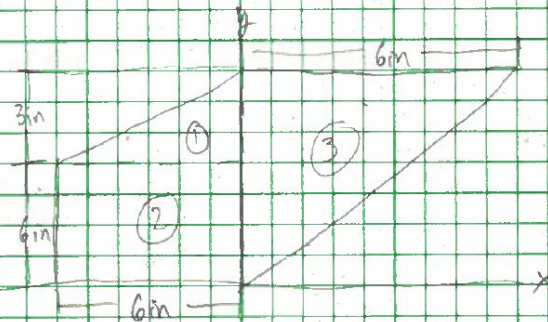
$$\textcircled{3} = 75 + 150 + 15 = 172.5$$

$$\bar{y} = \frac{\sum A_i \bar{y}_i}{\sum A_i} = \frac{A_1 \bar{y}_1 + A_2 \bar{y}_2 + A_3 \bar{y}_3}{A_1 + A_2 + A_3}$$

$$= \frac{(15)(150)(75) + (150)(15)(90) + (15)(100)(172.5)}{(15)(150) + (150)(15) + (15)(100)}$$

$$= \frac{478125 \text{ mm}^3}{6000 \text{ mm}^2} = \boxed{79.7 \text{ mm}}$$

9-62 Locate the centroid $(\bar{x}, \bar{y})$ of the shaded area

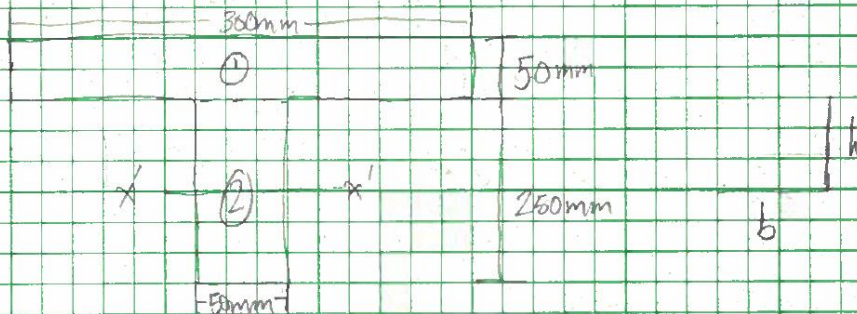


	$\bar{x}$	$\bar{y}$	A	$\bar{x}A$	$\bar{y}A$
1	$\frac{1}{3}(-6) = -2$	$6 + \frac{1}{3}(3) = 7$	$\frac{1}{2}(6)(3) = 9$	$(-2)(9) = -18$	$(7)(9) = 63$
2	-3	3	$(6)(6) = 36$	$(-3)(36) = -108$	$(3)(36) = 108$
3	$\frac{1}{3}(6) = 2$	$\frac{1}{3}(9) = 3$	$\frac{1}{2}(6)(6) = 18$	$(2)(18) = 36$	$(3)(18) = 54$
			$\Sigma A = 72$	$\Sigma \bar{x}A = -72$	$\Sigma \bar{y}A = 333$

$$\bar{x} = \frac{\Sigma \bar{x}A}{\Sigma A} = \frac{-72}{72} = -1 \text{ in}$$

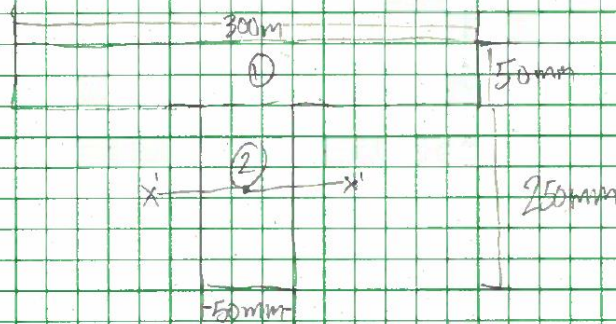
$$\bar{y} = \frac{\Sigma \bar{y}A}{\Sigma A} = \frac{333}{72} = 4.625 \text{ inches}$$

10-34 Determine the moment of inertia of the beam's cross-sectional area of y .



$$\begin{aligned}
 I_{y'y'} &= \frac{1}{12} h_1 b_1^3 + \frac{1}{12} h_2 b_2^3 = \frac{1}{12} (250)(50)^3 + \frac{1}{12} (50)(300)^3 \\
 &= 2.60417 \cdot 10^6 \text{ mm}^4 + 112.5 \cdot 10^6 \text{ mm}^4 \\
 &= 115.104 \cdot 10^6 \text{ mm}^4
 \end{aligned}$$

10-35- Determine $\bar{y}$, which locates the centroid axis X for the cross-sectional area of the T-beam, find moment of inertia about the X -axis



$$A_1 = 250 \times 50 = 12500$$

$$A_2 = 300 / 2 = 150$$

$$\bar{y} = \frac{\sum A_i \bar{y}_i}{\sum A_i} = \frac{A_1 \bar{y}_1 + A_2 \bar{y}_2}{A_1 + A_2}$$

$$= \frac{(300)(50)(275) + (50)(250)(125)}{(300)(50) + (50)(250)}$$

$$= 206.8 \text{ mm}$$

$$I_{x-x} = \frac{1}{12} b h^3$$

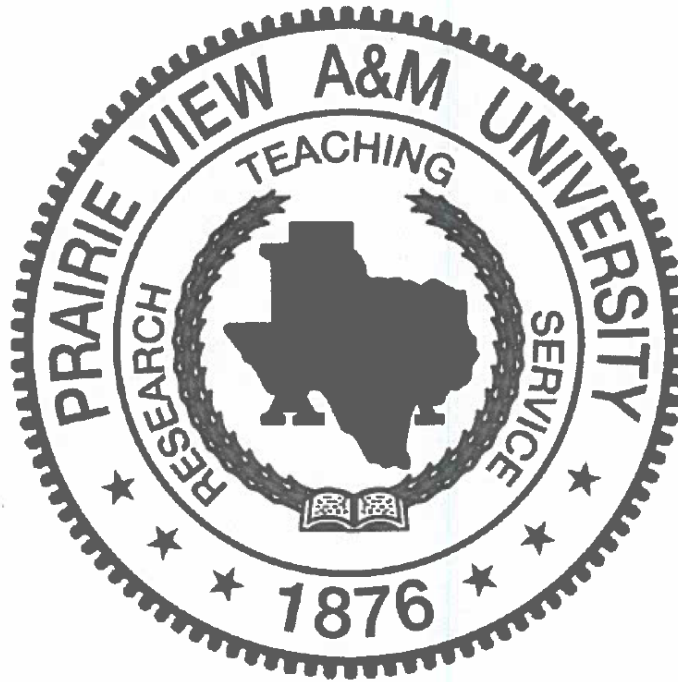
$$I_{x'} = I_{x-x} + A_i (d_i)^2 + I_{x-x} + A_i (d_i)^2$$

$$I_{x'} = \frac{1}{12} (50)(250)^3 + (50)(250)(206.8 - 125)^2 + \frac{1}{12} (300)(50)^3 + (50)(300)(-206.8 - 275)^2$$

$$I_{x'} = 272 \cdot 10^6 \text{ mm}^4$$

BELOW AVERAGE

Prairie View A&M University



CVEG 2301 P02

Engineering Mechanics HW #6

Assigned: November 23, 2021

Due: November 30, 2021

Submitted by: Tyson Morris, Roster #12

Submitted to: Dr. Abdul M. Choudhury

e/

Tyson Morris

CVEG 2302-P02 HW7

Nov 11

Q's: 9-11(482), 9-61(490), 9-62(490), 10-31(545), 10-35(545)

9-11(490): Locate the centroid $\bar{x}$ for the area.

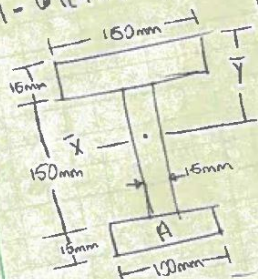


$$(\bar{x}, \bar{y}) = (x, \frac{y}{2})$$

$$\bar{x} = \frac{\int \bar{x} dA}{\int dA} = \frac{\int_0^b x(y dx)}{\int_0^b y dx} = \frac{\int_0^b \frac{h}{b^2} x^3 dx}{\int_0^b \frac{h}{b^2} x^2 dx}$$

$$\bar{x} = \frac{3b}{4}$$

9-61(490): Determine the location $\bar{y}$ of the centroid C of the beam.



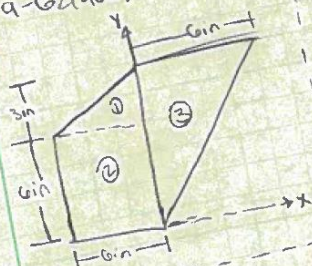
y	A	yA
7.5	2250	16875
90	2250	202500
172.5	1500	258250

$$\sum yA = 478125 \text{ mm}^3$$

$$\sum A = 6000 \text{ mm}^2$$

$$\bar{y} = \frac{\sum yA}{\sum A} = \frac{478125}{6000} = 79.7 \text{ mm}$$

9-62(490): Locate the centroid $(\bar{x}, \bar{y})$ of the shaded area.



	$\bar{x}$	$\bar{y}$	A	xA	yA
1	-2	7	9	-18	63
2	-3	3	36	-108	108
3	2	6	27	54	162

$$\sum yA = 333 \text{ in}^3$$

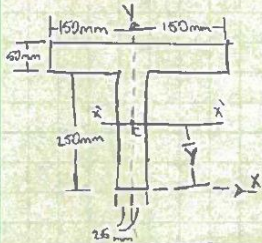
$$\sum A = 72 \text{ in}^2$$

$$\sum xA = -72 \text{ in}^3$$

$$\bar{x} = \frac{\sum xA}{\sum A} = \frac{-72}{72} = -1 \text{ in}$$

$$\bar{y} = \frac{\sum yA}{\sum A} = \frac{333}{72} = 4.625 \text{ in}$$

10-34(545): Determine the moment of inertia for the beam's cross-sectional area about the y-axis

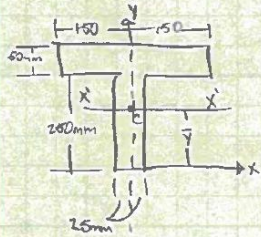


$$\bar{x} = 150 \text{ mm}$$

$$I_{y-y} = \frac{50 \times 300^3}{12} + \frac{250 \times 50^3}{12}$$

$$= 11510416.7 \text{ mm}^4$$

10-35(545): Determine $\bar{y}$ which locates the centroidal axis x' for the cross-sectional area of the T-beam, and then find the moment of inertia about the x' axis



$$\bar{y} = \frac{(250 \times 50 \times 125) + (300 \times 50 \times (250 + 25))}{(250 \times 50) + (300 \times 50)}$$

$$= 206.8182 \text{ mm}$$

$$I_{x-x'} = \frac{50 \times 25^3}{12} + (50 \times 25)(206.8182 - 125)^2 + \frac{300 \times 50^3}{12} + (300 \times 50)(206.8182 - 275)^2$$

$$= 221638257.6 \text{ mm}^4$$