ARCH 314
STRUCTURE I

RECITATION SESSION 1
FACULTY: Prof. Peter Von Buelow
GSI: Faezeh Choobkar
FALL 2025

TAUBMAN COLLEGE
ARCHITECTURE & URBAN PLANNING
UNIVERSITY OF MICHIGAN

Welcome to recitation session

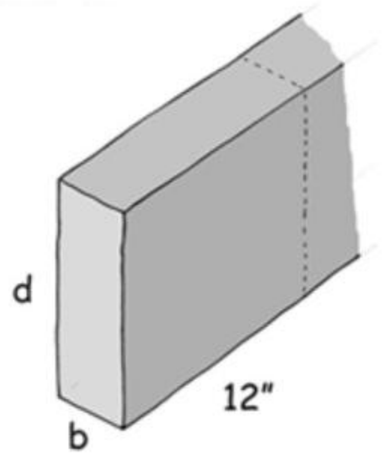
Introduction:

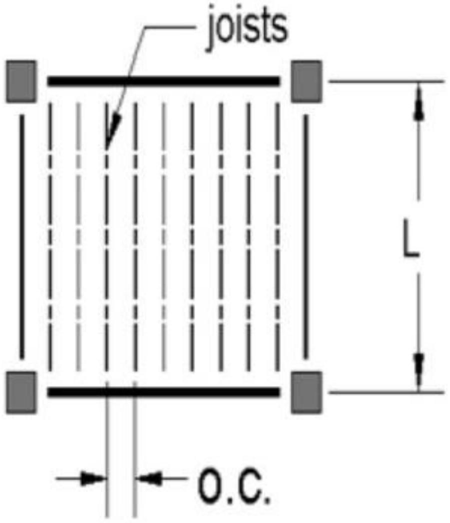
Faezeh Choobkar (PhD student)
Contact: faezehch@umich.edu
Office hours: by appointment

Outline:

Quick Recap
Provide the solution for the assignment (Problem set 1 and 2)
Answering student's questions
Recitation lab: Adding Forces

Problem Set 1: Dead Load Calculation





1. Dead Load Calculation

For the given member cross-section and length, find the DL in PLF of the joist member, total pounds of the member, and PSF DL of the joist on the floor.

DATASET: 1 -2- -3-

Width: b	3.5 IN
Depth: d	7.5 IN
Length: L	8 FT
On center spacing	24 IN
Species class	Eastern White Pine
Density	22 PCF

Problem Set 1: Dead Load Calculation

#	Question	Your Response		Correct Answer	Score
1	The cross-sectional area: A		IN^2	SUBMIT	
2	Dead load of joist section		PLF	SUBMIT	
3	Dead load of whole joist member		LBS	SUBMIT	
4	Dead load of joists on floor		PSF	SUBMIT	

Q1:

Cross sectional area=b × d

= 3.5 in × 7.5 in

= 26.25 in^2

Problem Set 1: Dead Load Calculation

#	Question	Your Response		Correct Answer	Score
1	The cross-sectional area: A		IN^2	SUBMIT	
2	Dead load of joist section		PLF	SUBMIT	
3	Dead load of whole joist member		LBS	SUBMIT	
4	Dead load of joists on floor		PSF	SUBMIT	

Q2:

Cross sectional area=26.25 in² × 1/12 × 1/12 = 0.182 ft²

Density=22 PCF

Volume of joist= cross sectional area × L(per unit length)= 0.182 ft³

Dead load of joist section= Density × Volume = 22 × 0.182 = 4.010 PLF

Problem Set 1: Dead Load Calculation

#	Question	Your Response		Correct Answer	Score
1	The cross-sectional area: A		IN^2	SUBMIT	
2	Dead load of joist section		PLF	SUBMIT	
3	Dead load of whole joist member		LBS	SUBMIT	
4	Dead load of joists on floor		PSF	SUBMIT	

Q3:

Cross sectional area=26.25 $in^2 \times 1/12 \times 1/12 = 0.182\ ft^2$

Density=22 PCF

Dead load of joist section= 4.010 PLF

Dead load of whole joist member= $4.010 \times 8 = 32.08$ LBS

Problem Set 1: Dead Load Calculation

#	Question	Your Response		Correct Answer	Score
1	The cross-sectional area: A		IN^2	SUBMIT	
2	Dead load of joist section		PLF	SUBMIT	
3	Dead load of whole joist member		LBS	SUBMIT	
4	Dead load of joists on floor		PSF	SUBMIT	

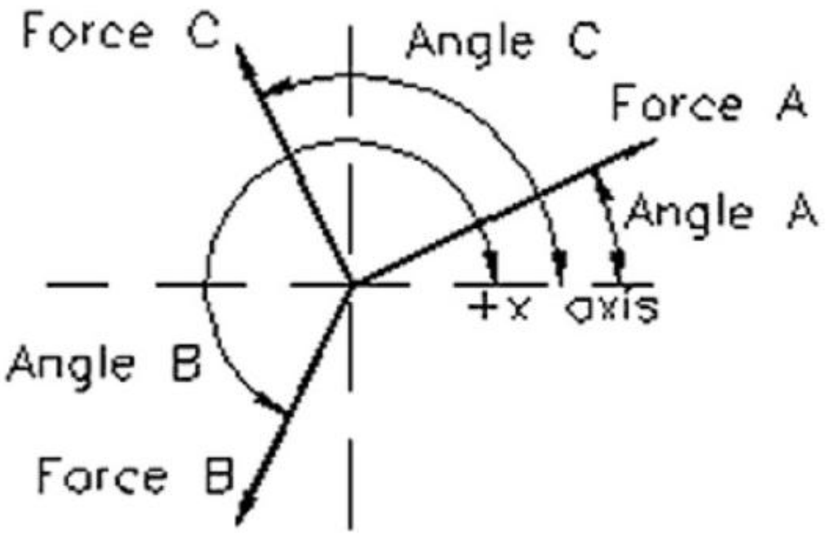
Q4:

Dead load of joist section= 4.010 PLF

Surface= (24/12) × 8 = 16 ft^2

Dead load of joist on floor = 32.08 ÷ 16 = 2.005 PSF

Problem Set 2: Three Vector Addition



Find the horizontal and vertical components of each of the three forces shown. Then find the resultant of all forces and the angle measured counter-clockwise from the + x-axis.

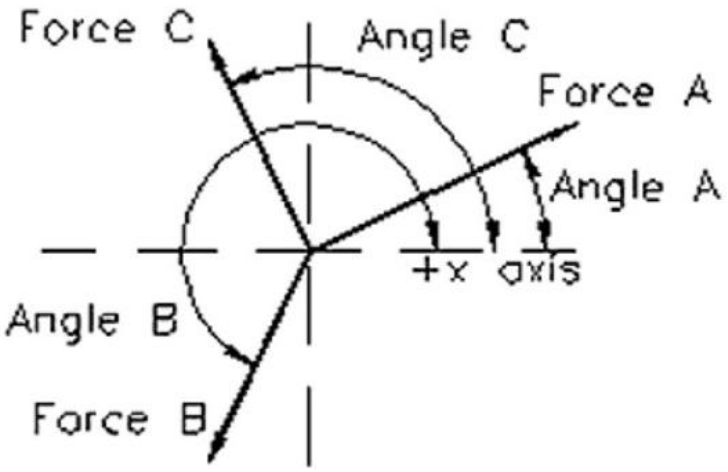
DATASET: 1 -2- -3-

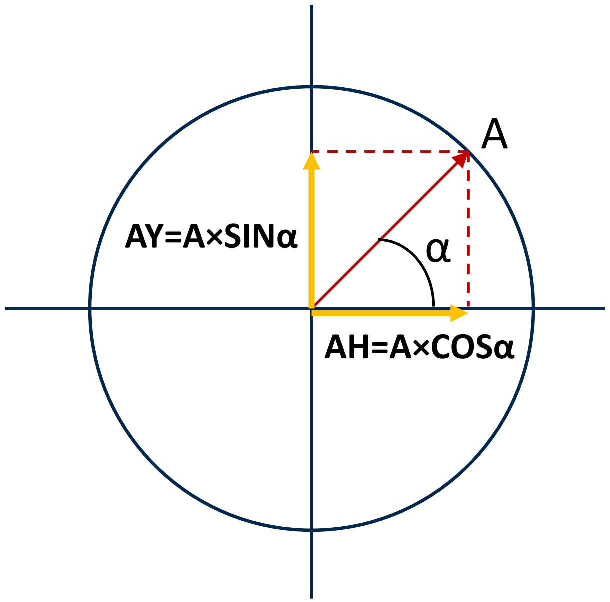
Force A	21 LBS
Angle A	7 DEGREES
Force B	68 LBS
Angle B	210 DEGREES
Force C	39 LBS
Angle C	284 DEGREES

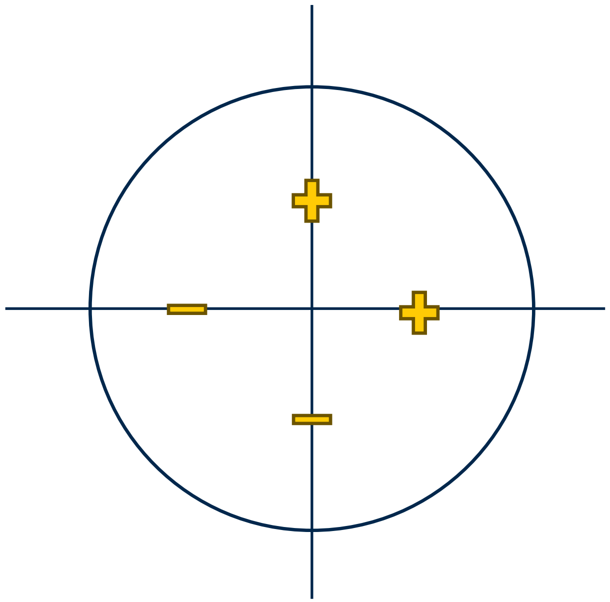
Problem Set 2: Three Vector Addition

#	Question	Your Response	Correct Answer
1	Horizontal component of Force A (+ to right: - to left)	LBS	SUBMIT
2	Vertical component of Force A (+ upward: - downward)	LBS	SUBMIT
3	Horizontal component of Force B (+ to right: - to left)	LBS	SUBMIT
4	Vertical component of Force B (+ upward: - downward)	LBS	SUBMIT
5	Horizontal component of Force C (+ to right: - to left)	LBS	SUBMIT
6	Vertical component of Force C (+ upward: - downward)	LBS	SUBMIT
7	Sum of horizontal components (+ to right: - to left)	LBS	SUBMIT
8	Sum of vertical components (+ upward: - downward)	LBS	SUBMIT
9	Resultant of Forces A + B + C (absolute value)	LBS	SUBMIT
10	Angle of the Resultant in DEGREES from + x axis counterclockwise	DEGREES	SUBMIT

Problem Set 2: Three Vector Addition

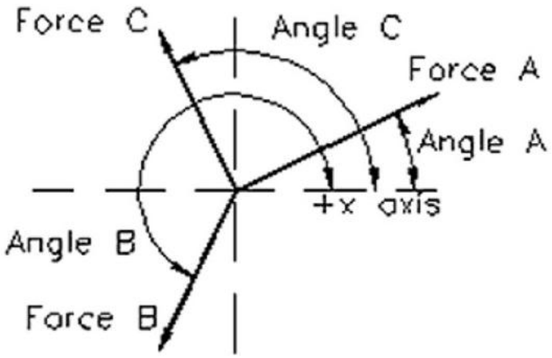






cos(210)=cos(180+30)= -cos(30)

Problem Set 2: Three Vector Addition

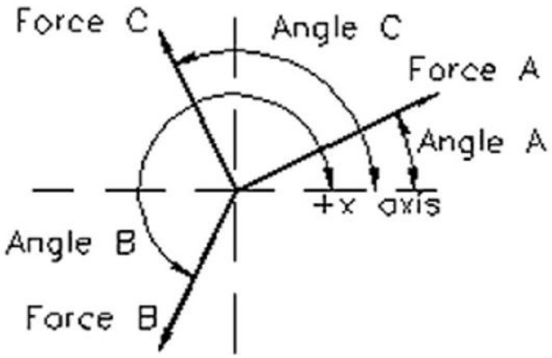


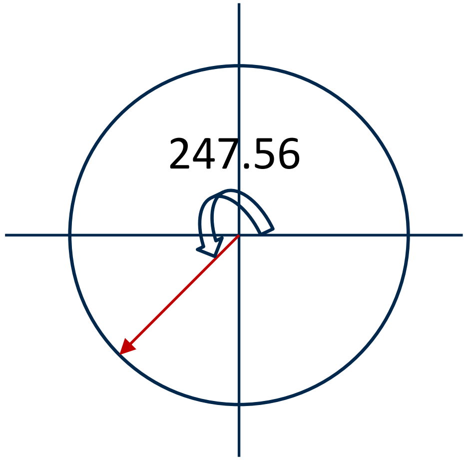
Q1-8:

Force A	21 LBS
Angle A	7 DEGREES
Force B	68 LBS
Angle B	210 DEGREES
Force C	39 LBS
Angle C	284 DEGREES

Force	Horizontal	Vertical
A	21 × COS(7) = +20.84	21 × SIN(7) = +2.56
B	68 × COS(210) = -58.89	68 × SIN(210) = –34
C	39 × COS(284) = +9.43	39 × SIN(284) = –37.9
SUM	-28.62	-69.34

Problem Set 2: Three Vector Addition





Q9:

$$F_R = \sqrt{Fx^2 + Fy^2}$$

$$= \sqrt{(-28.62)^2 + (-69.34)^2} = 75.014$$

Q10:

$$\text{Tan } \alpha = \frac{Fx}{Fy}$$

$$\alpha = Tan^{-1} \frac{Fx}{Fy}$$

$$= 67.56 + 180 = 247.56$$

LAB

Adding Forces

Description

This project is intended to give a sense how forces combine in a system of equilibrium. A selection of 3 force equilibrium systems are modeled both physically and graphically to verify hand calculations.

Goals

To model two component forces of an equilibrant in tension using a physical model.
To show the vector addition of the same 2 forces to find the resultant
To make hand calculations of the same vector addition.

Procedure

1. Using a piece of string with some weight tied to the middle; hold the two string ends at 0° and 90° (horizontal and vertical). Observe that the horizontal is slack (no force in the string). Your hand on the vertical string is the equilibrant force to the force of gravity acting on the weight.
2. Move the vertical string so one string is at 45° and the other at 0° (horizontal).
3. Make a scaled sketch of equilibrant force (opposite to the weight) and its 2 component forces (the two strings in your hands). Scale the *force* not the string. Assume the weight to be 10 units. Scale the forces on the graph paper and estimate the force magnitude of each of the two component forces.
4. Use either trigonometry or similar triangles to calculate the forces in the strings. Compare your results with the graphic result.
5. Try another variation like the third figure below.
6. Try to pull the 2 strings horizontal (don't break the string). Observe that there tends to be a small sag in the string even when pulled fairly taught.