Type A: Midterm 1 Exam

Make sure that you are taking the correct Type Midterm Exam. You can find the Type from the Exam Instructions PDF posted in bcourses.

Date and time: The exam will be 50 minutes long, from 2:10 pm to 3 pm, and you will have an additional 10 minutes to scan and submit your exam to Gradescope. Make sure your document is submitted before 3:10 pm. Late exams will not be accepted. If you are having technical issues submitting your exam, please contact me and the GSIs as soon as possible.

During the exam: Please take the exam in a quiet space with reliable internet access so you can submit your exam. You may not share a room with anyone else taking the exam. The GSI and I will be on zoom in case you have any questions. Logging into zoom will not be required during the exam.

Materials that can be used during the exam: You will only be allowed to use a calculator and two sheets (front and back) of notes. You may not use any internet resources during the exam, except zoom.

Submission: Please scan your submission clearly and ensure all text is legible to Gradescope. You can use a third-party scanning app (for example, CamScanner) that produces a PDF file. You cannot submit raw pictures. Here is a nice google doc that explains how to make a PDF: https://t.co/s8B8qIiJ84?ssr=true. It is your responsibility that your submission is legible and easy to understand. Please double and triple check your submitted PDF that everything is legible and all pages of your exam are included.

On your first page, please write down your Exam Type along with your name and student ID. When working on the exam, make sure to start every problem on a new page and clearly label Problem 1, Problem 2, part a) and part b). In Gradescope, submit your PDF to the corresponding Midterm Type Assignment and select the pages of your work that corresponds to the problem numbers.

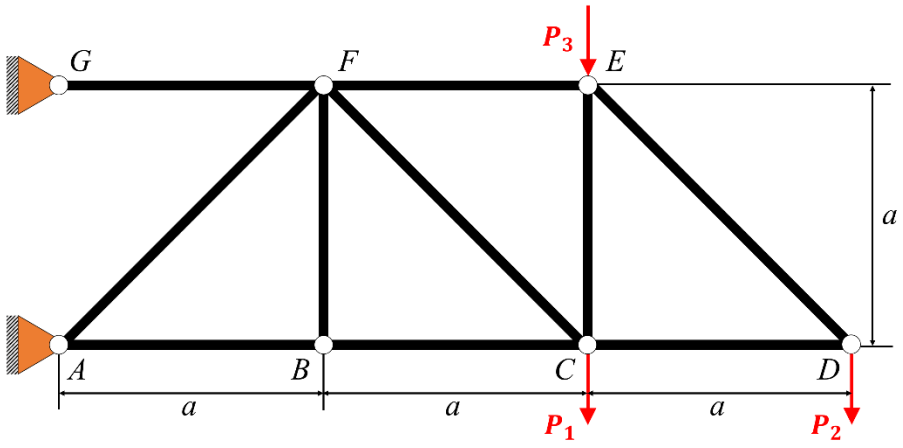
Honor code: Please write out this statement on the first page of your exam submission:

"I pledge my honor that all my exam work was done entirely by myself, with no help from others; I did not communicate with anybody during the exam; I did not share information with others during the exam; I did not use any materials beyond a calculator and two sheets of notes during the exam."

Things to note: Make sure to provide units when necessary. Show all work. Good luck!

Problem 1 (8pts)

Determine the force in members FE, CF, and BC. State if the members are in tension or compression. Take $a = 1$ m, $P_1 = 500$ N, $P_2 = 800$ N, $P_3 = 1000$ N.



Problem 2 (8pts)

Grog and his wooly mammoth Thrug are moving a stone up a hill in order to build their stone age pizza place, Sabertooth Slice.

Thrug, the mammoth pulls a *horizontal* cable attached to the top of the stone with a force $\boldsymbol{F_m = 5kN}$. The stone stands perpendicular to an inclined hill of angle $\boldsymbol{\theta = 30°}$**.** Grog pulls a cable attached to the midpoint of the stone with a force $\boldsymbol{P}$. The cable forms an angle $\boldsymbol{\phi = 60°}$ with the horizontal. The center of mass of the stone is ⅓ of the way up its length. The stone is $\boldsymbol{h = 6m}$ tall and has a mass $\boldsymbol{m = 2500kg}$. Static friction exists. Other relevant angles and dimensions are labeled in the image below. (Give all answers in SI units. Take gravitational constant $g = 10$N/kg)

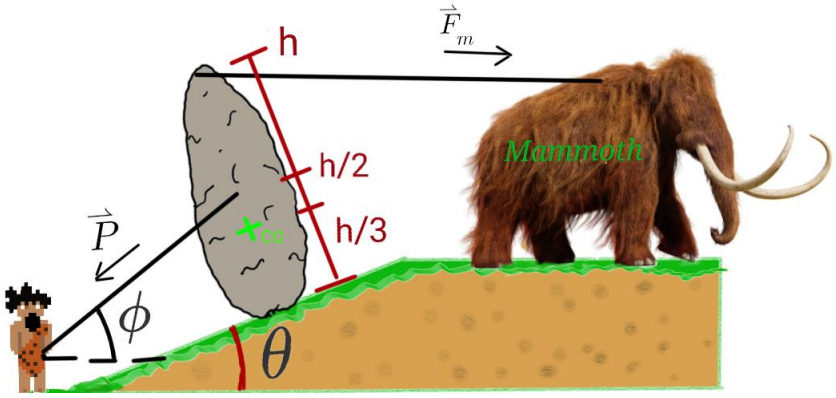
a). Draw a free body diagram of the stone. (2.5pts)

b). Calculate the moment generated by the mammoth about the base of the stone. (1.5pts)

c). What force *P* does Grog need to pull with so that the stone does not topple over (stays in equilibrium)? (2pts)

d). Calculate the magnitude of the normal force acting on the stone from the hill. (2pts)

For b), c) and d), we strongly recommend you to first come up with a parametric representation of the answer and then calculate the numerical values.



Problem 3 (15pts)

A two-member frame is subject to external loads as shown below. Member AC has a mass $\boldsymbol{M_{AC}} = \mathbf{10\sqrt{3}kg}$ acting at the center. The mass of member BC is negligible. (Take gravitational constant $g =$ 10N/kg.) (15pts)

a). Draw the FBD of member AC and BC separately. (5.5pts)

b). Determine the magnitude of the horizontal and vertical components of the force acting on pin C. (7pts)

c). Determine the magnitude of the total resultant force at the pin A. (2.5pt)