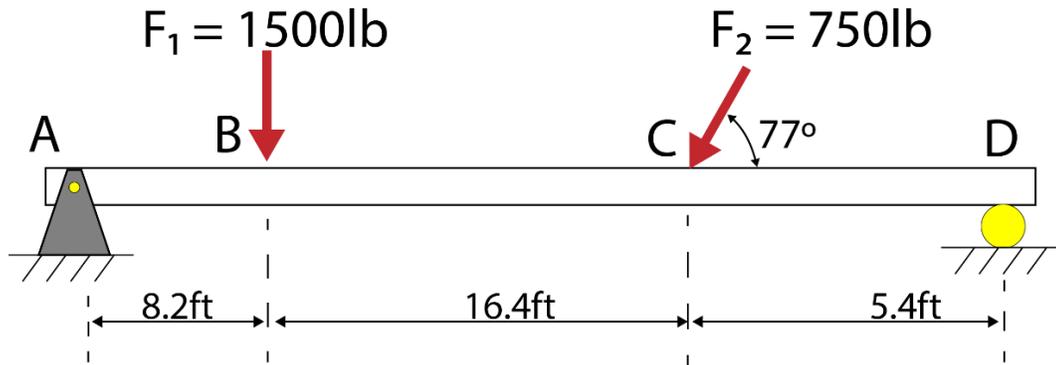


NOTE: Use engineering format for problems 1-4. Use non-engineering format for problems 5-9. This is an individual assignment.

1. For the beam below, find the reaction forces at pinned joint A and roller joint D.

$$A_y = 1221.54\text{lb}, A_x = 168.71\text{lb}, \text{ and } D = 1009.24\text{lb}$$

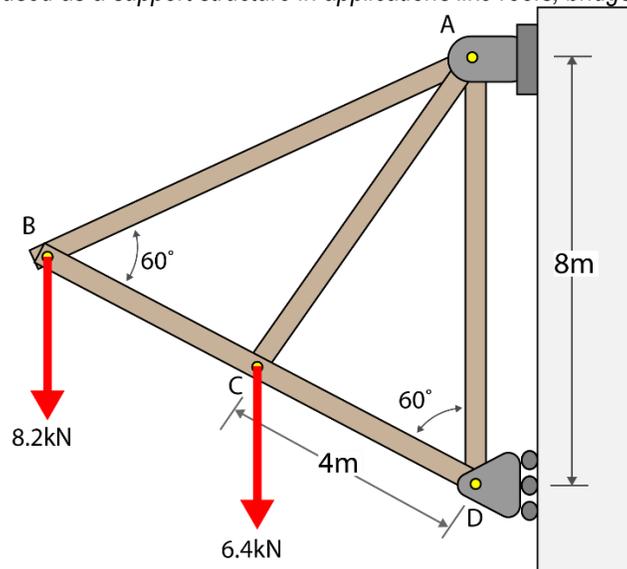


2. Rework problem 1 to derive equations for the reaction forces A_x , A_y and D as a function of angle θ . Plot these equations using Mathcad on a single graph where θ ranges from 0° to 180° in increments of 5° . The single graph should include ...
- the reaction force A_x in terms of θ ;
 - the reaction force A_y in terms of θ ; and
 - the reaction force D in terms of θ .

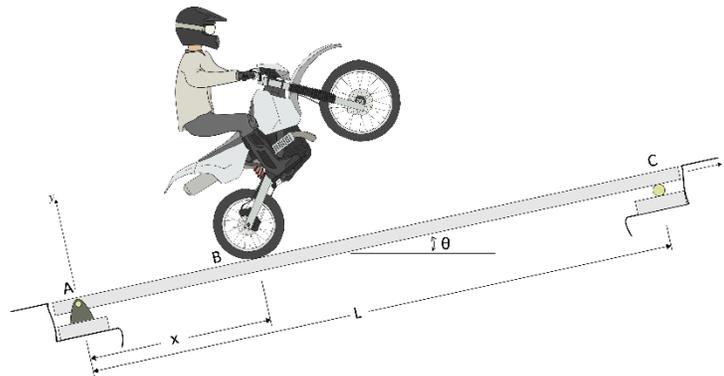
3. For the truss below, find the reaction forces at pinned joint A and roller joint D. Although the roller joint is drawn with three rollers, it behaves like the roller at point D in problem 1. When you draw the FBD, you can represent the reaction force at the roller using a horizontal force acting to the left at D. **Note:** The internal forces in the truss members (such as the tension in member AB) does not show up on the FBD; only the external forces and reactions should appear on the FBD (reactions at A and D as well as the external loads at B and C).

$$D = 9.87\text{kN}, A_x = 9.87\text{kN}, \text{ and } A_y = 14.6\text{kN}$$

A **truss** is a framework used as a support structure in applications like roofs, bridges, and many other structures.



4. A stunt motorcycle driver rides a wheelie across a 25m long bridge at an angle θ to a horizontal plane. The combined weight of the rider and the motorcycle is 2.45 kN (about 550 lbs). Determine the reactions at A and C for $x = 8$ m and $\theta = 22^\circ$. Hint: Shifting your coordinate system may make this problem easier to solve.
 $C = 0.73\text{kN}$, $A_x = 0.92\text{kN}$, and $A_y = 1.54\text{kN}$



5. Write a program to perform some action of your choosing in the main loop of an Arduino sketch. Implement the interrupt command discussed in class to respond to the input from a switch. When the switch is pressed, have the interrupt command tell the Arduino to perform some other action of your choosing independent from the main loop actions.

Examples of actions that you can program: light/blink and LED, read temperature on thermistor, detect objects using IR, make a speaker sound, and change color of RGB LED. You are not limited to this list. Your code must be different from the code provided in the presentation. Remember the actions that you include in your interrupt command cannot have anything associated with time (e.g., `millis()`, `delay()`, `delayMicroseconds()`, etc).

Note: Have your Arduino/circuit out on your table with the program running so that your instructor or class assistant can quickly check your work. Do not turn your homework in at the front; have it ready so that the instructor/assistant can grade the interrupt activity.

6. Search online for how gears work. Read articles or watch videos about gears. Summarize three different points that you learned about how gears work.
7. Review the list of sensors/devices that can be checked out for the ENGR 122 project. Choose one to research in more depth. Write a few sentences about how the sensor/device works. Include some potential applications for the sensor/device.
8. Add another idea to your "Idea Wallet" by talking to someone about what bugs them. Their bug can be something that doesn't work quite right or that could be improved, something that bothers them, or things that they have noticed to cause problems for others. Please name the project idea, state who you talked with, write up at least a two-sentence description of the idea, and provide pictures when it makes sense to do so. *You don't need to try to find a solution to the problem at this point!*
9. Bring a servo from your tool kit to class. We will be disassembling them to help discuss how gears work.