ME 270 – Spring 2014 Exam 2 **NAME (Last, First): _____**

Please review the following statement:

I certify that I have not given unauthorized aid nor have I received aid in the completion of this exam.

Signature: _____

INSTRUCTIONS

Begin each problem in the space provided on the examination sheets. If additional space is required, use the white lined paper provided to you.

Work on one side of each sheet only, with only one problem on a sheet.

Each problem is worth 20 points.

Please remember that for you to obtain maximum credit for a problem, it must be clearly presented, i.e.

- The coordinate system must be clearly identified.
- Where appropriate, free body diagrams must be drawn. These should be drawn separately from the given figures.
- Units must be clearly stated as part of the answer.
- You must carefully delineate vector and scalar quantities.

If the solution does not follow a logical thought process, it will be assumed in error.

When handing in the test, please make sure that all sheets are in the correct sequential order and make sure that your name is at the top of every page that you wish to have graded.

Instructor's Name and Section:

Sections: J Jones 9:30-10:20AM P Sojka 1:30-2:20PM J Silvers 3:30-4:20PM
J Jones Distance Learning

Problem 1 _____

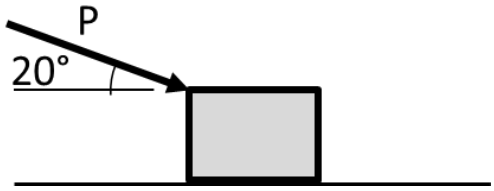
Problem 2 _____

Problem 3 _____

Total _____

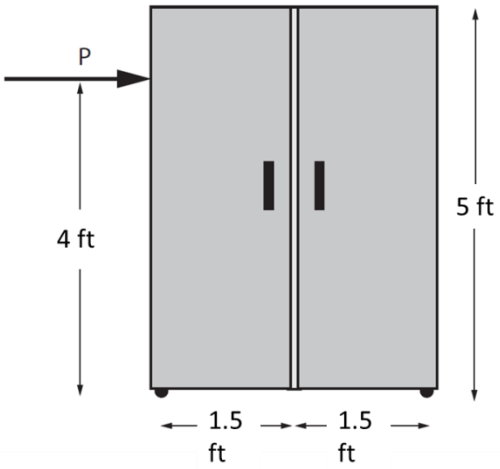
PROBLEM 1 (20 points) – Prob. 1 questions are all or nothing.

1A. A force, P, is applied to a block at the angle shown. The block has a mass of 10 kg. When P is 40 N, the block just begins to move. What is the coefficient of friction between the block and the ground?



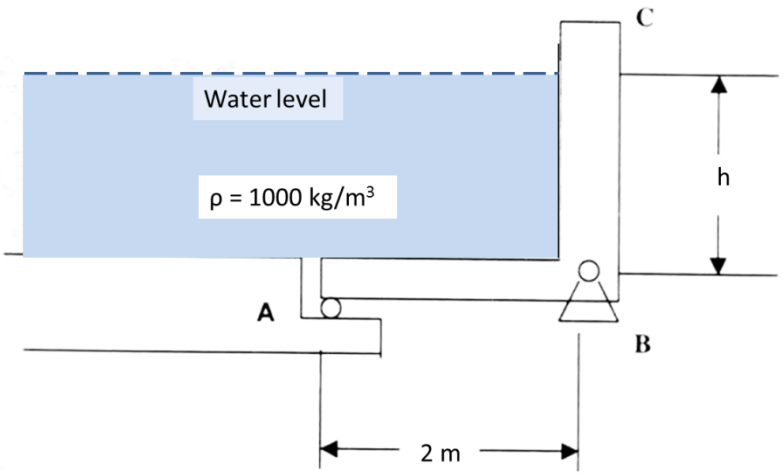
μ =	(4 pts)

1B. The refrigerator shown weighs 260 lbs and rests on a surface with a coefficient of friction μ = 0.3. What force, P, would be necessary to tip the refrigerator (P_{tip})? to slide the refrigerator (P_{slip})? Which would occur? Assume the weight of the refrigerator is uniformly distributed.



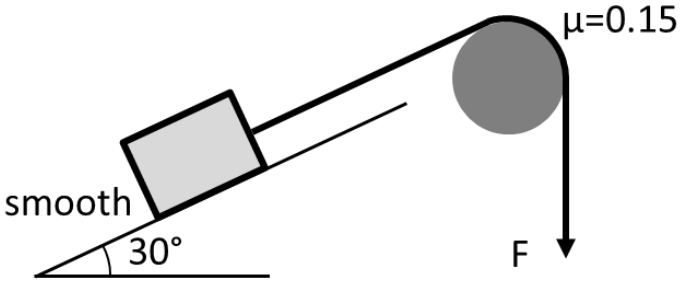
P_{tip} =			(2 pt)
P_{slip} =			(2 pt)
(Circle one)	Tip	Slip	(1 pt)

1C. Gate ABC is one solid piece extending 4 m into the page, and is supported by a pin joint at B. At what water level, h, will the gate begin to tip?



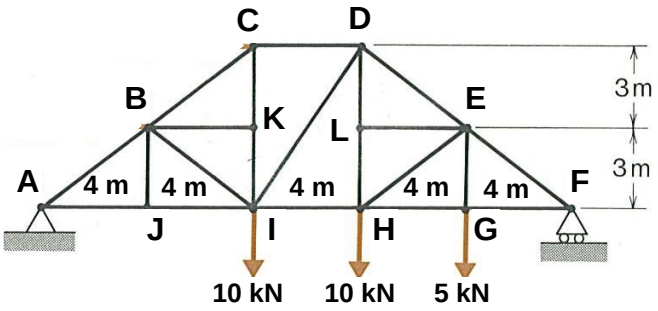
h =	(7 pts)

1D. A block weighing 60 N rests on a smooth incline. It is attached to a cable that wraps around a fixed drum with coefficient of friction μ = 0.15. Determine the force, F, needed to raise the block.



F =	(4 pts)

PROBLEM 2. (20 points)



GIVEN: Truss A-L is loaded as shown and is held in static equilibrium by a pin joint support at A and a roller support at F.

FIND:

a) On the artwork provided, complete the overall free body diagram for the truss. Determine the reactions at supports A and F. (4 pts)

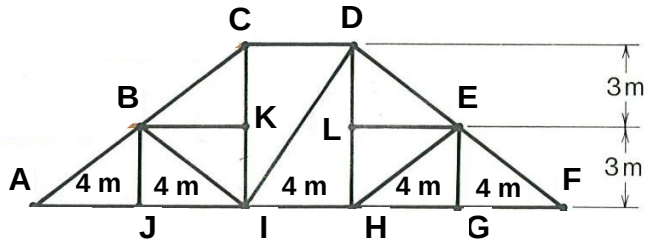
b) On the artwork provided, please put a zero on all zero-force members. (4 pts)

c) Using the method of sections, determine the loads in members F_{CD} and F_{DI}. Identify whether each is in tension or compression. (8 pts)

d) Using the method of joints, determine the load and sense (tension or compression) of member F_{BC}. (4 pts)

Free Body Diagram

a)

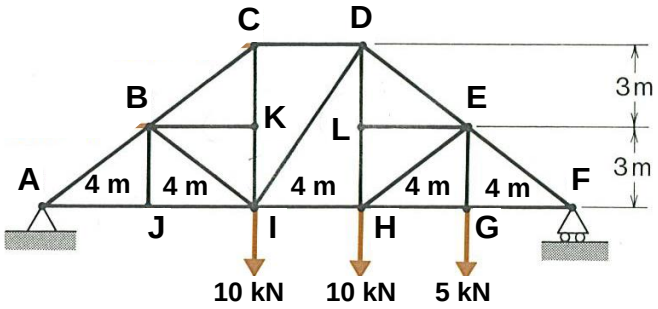


A_x =

A_y =

F_y =

b) Identify all zero-force members.



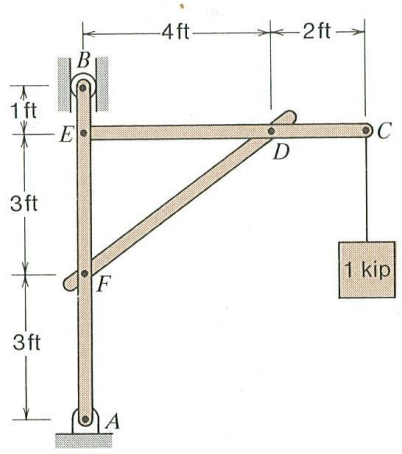
c) Method of Sections

F_{CD} =	T or C
F_{DI} =	T or C
	Circle One

d) Method of Joints

	Circle One
F_{BC} =	T or C

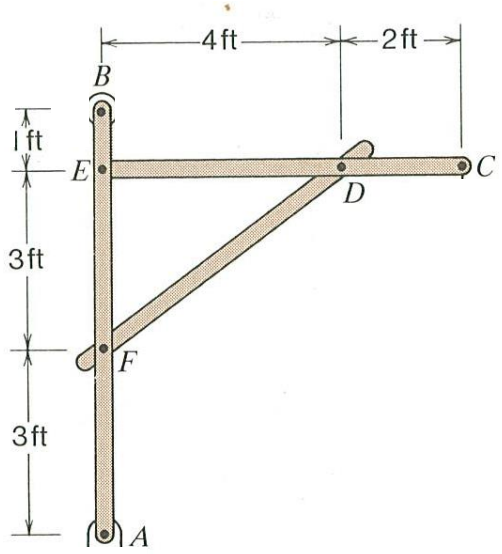
PROBLEM 3. (20 points)



GIVEN: Frame A-F is designed to hold a 1 kip (1,000 lb) load and is held in equilibrium by a pin support at A and a roller support at B. Assume the weight of the individual members are negligible.

FIND:

a) On the artwork provided, complete the overall free body diagram and solve for the reactions at supports A and B. (4 pts)

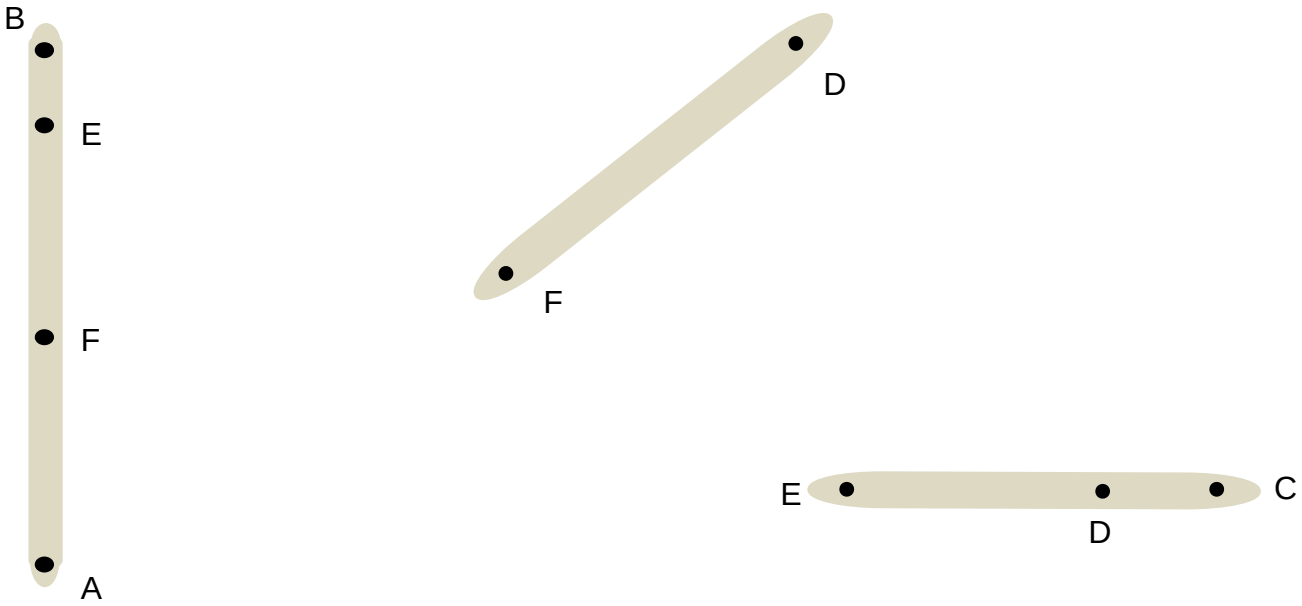


A_x =

A_y =

B_x =

b) On the members provided below, complete the individual free body diagrams of members AFEB, FD, and EDC. **Hint:** Are there any two-force members in the frame? (4 pts)



c) Determine the forces exerted on bar AFEB at pins E and F. Express the forces in vector form. (12 pts)

$$\overline{E}_{onAB} =$$

$$\overline{F}_{onAB} =$$

ME 270 Exam 2 Equations

Centroids

$$\bar{x} = \frac{\int x_c dA}{\int dA}$$

$$\bar{y} = \frac{\int y_c dA}{\int dA}$$

Centers of Mass

$$\tilde{x} = \frac{\int x_{cm} \rho dA}{\int \rho dA}$$

$$\tilde{y} = \frac{\int y_{cm} \rho dA}{\int \rho dA}$$

Buoyancy

$$F_B = \rho g V$$

Fluid Statics

$$p = \rho g h$$

$$F_{eq} = p_{avg}(Lw)$$

Belt Friction

$$\frac{T_L}{T_S} = e^{\mu\beta}$$

ME 270 Exam 2 Solutions

1A. $\mu = 0.34$

1B. $P_{tip} = 97.5$ lbs $P_{slip} = 78$ lbs Slip

1C. $h = 3.46$ m

1D. $F = 41.1$ N

2A. $A_x = 0$ kN $F_y = \frac{280}{20} = 14$ kN $A_y = 25 - 14 = 11$ kN

2B. BI, BJ, BK, LE

2C. $F_{CD} = 14.7$ kN Compression $F_{DI} = 1.20$ kN Compression

2D. $F_{BC} = 18.4$ kN Compression

3A. FBD $A_x = +6000/7$ lbs $A_y = +1000$ lbs $B_x = -6000/7$ lbs

3B. FBDs

3C. $\bar{E}_{onAB} = 2000\bar{i} + 500\bar{j}$ lbs $\bar{F}_{onAB} = -(2000)\bar{i} - (1500)\bar{j}$ lbs