

**MECH 211 Sections 1 and 2****Fall 2000****Test 1**

Due October 9, 2000 at the start of class.

Show all work. Any force existing in an equation must also be denoted on an appropriate free body diagram. Clearly indicate final answers.

This test is taken under the Rice Honor Code system. You may consult only the textbook (Pytel and Kiusalaas), and notes that you have personally taken or received from me in class. You may use a calculator, including programmable calculators. The test must be taken during a contiguous 3 hour period, with an optional 30 minute break.

At the conclusion of the test, place it in an envelope, seal it, and write your name across the seal.

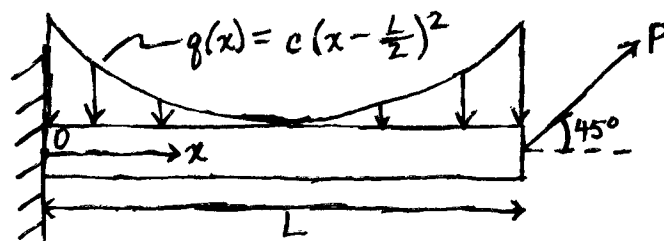
Time started: \_\_\_\_\_

Time finished: \_\_\_\_\_

Pledge: \_\_\_\_\_

1. According to Chad Landis, what are the two primary components required to solve a statics problem? (5 points)

2. The beam is built into the wall at point  $O$  and is loaded by the force  $P$  acting at  $45^\circ$  to the horizontal and the distributed load  $q(x) = c\left(x - \frac{L}{2}\right)^2$ .

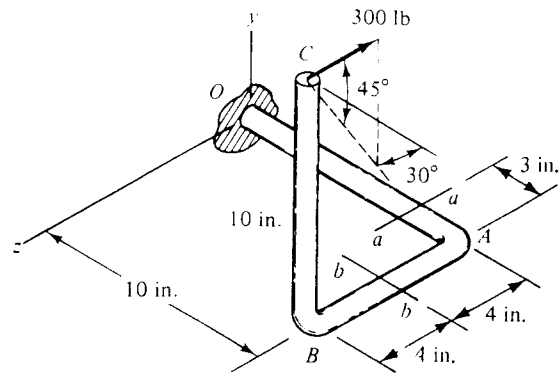


- a) The magnitude of the force  $P$  is such that the reaction at the built in end  $O$  is only a force. Determine  $P$  in terms of  $c$  and  $L$ . Draw any relevant FDBs. (10 points)

- b) Determine the internal forces and moments in the beam at  $x = \frac{L}{2}$  in terms of  $c$  and  $L$ .

Draw any relevant FBDs. Hint: Clever use of your homework solutions can help on this problem. (15 points)

3. For the structure shown a 300 lb force is applied at point C. The projection of the force onto the  $x$ - $z$  plane is at  $30^\circ$  from the  $x$  axis. Forty-five degrees is the angle between the line at  $30^\circ$  from the  $x$  axis and the direction of the force. The length  $OA$  is 10 in., the length  $AB$  is 8 in., and the length  $BC$  is 10 in.

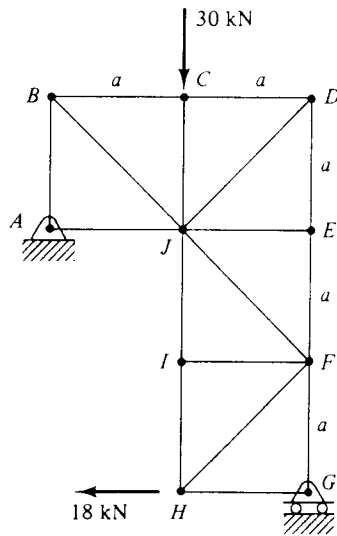


- a) Determine the moment due to the 300 lb force about point  $O$ . (8 points)

b) Draw a free body diagram of the structure and determine the reactions at point  $O$ .  
(10 points)

c) Determine the moment of the 300 lb force about the axis  $OB$ . (7 points)

4. For the truss shown determine the forces carried by each member. Specify whether each member is in tension or compression. All horizontal and vertical lengths are  $a$ . Draw all relevant free body diagrams. (25 points)



5. The device shown is used for punching holes in leather. Note that  $F$  acts perpendicularly to the arm  $AB$ . The length  $AB$  is 12 in.,  $BC$  is 4 in., and  $CD$  is 4 in. There are pin joints at  $B$ ,  $C$  and  $D$ . a) What is the punching force  $P$  exerted on the leather if  $F = 8$  lb? b) What is the mechanical advantage of this device (i.e. the ratio  $P/F$ )? Draw all relevant free body diagrams. Hint: the leather can place  $x$  and  $y$  components of force *and* a moment on the punch. (20 points)

