

Name: \_\_\_\_\_

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## TAM 210/211 - Worksheet 5

Objectives:

- Evaluate moments in 2D and 3D problems
- Obtain resultant forces and moments for equivalent systems.

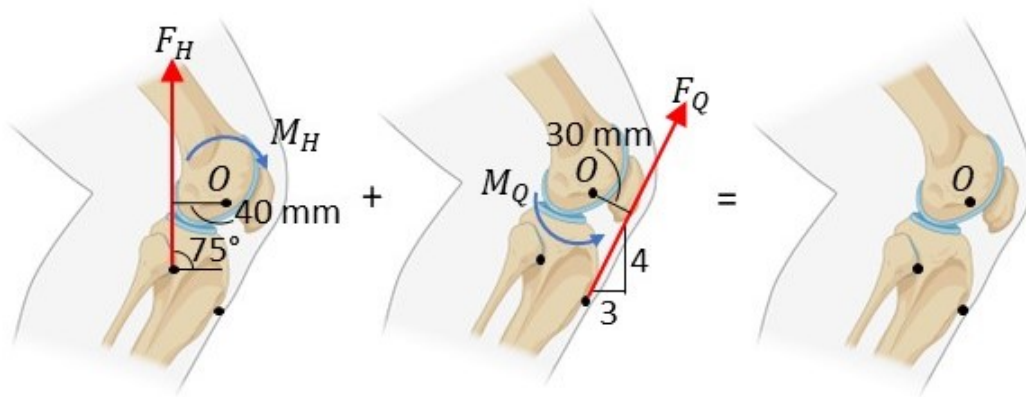
1) Draw the forces and resulting moment that acts on a wrench when unfastening a nut.



2) Sketch a diagram of the forces and moments acting on a bottle opener.



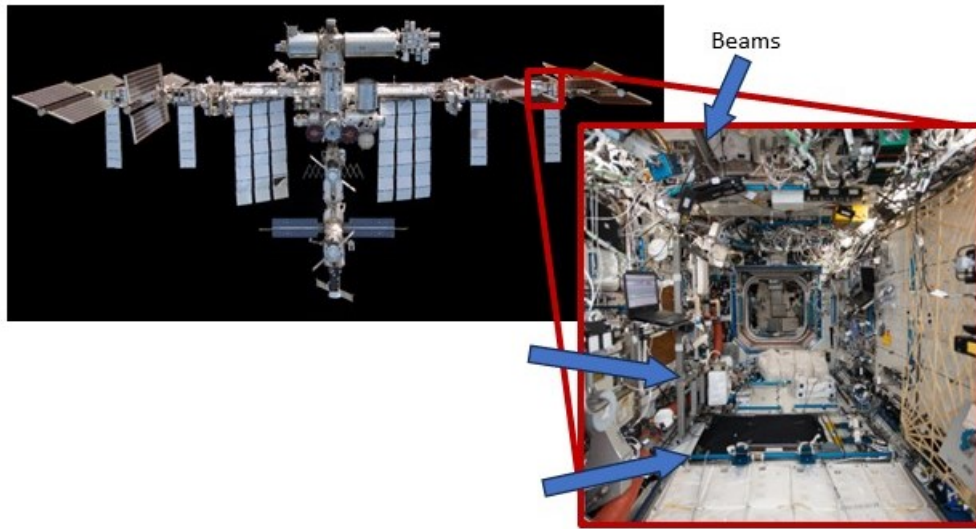
3.i) A rotational moment in the knee is generated by the force from the hamstrings ( $F_H$ ) and the force from the quadriceps ( $F_Q$ ). The diagram for each muscle is given separately. On the blank knee diagram, draw the forces and resulting moment that acts on the knee when it is in a flexed position.



3.ii) The force generated by the hamstrings and the quadriceps are 845 N and 1500 N, respectively. Using Figure in problem 3.i, determine the moment of the force about point  $O$  using the scalar formulation.

3.iii) Using Figure in problem 3.i, determine (a) the  $\langle i; j; k \rangle$  components of  $F_H$  and  $F_Q$ , (b) the moment of the force about point  $O$  using the vector formulation, and (c) the moment of the same force about the x-axis. (d) Is the knee flexing or extending?

Rotational moments are often seen in beam applications. The following examples are of beams that could be found on a space station!



4) Using Figure 3 (Fig. below), determine the magnitude of  $F$  so that the resultant couple moment is 600 lb.ft counterclockwise. Where on the beam does the resultant couple moment act?

