

UNIVERSITY OF CALIFORNIA BERKELEY    Structural Engineering,  
Department of Civil Engineering        Mechanics and Materials  
Summer 2016                                    Professor: S. Govindjee

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CE W30 / ME W85

Midterm Exam 1

July 14, 2016

1.5 hours (download to upload)

No late exams will be accepted

## Open Resource Exam

## No Collaboration Permitted

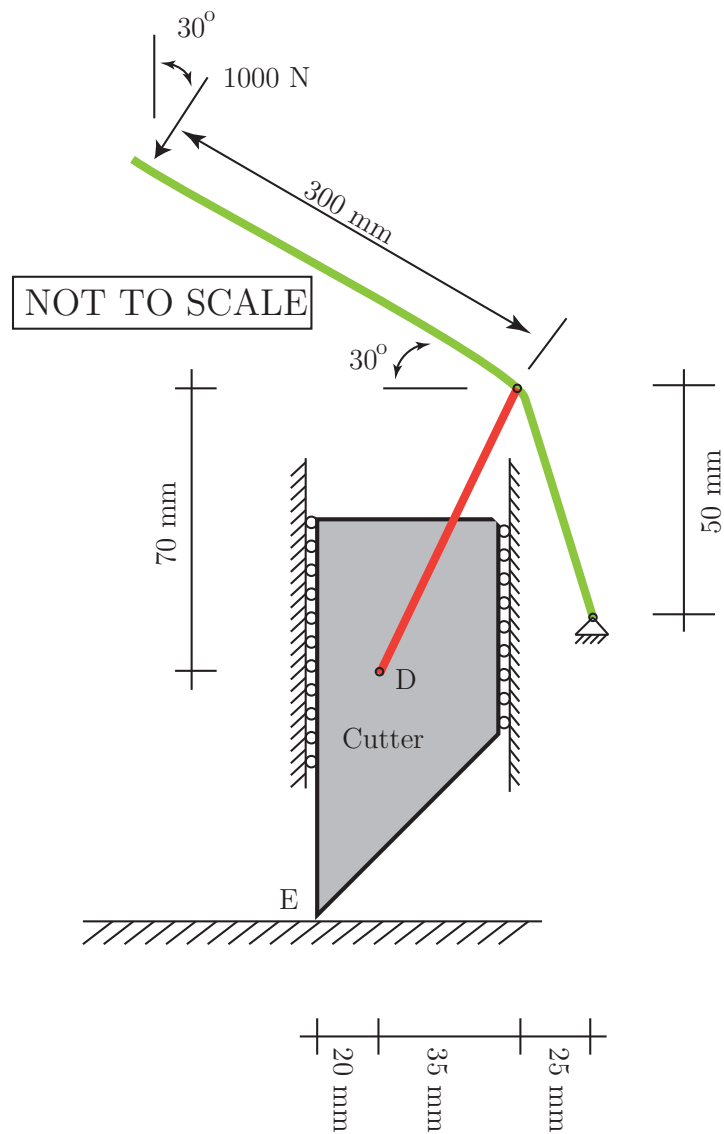
Problem	Score
#1	/50
#2	/30
#3	/20
Total	/100

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**Attach this cover-page to your upload**

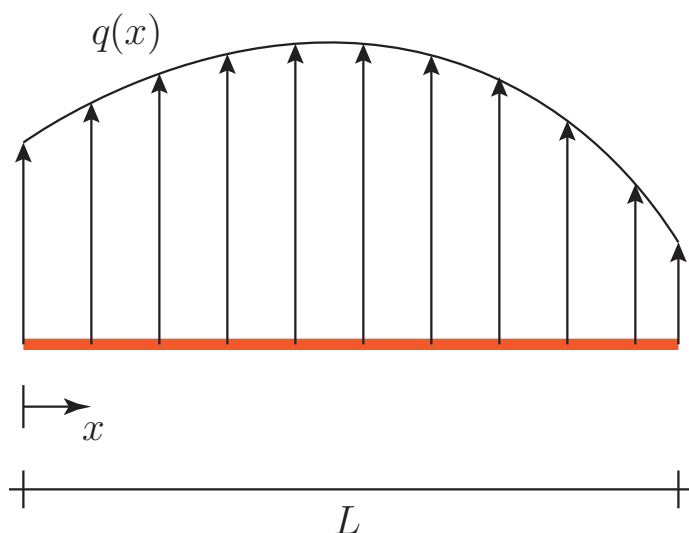
1. Consider the sheet-metal shear shown, where each individual part can be considered to be a rigid-body. Assuming zero friction everywhere:
- What is the cutting force at  $E$ ?
  - What net force and moment do the cutter's vertical guides have to provide? State your answer with respect to  $D$  (i.e. use  $D$  as your reference point).



2. A rigid rod of length  $L$  is subjected to a vertical distributed load

$$q(x) = \left[ q_o + q_1 \frac{x}{L} + q_2 \left( \frac{x}{L} \right)^2 \right].$$

Find a point force system that is equivalent to the given distributed load.



3. The linear elastic bar shown has an inhomogeneous coefficient of thermal expansion  $\alpha(x) = \alpha_o + \alpha_1 \frac{x}{L}$ , where  $\alpha_o$  and  $\alpha_1$  are given constants.
- For the mechanical load shown and an assumed change of temperature  $\Delta T$ , find  $R(x)$ ,  $\sigma(x)$ ,  $\varepsilon(x)$ , and  $u(x)$ .
  - Neatly sketch each field and label all critical points, slopes, and intersections.

Assume the cross-sectional area and Young's modulus are constants.

