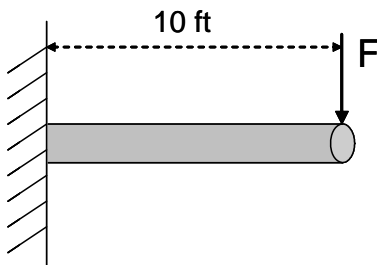
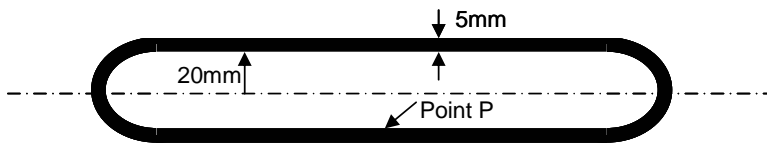


Midterm Exam - I

1. An engineer is asked to design a straight round bar that can be subjected to an end loading F (see below), with a likely maximum loading of 200 lb. The bar will be made of 303 stainless steel that has the yield strength of 35 kpsi. What is the minimum diameter of the bar to be used that maintains a minimum safety factor of 3.



2. A long cylindrical pressure vessel with hemispherical ends has an inside radius of 20 mm and a wall thickness of 5 mm. It is used for storage of nitrogen with a gas pressure of $p_i = 50 \times 10^5$ Pa and the outer wall is subjected to atmospheric pressure $p_o = 1 \times 10^5$ Pa. Draw the Mohr's stress circle (3-D) and determine the maximum shear stress at the middle point P on the inside vessel wall.



3. The strain gauge rosette below is mounted on the outer wall of one of a Boeing 747 plane's nozzles, where the material is in homogeneous state of plane stress. The strain measured by the rosettes are $\epsilon_a = 0.0010$, $\epsilon_b = 0.0025$, and $\epsilon_c = -0.0050$. The modulus of elasticity and Poisson's ratio of the materials are $E = 70$ GPa and $\nu = 0.33$. What are the principle stresses and the absolute maximum shear stress at the point? What is the normal stress in the direction of strain gauge b?

