Optimum Design - Sheet 2
Graphical Optimization

1. Solve the following problems using the graphical method by hand and a Matlab code:

   a. Maximize $f(x_1, x_2) = 4\, x_1\, x_2$
   subject to $x_1 + x_2 \leq 20$
   $x_2 - x_1 \leq 10$
   $x_1, x_2 \geq 0$

   b. Minimize $f(x_1, x_2) = 5x_1 + 10x_2$
   subject to $10x_1 + 5x_2 \leq 50$
   $5x_1 - 5x_2 \geq -20$
   $x_1, x_2 \geq 0$

   c. Minimize $f(x_1, x_2) = x_1 x_2$
   subject to $x_1 + x_2^2 \leq 0$
   $x_1^2 + x_2^2 \leq 9$

2. Solve the rectangular beam problem of Sheet 2 Problem 4 graphically by hand and a Matlab code for the following data: M = 80 kN·m, V = 150 kN, σ_a = 8 MPa, and τ_a = 3MPa.

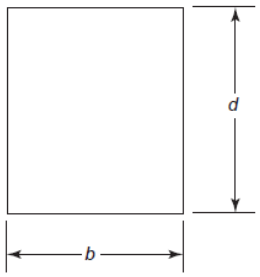

Fig.1 Cross section of a rectangular beam.

3. Solve the cantilever beam problem of Sheet 2 Problem 7 graphically by hand and a Matlab code for the following data: P = 10 kN; L = 5.0 m; modulus of elasticity, E = 210 Gpa; allowable bending stress, σ_b = 250 MPa; allowable shear stress, τ_a = 90 MPa; mass density, ρ= 7850 kg/m3; $R_o \leq$ 20.0 cm; $R_i \leq$ 20.0 cm.

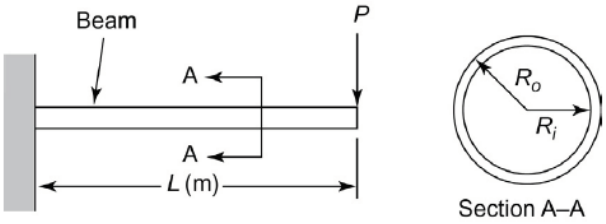

Fig.2 Cantilever beam.