Problem 1: (25 points) A log weighing 800 lb is lifted by tongs as shown. Determine the forces exerted at $E$ and $F$ on tong $DEF$.
Problem 2: (20 points) By direct integration, derive expressions for the area and the location of the centroid of the area shown from the x-axis.

Problem 3: (35 points) Calculate the force in each member of the truss shown. State whether each member is in tension or compression.
Problem 4: (5 points each, no partial credit) Draw the free-body diagram(s) for the following situations. Do not solve!

(a) Determine the reactions at the roller $A$ and the pin $B$.

(b) Determine the force that the pliers exert on the nut held in the jaws.
(c) A 250 × 400-mm plate of mass 12 kg and a 300-mm-diameter pulley are welded to axle AC which is supported by bearings at A and B. For $\beta = 30^\circ$, determine the tension in the cable and the reactions at A and B. The bearing at A is a thrust bearing, whereas the bearing at B does not exert any axial thrust.

(d) The uniform bars AB and BC each weigh 4 lb/ft. Calculate the tension in cable DE, and the magnitudes of the ball-and-socket reactions at A, B, and C.