

1. A film of soap is suspended between the two wires, one defined by the line  $y = 1$  and the other by the curve  $y = x^2$ . Due to gravity the density of the soap film  $\rho(x, y) = k(1 - y)$  where  $k$  is a constant.

(a) Sketch the soap film.

(b) Find  $k$  if the total mass of soap film is 1 gram.

(c) Find the center of mass of the soap film.

2. Evaluate the integral

$$\iiint_R z(x^2 + y^2) dV$$

where

(a)  $R$  is the solid bounded by the planes  $x = 1$ ,  $y = 0$ ,  $y = 1$ ,  $z = 0$  and  $z = x$

(b)  $R$  is the solid bounded by the cylinder  $x^2 + y^2 = 4$  and the planes  $z = 3$  and  $z = 0$ .