Mass of a Disk

The mass density of a flat object can be specified by $\sigma = \sigma(x, y)$, with units of mass per unit area. The total mass of the object is found from the double integral

$$M = \int \int_A \sigma(x, y)\, dx\, dy.$$

Suppose a circular disk of radius R has mass density ρ_0 at its center and ρ_1 at its edge, and its density is a linear function of the distance from the center. Find the total mass of the disk.