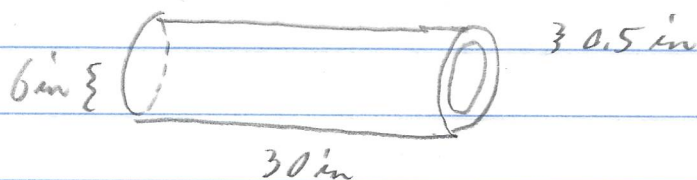


3.11.53 Estimate the volume of material in a cylindrical shell with length 30 inches, radius 6 inches, and shell thickness 0.5 inches.



Solution

Let  $f$  be the volume of a cylinder of height 30 inches and radius  $r$  (inches).

Then  $f(r) = 30\pi r^2 \text{ in}^3$ . Then we

approximate  $\Delta y = \Delta f$  with  $dy$  where

$dy = f'(r) dr = f'(r) \Delta r$  where  $dr = \Delta r = 0.5 \text{ in}$ .

Since  $dy = f'(r) dr = 60\pi r dr$  then

for  $r = 6 \text{ inches}$  and  $dr = \Delta r = 0.5 \text{ inches}$ ,

we have  $dy = 60\pi(6)(0.5) = \boxed{180\pi \text{ in}^3}$

$\approx 565.5 \text{ in}^3$ .  $\square$