Lab 6
Bikramjit Narwal 1005242300

Area $= 8r^2 + 2\pi r h$
Volume $= \pi r^2 h$
Volume $= 2000\text{cm}^3$

$$\frac{V}{\pi r^2} = \frac{\cancel{\pi r^2} h}{\cancel{\pi r^2}}$$

$$h = \frac{V}{\pi r^2}$$

$$A = 8r^2 + 2\pi r h$$

$$A(r) = 8r^2 + 2\cancel{\pi}\cancel{r}\left(\frac{V}{\cancel{\pi} r^{\cancel{2}}}\right)$$

$$A(r) = 8r^2 + 2\left(\frac{2000}{r}\right)$$

$$= 8r^2 + 4000r^{-1}$$

$$A'(r) = 16r - 4000r^{-2}$$

$$0 = 16r - \frac{4000}{r^2}$$

$$16r^3 = 4000$$

$$r = 6.3\text{cm}$$

$$h = \frac{2000}{\pi(6.3)^2}$$

$$h = 16.03\text{cm}$$

```
close all
figure
hold all
grid on

x = linspace(2,10,101);
y = (16.*x) - (4000./x.^2);
plot(x,y)


Q = (8*x.^2)+(4000./(x))
plot(x,Q)

xlabel('Radius (cm)')
ylabel('Area (cm^2)')
title('Minimizing Cylindrical Surface Area')
legend('Derivative','Original Function')
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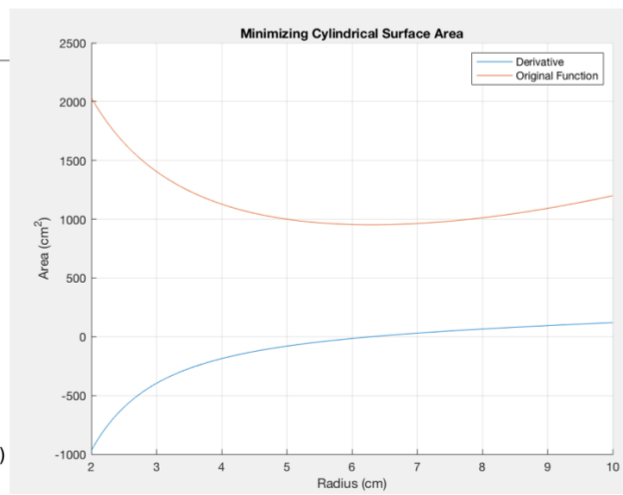

Thought Process for Calculations

I instantly identified this situation as an optimization problem, so I knew the derivative had to be taken to determine where the extrema value was. Like every problem, I wrote out what I knew about the problem itself, this included the equations and the given values. Since area was a function of radius, I had to isolate the volume function for height, so it could be plugged into the area function. After solving for height and plugging it into the area function, the derivative was found and set equal to 0. From this the radius was been found to be approximately 6.3cm which resulted in a height of 16.03cm. To check whether I was right, I solved for the volume with the radius and height I calculated. I had received the same volume that was given in the question, so I knew I was correct.