Lab 6 – Question 2
Malhar Shah (1004926912)

Work Process

For this lab, I had to answer the following question:
What radius, r, and height, *h*, of the can will minimize the total amount of material required for the rectangle and the two circles?

In order to answer this question, I knew that I had to use the following equations:

$$Area = 8r^2 + 2\pi rh$$
$$Volume = \pi r^2 h = 2000\ cm^3$$

First, I isolated the Volume equation for height, h:

$$h = = \frac{2000}{\pi r^2}$$

Then I plugged in this new equation into the area equation to get:

$$Area = 8r^2 + 2\pi r \frac{2000}{\pi r^2}$$

Now I know that when change in area per change in radius is 0, that is the value of radius that will minimize the total amount of material required for the rectangle and the two circles:

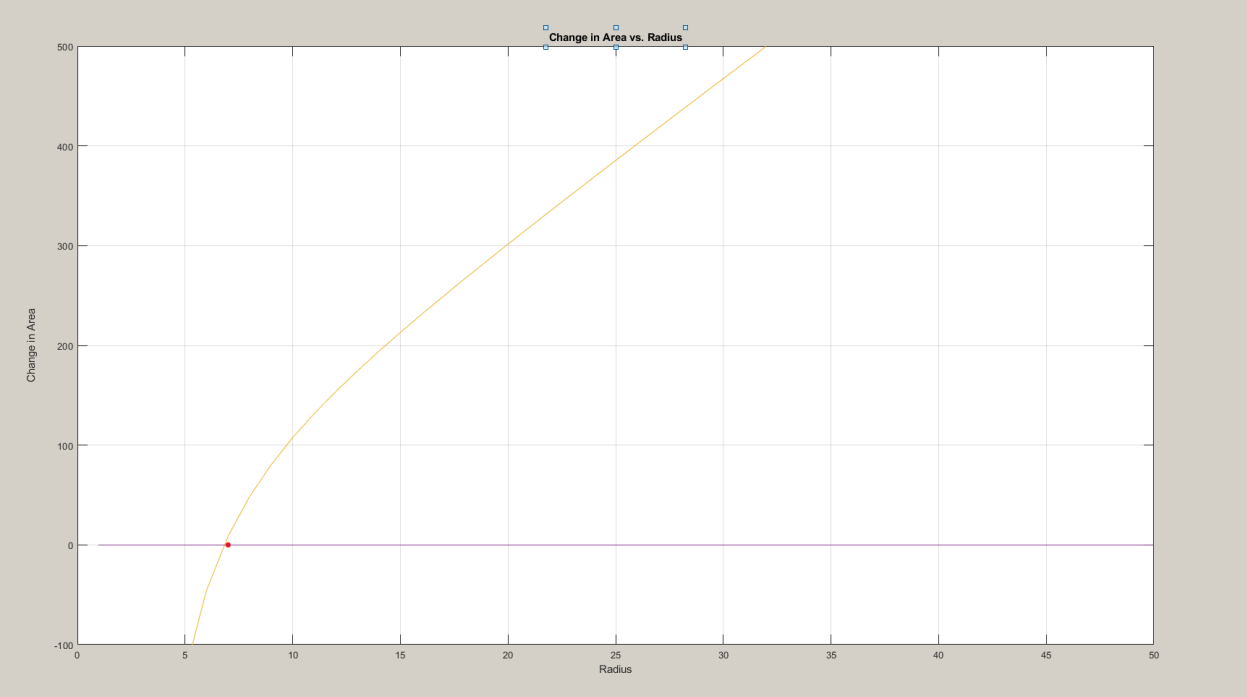
$$\frac{d(Area)}{d(r)} = 0$$

I used MatLab to plot the function through this code:

Code and Calculation

```
r = 0:50;
h = 2000./(pi.*r.^2);
Area = 8*(r.^2) + 2*pi*r.*h;
Area_prime = diff(Area);
plot(Area_prime)
y = 0*x
plot(y)
hold all
grid on
```

Graph



Analysis of the Graph

Using the graph, Area_prime = 0 when r = 6.2996.
Therefore, the change in Area per change in radius= 0 when r= 6.2996 cm.

$$h = = \frac{\pi(6.2996)^2}{2000} = 16.042\ cm$$

Therefore, a radius of 6.2996cm and a height of 16.042 cm will minimize the total amount of material required for the rectangle and the two circles.

$$Volume = \pi(6.2996)^2(16.042) = 2000\ cm^3$$

After plugging the values back into the equation gives the same answer as well.

Justification of the Measurements

I decided to use centimeters as the scale because I felt that using a metres scale would require small radius values making the graph more difficult to understand. Utilizing centimeters gives a better experience with the graph and values since they are in the 1-10cm range instead of the 0.001 – 0.010 m range.

Other Considerations Engineers might take into account

Engineers might want to consider how accurate and precise the radius and height values should be depending on the precision of the cutting instrument used by Emma. Other considerations might include taking a slightly larger radius due to putting together the can will require the gluing of the body of the can to the two circular lids which will use of some of the radius.