TZDII Problem 16.15 part b)

The density of mass inside a nucleus is approximated by

$$\rho(r) = \frac{\rho_0}{1 + e^{r - R / t}}$$

where $\rho_0$, $R$, and $t$ are positive constants. Sketch $\rho$ as a function of $r$.

```
In[45]:= 
 rho = rho0 / (1 + Exp[(r - R) / t])

Out[45]= 
 rho0 / (1 + e^(-r / t))
```

Take some random small values in for $R$ and $t$ (but $\rho_0$ is fairly well known) since it’s only the shape of the curve matters. Then plot it.

```
In[101]:= 
 rho0 = 3 * 10^17;
 R = 4;
 t = 0.5;

In[107]:= 
 PlotA = Plot[rho, {r, 0, 10},
 TextStyle -> {FontFamily -> Helvetica, FontSize -> 12, FontColor -> RGBColor[0, 0, 0.75]},
 Ticks -> {{5, 10}, Automatic},
 PlotStyle -> {RGBColor[0, 0, 0.75]}]
```

```
In[117]:= 
 rho0 = 3 * 10^17;
 R = 3;
 t = 0.5;
```
In[120]:=  
PlotB = Plot[rho, {x, 0, 10},  
TextStyle -> {FontFamily -> Helvetica, FontSize -> 12, FontColor -> RGBColor[0, 0.75, 0]},  
Ticks -> {{5, 10}, Automatic},  
PlotStyle -> {RGBColor[0, 0.75, 0]}]

In[133]:=  
rhonaught = 3 \times 10^{17};  
R = 5;  
t = 0.5;

In[136]:=  
PlotC = Plot[rho, {x, 0, 10},  
TextStyle -> {FontFamily -> Helvetica, FontSize -> 12, FontColor -> RGBColor[0.5, 0, 0]},  
Ticks -> {{5, 10}, Automatic},  
PlotStyle -> {RGBColor[0.5, 0, 0]}]
In[138]:=

Show[PlotA, PlotB, PlotC]