Math 151 Lab 2

Use Python to solve each problem.

1. Solve the following equations. Give exact real answers only.
   a) $e^{3x} = 10e^{2x}$ (NOTE: use **exp** for the exponential function)
   b) $\ln(x-1)+\ln(x+2) = 2$ (NOTE: use **log** for the natural logarithm function)
2. A water tower at Warner Bros. Studio consists of a cylinder with a hemisphere (half-sphere) underneath (see figure below. Assume the conical top is for aesthetics only and does not contribute to the volume).

   a) Suppose the height of the cylinder is 5m and the volume of the tower is 525 cubic meters. Write an expression (equal to 0) which can be solved to find the radius.
   b) Find the radius (approximate values if necessary)
3. Recall in Lab 1 you used the identity $(\cos x)^2 = \frac{1}{2}(1 + \cos(2x))$. We now look at a common MISTAKEN identity: $\sin(2x)$ " = " $2\sin(x)$.
   a) To show that $\sin(2x) = 2\sin(x)$ is NOT an identity, plot the function $f(x) = \sin(2x) - 2\sin(x)$ on the domain $x \in [0, 2\pi]$, noting that it is NOT always zero!
   b) Use Python to find the values of x where $f(x) = 0$ (you may be able to verify your results from the graph in part a)).
   c) Notice the graph of f has a maximum and minimum value on $[0, 2\pi]$. To find the x-values at these points, solve the equation $2\cos(2x) - 2\cos(x) = 0$ (you will learn why later this semester. Also, it is OK if you get solutions outside the domain-just ignore them).
4. Given the curve parametrized by $x = \dfrac{3t^2}{t^3+1}$, $y = \dfrac{3t}{t^3+1}$:
   a) The Cartesian equation of the curve is $x^3 + y^3 = 3xy$. Evaluate the left and right-hand sides to show you do obtain the same expression.
   b) Use the **plot_parametric** command to sketch the graph on the domain $t \in [-0.5, 10]$.