Only attempt this if you are done with the worksheet and have additional time. For your reference, I've attached some notes on basic differential equations on the last page of this handout. We will go over this together at the end of today's module.

Problem 1. The number of cells in a T25 flask is growing at a rate of $\alpha \exp(\lambda t)$, where t represents the time elapsed since the initial time.

(a) Write a differential equation to model the rate at which the cells are dividing. Use the function $F(t)$ to denote the number of cells at any given time.

(b) At $t = 0$, there are ϕ cells in the flask. Use the equation you wrote in part (a) to find the number of cells present at time $t = \delta$.

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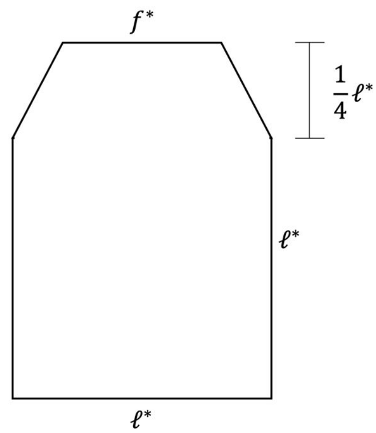
(c) Assume all cells are adhered to the bottom of the flask and that each of the cells can be modelled as a 2D circle with radius R^* in the order of μm. The flask has the dimensions shown in the image below, where f^* and l^* are known constants. Using this information and your answer from part (b), calculate the cell confluency at time $t = \delta$.



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Solving Basic Differential Equations Through Separation of Variables

A separable equation is a 1st order differential equation of the form:

$$\frac{dy}{dx} = f(x)g(y) \qquad (1)$$

Use the following steps to solve the equation:

1. Manipulate the equation so that the left side is a function of y and the right side is a function of x.

$$\frac{dy}{g(y)} = f(x)\,dx \qquad (2)$$

2. Integrate both sides (don't forget to add a $+C$)

3. Solve for y if possible and C if given an initial value.