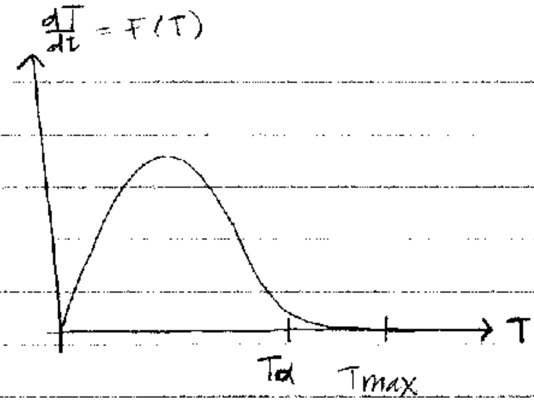
Growth!

1. (a) possible growth function:



(b) $\frac{dT}{dt} = Te^{-T}$

* there are much simpler cases!

2. We have (i) the # of proliferating cells is proportional to the volume: $T = kV$ or $V = \tilde{k}T$ $(\tilde{k} = 1/k)$

(ii) the # of proliferating cells, P is proportional to the surface area of the sphere:

$$V = \frac{4}{3}\pi r^3(t) \rightarrow \left(\frac{3V}{4\pi}\right)^{1/3} = r(t)$$

$$SA = 4\pi r^2(t)$$

$$P = k_2 SA = k_2(4\pi r^2(t))$$

$$= k_2\left(4\pi\left(\frac{3V}{4\pi}\right)^{2/3}\right)$$

$$= k_3 T^{2/3} \quad \text{where } k_3 = k_2 \cdot 4\pi \cdot \left(\frac{3\tilde{k}}{4\pi}\right)^{2/3}$$

$$\frac{dT}{dt} = k_3 T^{2/3}$$

3. In case (A)

If $x(0) = 1$, $x(t)$ increases until it reaches 2

If $x(0) = -4$, $x(t)$ still increases until it reaches 2

If $x(0) = 3$, for example, $x(t)$ decreases until it reaches 2

In case (B)

If $x(0) = 1$, $x(t)$ decreases until it reaches -2

If $x(0) = -4$, $x(t)$ increases until it reaches -2

If $x(0) = 4$, for example, $x(t)$ increases indefinitely