Understanding exponential functions

Taylor Series
\[ e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots + \frac{x^n}{n!} = \sum_{n=0}^{\infty} \frac{x^n}{n!} \]

A Learning Curve
(why you get better with time, assuming other to be variables constant)

Q = amount of specific knowledge
At any time \( t \), Q changes at a rate proportional to the amount of Q present.

\[ \frac{dQ}{dt} = kQ \quad (k \text{ must have units of } t^{-1}, \text{i.e., a rate}) \]

\[ \frac{dQ}{Q} = k \, dt \]

\[ Q = Q_0 \, e^{kt} \quad \text{(unbounded growth at rate kQ)} \]

Alternately for asymptotic growth to \( Q_f \):

\[ Q = Q_f \left(1 - e^{-kt}\right) \quad \text{(Q increases from 0 to } Q_f) \]
Understanding the solar cell device

1. Electronic design
   a. semiconductor material
   b. p-n junction
   c. top contact
   d. bottom contact
   e. backside electric field
   f. interface passivation

2. Photonic design
   a. Anti-Reflection (AR) coating
   b. Lambertian frontside texture
   c. backside diffractive element
   d. backside reflector