Introduction to Mathematical Modelling

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In applications we often have info about the rate of change of a quantity
Eg. Consider a population of organisms, P(t), with unlimited resources (space, food, etc)
That is, $\frac{dP}{dt} = aP$ for some $a \epsilon R$

$$\rightarrow P(t) = Ce^{at}$$

At $t = 0$ we have $P(0) = C$, so C is the initial population.

$$P(t) = P_0 e^{at}$$

(this is the Malthusian model of population growth)
Malthus suggested including a "carrying capacity", K (a maximum sustainable population). How might we modify the equation?

One way: The Logistic Model
We should alter it in such a way that the dervitive is 0 when we reach K

$$\frac{dP}{dt} = aP(1 - \frac{P}{k})$$