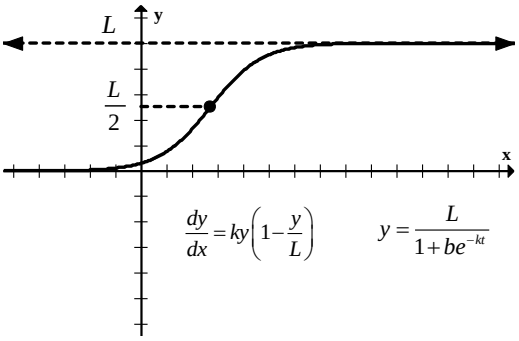


Logistic Differential Equation $\frac{dy}{dx}=ky\left(1-\frac{y}{L}\right)$ is used to model situations like population growth with a carrying capacity. The rate of change is proportional to the value of *y*.

If $f(x)$ is a solution to the logistic differential equation, then

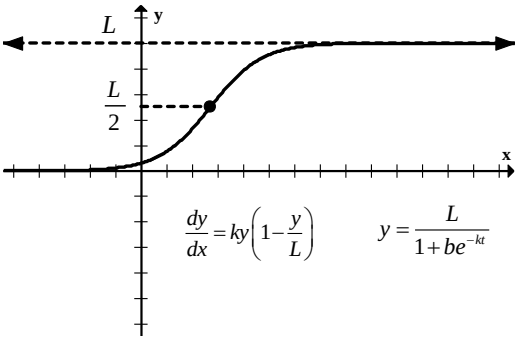
$\lim_{x\to\infty} f(x)=L$

$f(x)$ has an inflection point when $y=\frac{L}{2}$

In the context of population growth, the logistic differential equation is often expressed as $\frac{dP}{dt}=kP\left(1-\frac{P}{L}\right)$.

Note that some factoring may need to be performed to achieve the "1" in the logistic differential equation.

$$\frac{dP}{dt}=5P(7-P)\leftrightarrow\frac{dP}{dt}=35P\left(1-\frac{P}{7}\right)$$



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A rumor spreads among a population of N people at a rate proportional to the product of the number of people who have heard the rumor and the number of people who have not heard the rumor. If p denotes the number of people who have heard the rumor, which of the following differential equations could be used to model this situation with respect to time t, where k is a positive constant?

(a)	(b)	(c)	(d)	(e)
$\frac{dp}{dt} = kp$	$\frac{dp}{dt} = kp(N-p)$	$\frac{dp}{dt} = kp(p-N)$	$\frac{dp}{dt} = kt(N-t)$	$\frac{dp}{dt} = kt(t-N)$

A population of wolves is modeled by the function P and grows according to the logistic differential equation $\frac{dP}{dt} = 5P\left(1-\frac{P}{5000}\right)$, where t is the time in years and $P(0)=1000$. Which of the following statements are true?

I. $\lim_{t\to\infty} P(t) = 5000$ II. $\frac{dP}{dt}$ is positive for $t>0$ III. $\frac{d^2P}{dt^2}$ is positive for $t>0$

(a) I only (b) II only (c) I and II only (d) I and III only (e) I, II, and III

AP Calculus BC 2004 #5: FRQ that is focused on the LDE
AP Calculus BC 2008 #6: FRQ that is focused on the LDE, skip part (c)
AP Calculus BC 2006 Form B #5: FRQ that is focused on the LDE

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IV. $\lim_{t\to\infty} P(t) = 5000$ V. $\frac{dP}{dt}$ is positive for $t>0$ VI. $\frac{d^2P}{dt^2}$ is positive for $t>0$

(f) I only (g) II only (h) I and II only (i) I and III only (j) I, II, and III

AP Calculus BC 2004 #5: FRQ that is focused on the Logistic Differential Equation
AP Calculus BC 2008 #6: FRQ that is focused on the LDE, skip part (c)
AP Calculus BC 2006 Form B #5: FRQ that is focused on the LDE