

## Differential Equations

Warm up: Solve for  $x$ .

1.  $2 \ln x - 3 = 7$

2.  $e^{x+2} = 6$

Important Log Properties to know:

ex 1: The rate of change of the volume  $V$  of water in a tank with respect to time  $t$  is directly proportional to the square root of the volume. Write a differential equation that describes this relationship.

ex 2: Out of a population of  $N$  people, a rumor is spreading at a rate proportional to the product of the people who have heard it and the people who haven't. If  $p$  is the number of people who have heard it, write a differential equation that models this behavior.

ex 3: The amount of bacteria in a culture  $B$  is growing at a rate that is proportional to the cube root of the bacteria present. Write a differential equation that models this behavior:

Finding General Solutions: Separation of Variables

$$\frac{dy}{dx} = ky$$

84. Population  $y$  grows according to the equation  $\frac{dy}{dt} = ky$ , where  $k$  is a constant and  $t$  is measured in years. If the population doubles every 10 years, then the value of  $k$  is

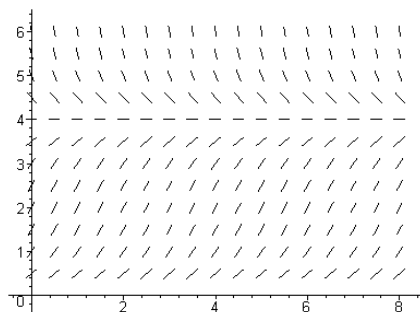
- (A) 0.069      (B) 0.200      (C) 0.301      (D) 3.322      (E) 5.000

Find  $y$  if  $\frac{dy}{dx} = 3y + 6$

Newton's Law of Cooling:  $\frac{dT}{dt} = k(T - S)$

Suppose an object that is 1200 C is put into an environment with a constant 80 C temperature. After an hour, the object's temperature is 950 C. Find the temperature after 5 hours in the environment.

Particular Solutions



Find the particular solution to  $\frac{dy}{dx} = -\frac{xy^2}{2}$  with initial condition  $f(-1) = 2$