APPLICATIONS OF UNINHIBITED GROWTH

Note Title 4/9/2019

EXPONENTIAL FUNCTIONS

CONSIDER THE EQT $f(x) = 5e^{3x}$, THEN

$$f'(x) = 5e^{3x} \cdot 3$$

OR $$f'(x) = 3 \cdot 5e^{5x}$$

OR $$f'(x) = 3 \cdot f(x)$$

GRAPHICALLY THE DERIVATIVE IS 3 TIMES THE FUNCTION VALUE.

THEOREM: A FUNCTION $y = f(x)$ SATISFIES THE EQUATION $\frac{dy}{dx} = ky$ IFF $y = Ce^{kt}$, FOR SOME NON-ZERO CONSTANT C

(1ST ORDER DIFFERENTIAL EQUATION $\Rightarrow$ $k \rightarrow$ GROWTH RATE)

- TO SOLVE A DIFFERENTIAL EQUATION YOU NEED TO KNOW

1) ITS FORM

2) STARTING CONDITIONS

IE SOLVE A) $\frac{dP}{dt} = 4P$

B) IF $P_0 = 5$, FIND C

SOLN A) SINCE $\frac{dP}{dt} = 4P$, THEN $K = 4$

$$\therefore P = Ce^{4t}$$

B) IF $P_0 = 5$, FIND C

$$5 = Ce^{4(0)}$$

$$C = 5 \implies P = 5e^{4t}$$

IF SOLVE A) $\frac{dP}{dt} = 2P$ IF $P_0 = 3$

B) FIND t IF $P = 5000$

SOLN A) $K = 2$ $\therefore$ $P = Ce^{2t}$

$3 = Ce^{2(0)}$

$3 = C$

$P = 3e^{2t}$

B) $\frac{5000}{3} = \frac{3e^{2t}}{3}$

$$\frac{5000}{3} = e^{2t}$$

$$\frac{\ln\left(\frac{5000}{3}\right) = 2t}{2} \qquad \frac{}{2}$$

$$3.71 = t$$

IE A POPULATION OF INSECTS GROWS ACCORDING TO THE EQUATION $\frac{dE}{dt} = kt$. THE INSECTS ARE GROWING AT A RATE OF 5.6% CONTINUOUSLY. AT PRESENT THERE ARE 2000 INSECTS (AFTER 5 YEARS OF GROWTH). HOW MANY INSECTS WERE THERE 2 YEARS AGO?

Solve $t = 5$

$k = 0.056$

$E = 2000$

$E = Ce^{kt}$

$2000 = Ce^{(0.056)(5)}$

$2000 = C(1.32)$

$1511.57 = C$

$E = 1511.57e^{(0.056)(3)}$

$E = 1788$

HW Pg 305

3, 4, 7-9, 23, 29

SUBMIT THIS WORK BY THURSDAY