Calculus
Chap. 6 section 5
Targets with examples

Name: ______________________________
Date: ______________________________
Period: ______________________________

Solving Differential Equations

Challenging problems can be solved with differential equations.

6E Understanding Applications of Differential Equations

1. Solve exponential growth and decay problems
2. Solve logistic growth problems*

[6.4] 11, 15, 25, 26, 29 {6E.1}
[6.5] 5 - 11 odd, 17 {6E.2}

Solve exponential growth and decay problems

Sample Question	Suppose the amount of oil pumped from one of the canyon wells in Whittier, California, decreases at the continuous rate of 10% per year. When will the well's output fall to one-fifth of its present level?
Sample Response	Show / Hide Answer Suppose the amount of oil pumped from one of the canyon wells in Whittier, California, decreases at the continuous rate of 10% per year. When will the well's output fall to one-fifth of its present level? $\frac{dR}{dt} = k \cdot R \quad k = -0.10$ $\frac{dR}{dt} = -0.10R$ $\frac{1}{R}dR = -0.10\,dt$ $\ln\lvert R\rvert = -0.10t + C$ $\lvert R\rvert = e^{-0.10t + C}$ $R = e^{-0.10t} \cdot e^{C}$, let $R_0 = e^{C}$ $R = R_0 e^{-0.10t}$ So... $\frac{1}{5}R_0 = R_0 e^{-0.10t}$ $\frac{1}{5} = e^{-0.10t}$ $\ln\frac{1}{5} = -0.10t$ $t = \frac{\ln\frac{1}{5}}{-0.10} \approx 16.094$ YRS

Solve logistic growth problems*

Sample Question	A population of rabbits is given by the formula $P(t) = \dfrac{1000}{1+e^{4.8-0.7t}}$ where *t* is the number of months after a few rabbits are released. - Show that the function is the solution of a logistic differential equation and identify the carrying capacity
Sample Response	[Show](#) / [Hide](#) Answer A population of rabbits is given by the formula $P(t) = \dfrac{1000}{1+e^{4.8-0.7t}}$ where *t* is the number of months after a few rabbits are released. - Show that the function is the solution of a logistic differential equation and identify the carrying capacity $\dfrac{dP}{dt} = \dfrac{k}{M}P(M-P)$, $P = \dfrac{M}{1+Ae^{-kt}}$ ARE THE TWO FORMS OF A LOGISTIC FUNCTION... $1 + e^{4.8-0.7t} = 1 + Ae^{-kt}$ $1 + \underbrace{e^{4.8}}_{\text{"A"}} \cdot e^{-\underbrace{0.7}_{\text{"k"}}t}$