**DIFFERENTIAL EQUATIONS (ODEs)**

**MA 2051–C99**

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**TOPICS**

- Business
- Terminology
- A Model
- Solve a Couple of Examples

## GRADE SCHEME

- 2 Tests .......................................... 200 points
- Homework .......................................... 100 points
- 2 Projects .......................................... 100 points

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- Total .......................................... 400 points



## Recommended Problems

$\hookrightarrow$ **Visit the Web...**

## MODELING CYCLE

**Formulate**

**Analyze**

**Interpret**



## TERMINOLOGY:

- ODE
  - dependent variable, independent variable
  - parameter
  - initial data
- The MODEL is the ODE
- Solution ...a function
  - Test a Solution? .................. Plug it in!

**Example: Heat-Loss Model**

$$T'(t) = \gamma \left[T_{\mathrm{out}} - T(t)\right]$$

- independent variable: $t =$ time
- dedependent variable: $T =$ temperature
- parameters: $\gamma$ and $T_{\mathrm{out}}$



**A Few Models:**

Population: ............................ $P'(t) = aP - sP^2$

Heat Loss: ........................ $T'(t) = \gamma \left[T_{\mathrm{out}} - T(t)\right]$

Damped Spring: .................. $mx'' + px' + kx = F(t)$

Free Fall: ...................................... $\dfrac{dv}{dt} = -g$

**SOLUTIONS:**

$$x''(t) + \omega^2 x(t) = 0$$

$$x_1(t) = \sin(\omega t), \qquad x_2(t) = \cos(\omega t)$$

Plug 'em in:



**Simple and Separable...Just Integrate**

Example #1:

$$\frac{dx}{dt} = \cos(t)$$

**Simple and Separable**

Example #2:

$$\frac{dP}{dt} = 0.012P(t), \quad P(1900) = 76.09$$



**HW Set #1 is due Monday**

Section 1.6: Problems 4, 6b, 13a

**Are the following quotes consistent?**

Since Isaac Newton's time (1642—1727):

- 90% of all the scientists and engineers who have ever lived are alive today.
- Knowledge in science and engineering doubles every 17 years.