DIFFERENTIAL EQUATIONS (ODEs)

MA 2051–C 2000

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Stratton Hall, Room 202A

TOPICS

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

GRADE SCHEMES

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

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- Total .... 400 points

VISIT THE WEB...

- Syllabus and Basic Rules
- Recommended Problems
- Lecture Slides (postscript)
- Other Stuff

MODELING CYCLE

Formulate

Analyze

Interpret

INTERPRETATION?

- How does the amplitude of a simple oscillator depend on the frequency of the external forcing?

$$mx''(t) + cx'(t) + kx(t) = F_0 \sin(\omega_f t)$$

- How does the period of a pendulum depend on the mass?

$$g \cdot \theta''(t) = -L \cdot \sin(\theta(t))$$

More Models:

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

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

Damped Spring: .... $y'' + by' + ky = F(t)$

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

TERMINOLOGY:

- ODE
  - dependent variable, independent variable
  - parameter
  - initial condition
- Solution
  - Test a Solution?

SOLUTIONS:

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

Guess and Check...

Simple and Separable

Example #1:

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

Simple and Separable

Example #2:

$$P'(t) = 0.0102P(t), \quad P(1900) = 76.09$$

When is Initial?

Example #2: Solve it...

$$P(t) = 0.000000029e^{0.0102t}$$

There has to be a better way to write it...

Homework Set #1:

HW Set #1 is due Monday ... *at the start of lecture* ...

Section 1.5: Problems 1, 4, 6b, 7b, 10, 13(a,c,e)

Bonus Problem #1: Due: Wednesday in Lecture

The Famous Snow Plow Problem:

On January 13 it began to snow early in the morning and the snow continued to fall throughout the day at a constant rate. Assume that the speed at which a snow plow is able to clear a road is inversely proportional to the height of the snow. The snow plow started at 5 a.m. and had cleared four miles by 8 a.m. By 12 noon it had cleared another two miles.

At what time did it start snowing?