Introduction to Mathematica
Workshop on Fundamental Engineering Skills

American Society for Engineering Education (ASEE)
Student Chapter at the University of Michigan
What we’ll cover today...

- Basic commands and syntax
- Function definition
- Integration
- Differentiation
- Plotting
Why Use Mathematica?

• Symbolic manipulation
• Analytic and numerical calculations
• Excellent graphics for visualizing results
• Powerful built-in functions
• User-friendly palettes
• Helpful online documentation center
A Few Introductory Points

• Program Structure
  – Front End
    • Handles interaction with the user
    • *Notebook* with cell groups
  – Kernel
    • Performs the computations

• Capital letters for all built-in functions
  – Plot[], Integrate[], DSolve[]

• Shift + Enter to run calculations in a notebook
• F1 for help with syntax and use of all built-in functions
Damped Harmonic Oscillator

- \( m \)
- \( Damping \ Coefficient, \ c \)
- \( Spring \ Stiffness, \ k \)
- \( -cv = -c \frac{dx}{dt} \)
- \( +x \)
- \( -kx \)
Damped Harmonic Oscillator

\[-kx - cv = ma\]

\[-kx - c \frac{dx}{dt} = m \frac{d^2x}{dt^2}\]

\[\frac{d^2x}{dt^2} + \frac{c}{m} \frac{dx}{dt} + \frac{k}{m} x = 0\]
Check out our website (http://asee.engin.umich.edu/) for upcoming Workshops on Fundamental Engineering Skills:

- Advanced Plotting in MATLAB
- LaTeX
- SolidWorks
- Photoshop
- Illustrator