

**MA205 - Integral Calculus**  
**Lesson 45: Euler's Method**

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Mechanics Based Problems

*For the following exercise use Euler's method with a step size of  $h = 0.1$ , and again with  $h = 0.05$  to obtain numerical solutions for the DE and stated initial condition. Perform these initial computations by hand and record your numerical solutions in a table. Then use Mathematica to obtain numerical solutions to the problems using step sizes of  $h = 0.001$  and  $h = 0.0001$ . Compare the different solutions.*

1.  $y' = 2x - 3y + 1, y(1) = 5$ ; find  $y(1.2)$



3. Select an appropriate step size for Problem Solving Problem #4, Lesson 39, and perform the following:

(a) Estimate the temperature of the cup of coffee after 10 minutes using Euler's Method. Compare your numerical results (from Euler's Analysis) to your graphical results. Do the results appear to be in agreement with each other?

(b) According to your numerical analysis, how long does it take for the coffee to cool down to room temperature?

4. A large tank contains 300 gallons of saltwater. A brine solution enters the tank at a rate of 3 gallons per minute. The concentration of the in flow is variable and is given by  $c_{in}(t) = 2 + \sin(t/4)$  in pounds per gallon. The solution in the tank is pumped out at a rate of 3 gallons per minute. If 50 pounds of salt is initially dissolved in the tank, how much salt is in the tank after 10 minutes? After 2 hours? After 10 days? What is the long term behavior of salt in the tank?