

Euler's Method: Exercises and Exploration

Here are some problems for you to further explore the Euler's method applet. Take time to play around with all three of them. Some of the phenomena you encounter will be explained in the next note in this session: *Errors in Euler's method*.

Start by opening the *Euler's Method*.

Concave and convex functions: overshooting and undershooting

1. Call up the DE $y' = 0.5y + 1$, use the initial point $(-2, -1)$, and construct the Euler solutions for increasing x using the stepsizes $h = 0.5, 0.25$, and 0.125 . Then compare with the actual solution. At each step, which is the best approximation? Is it too high or too low?
2. Now do the same for $y' = y^2 - 2y + 1$, with initial point $(-1, -1)$. Do you think you can predict when the approximation is going to be too high or too low?

A cautionary tale: separatrix crossing

3. Call up $y' = y^2 - x$, use as the initial point $(-0.98, 0)$. Select 'Actual' and 'Euler 0.50', and have the Applet draw the solutions. Then use the same initial condition with 'All Euler'. What happened? Can you describe the problem in the language of graphical solutions?

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