COLBY COLLEGE
Department of Mathematics
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Assignment 8: Nonlinear systems

Reading: Faires and Burden Chapter 10.

Due: Thursday 12 November

Big picture: we're going to try to solve a system for which Newton's method works poorly when we are far from the solution. Instead we are going to use steepest descent to get close and then Newton's method near the solution.

Newton fails

1. Start with `newton3d_demo.mws` from the web page and modify it to solve the system in Exercise 3c on page 422 of the book.
2. Use `fsolve` to find an exact solution.
3. If we start with the initial guess (0,0,0), what happens to Newton's method? What if we start with (1,0,0)?

Steepest descent

1. Use Maple to implement steepest descent, following the example on page 420 of the text. Go step by step to make sure you can duplicate the results in the book.
2. Use the set of commands you just debugged (and any procedures you wrote) to apply one iteration of steepest descent to the original problem, starting from (0,0,0) again.

   Hint: As the book implies, choosing α_3 is an art. In this case, I recommend 3. If you choose another value, make sure you know what to do if the critical point does not lie between $\alpha 1$ and $\alpha 3$.

   Hint: for help finding the critical point, see Exercise 6 on page 422.
3. Perform a few steps of Newton's method and see if convergence is going any better from this position.