Home work 2. (Due September 24, 2008)

Math 353 Section 12, Fall 2008, University of Delaware

MatLab Exercises

1. Write MatLab program to approximate the derivatives of the following functions at the given point. You have to use at least three different formulas. Make a table of the error and determine the optimal step size.

   (a)

   $$f(x) = 60x^{45} - 32x^{33} + 233x^5 - 47x^2 - 77, \quad x_0 = \frac{1}{\sqrt{3}}, \quad f''(x_0) - ?$$

   (b)

   $$f(x) = \tan\left(\cos\left(\frac{\sqrt{5} + \sin x}{1 + x^2}\right)\right), \quad x_0 = \frac{1 + \sqrt{5}}{3}, \quad f'(x_0) - ?$$

   (c)

   $$f(x) = x\sqrt{x}, \quad f'(0) - ?$$

   (d)

   $$f(x) = x^{x^x}, \quad f'(0.0001) - ?$$

2. Exercise 5.1.5. (Computer Problems)

Exercises.

1. Exercise 5.1.1.
2. Exercise 5.1.5.
3. Exercise 5.1.8.
4. Exercise 5.1.11.
5. Exercise 5.1.12.
6. *Partial differentiation formulas.* Finite difference formulas can be adapted to partial derivatives. Example:

   $$f_x(x,y) = \frac{\partial f}{\partial x}(x,y) \approx \frac{f(x+h,y) - f(x-h,y)}{2h}, \quad f_y(x,y) = \frac{\partial f}{\partial y}(x,y) \approx \frac{f(x,y+h) - f(x,y-h)}{2h}.$$

   Let $f(x,y) = 2xy/(x+y)$. Calculate approximations to $f_x(2,1)$ and $f_y(2,1)$ using the above defined formulas with $h = 0.1$, 0.01 and 0.001. Compare it with true values.