Math 151A

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Today…

- Newton’s Method
  - Basics
  - Implementation
- Special Topics on Newton’s Method
  - Complex Roots and Fractals
  - Fast Inverse Square Root Algorithm
- Exercise Problems
- Homework Q&A

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Newton's Method

- Algebraic Derivation

- Geometric Interpretation

Newton's Method

- MATLAB Implementation

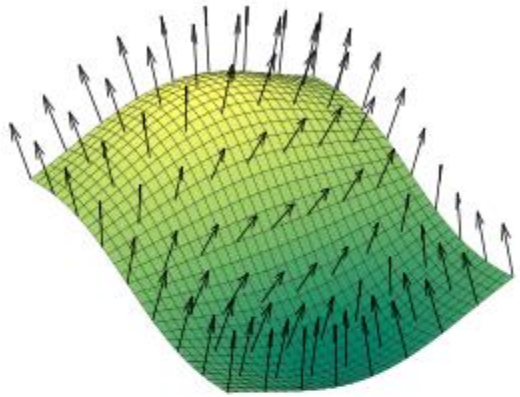
Complex Roots and Newton Fractals

- Note that for fixed point methods, it doesn't matter if the domain is real or complex (or even a higher dimensional space)
  - *as long as it is a contraction*

- However, we can't yet tell which point converges to *which root* when it's not close to any roots
- There are deep results on this topic. We will not cover this, but search for "Newton Fractal" if interested
- Some examples: (MATLAB)

Fast Inverse Square Root Algorithm

- In computer graphics, we use a technique called “trianglulization”
- For each triangle, to represent reflections of light, we need to find “normalized vector”
  - We need to compute inverse square roots to do this
- We have sometimes billions, or trillions(!) of triangles
- So a fast computation of inverse sqrt is required
- (YT)



Surface normals are used extensively in lighting and shading calculations, requiring the calculation of norms for vectors. A field of vectors normal to a surface is shown here.

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Exercise Problems

- Discuss when Newton's method gives linear/quadratic convergence for

$$f(x) = x^2(x-1)$$

HW Q&A

- Need hints for Q7?
- Other Questions?

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