

# Numerical Analysis (CS 450)

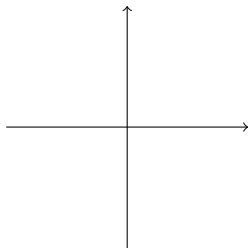
## Worksheet 18

**Objectives:** (1) Understand, predict convergence behavior of Newton in 1D/nD (2) Understand optimization terminology (3) Understand existence/uniqueness/sensitivity results for optimization problems

### Problem 1: Newton's method

(a) Think of a function where Newton's method will not converge. Draw a sketch below. Also mark your initial guess for Newton.

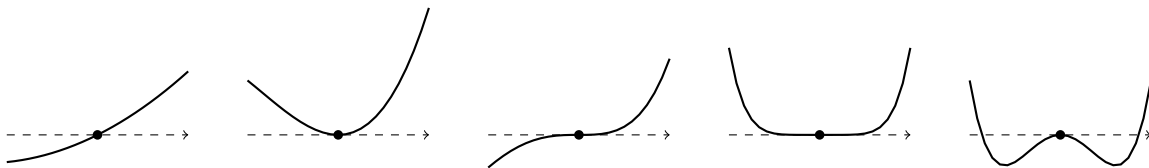
*Hint:*  $f'(x_k)$  is in the denominator. What type of number is bad in a denominator?



(b) Let  $x_k$  and  $x_{k-1}$  be the current and previous iterates in the Newton and secant methods. Write down the estimated slope near  $x_k$  used in each method.

### Problem 2: Existence and Uniqueness of minimizers

(a) Are the following functions coercive? convex? strictly convex?



(b) What does the coercivity, convexity, and strict convexity of the functions mean for the minimizers?

(c) Suppose  $\nabla f(x^*) = 0$  and  $H_f(x^*)$  is negative definite. (i.e.  $-H_f(x^*)$  is positive definite) What does  $f$  look like near  $x^*$ ?