

# MATH 437 Lab

Zoom W 8:00am – 8:50am

Jordan Hoffart

January 21, 2026



**TEXAS A&M**  
UNIVERSITY®

# Updates

- ▶ We meet on Zoom now
- ▶ Regular Zoom office hours will be W 8:50am – 10:00am (right after lab)
- ▶ Typed lecture notes on my website
- ▶ Homework 1 due this Saturday Jan 24 11:59pm on Canvas

## About homeworks

- ▶ Turn in a pdf of answers and code output on Canvas
- ▶ I'll try to be specific about what exactly I want turned in for each question. When in doubt, ask!
- ▶ Homeworks are 20 points per assignment, following the same grade percentages as the syllabus (A 90% – 100%, B 80% – 89%, C 70% – 79%, D 60% – 69%, F 0% – 59%)
- ▶ No late work unless you have a good reason and you let me know before the due date
- ▶ Accepted late work gets a 10% grade penalty

# Homework 1

- ▶ Assignment on Canvas:
- ▶ Fixed-point methods and Newton's method
- ▶ 5 questions, let's look at them. I fixed some typos and ambiguities in the problems on the slides, so refer to them here instead of the problem set on Canvas.

## Question 1

Let  $f$  be a three times differentiable function with a root  $p$  and  $f'(p) \neq 0$ . Let

$$g(x) = x - \frac{f(x)}{f'(x)} + f(x)^2 f''(x).$$

- (1) Show  $g(p) = p$ .
- (2) Show  $g'(p) = 0$ .

## Comments

Nothing to say here. Just compute and remember the quotient rule, product rule, and chain rule for part 2.

## Question 2

Consider the fixed point iteration to solve  $x = g(x)$  with

$$g(x) = x^3 - x + 1.$$

- (1) Do 3 iterations starting with  $x_0 = 1.1$ .
- (2) Does the method converge to the fixed point  $p = 1$  with this initial value? Why or why not?

### Comments

Recall that the fixed point iteration is  $x_{n+1} = g(x_n)$ . Tell me the values of  $x_1$ ,  $x_2$ , and  $x_3$  to 6 digits. For the second part, the reasoning does not have to be rigorous. Just 1 or 2 sentences for completion.

## Question 3

Determine an interval  $[a, b]$  for which the fixed-point iteration will converge for

$$x = \frac{5}{x^2} + 2.$$

Implement the fixed-point iteration and choose a starting value  $x_0$  that gives convergence. Iterate until the residual is within  $10^{-5}$  and report the iterates in a table.

### Comments

I changed the problem slightly from what's on Canvas. The rows of the table should be  $n, x_n, r_n$ , where  $n$  is the iteration number,  $x_n$  is the computed iterate, and

$$r_n := |x_n - g(x_n)|$$

is the residual. Stop when  $r_n < 10^{-5}$ .

## Question 4

Consider the fixed point problem  $x = g(x)$  with  $g(x) = x^3 - 6$ .

- (1) Take  $x_0 = 2.001$  and run 5 iterations of the fixed-point algorithm. Does the method converge to the fixed point  $p = 2$ ? Why or why not?
- (2) Now do 5 iterations of Newton's method on the function  $f(x) = x - g(x)$  starting with  $x_0 = 3$ . Does the method converge to the root  $p = 2$ ?

## Comments

Same comments as question 2. Recall that Newton's method is

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}.$$



## Question 5

Implement Newton's method and find the root  $p \in [1, 2]$  of

$$f(x) = e^x + 2^{-x} + 2 \cos x - 6$$

until the residual is within  $10^{-5}$ .

### Comments

Recall that the residual is  $r_n := |f(x_n)|$ . Turn in a table similar to question 3.