

Math 229 Calculus Computer Lab Fall 17 Final a

Name: Solutions

- I will count your best 6 of the following 8 questions.
- You may only use Julia during this exam. No calculators or cell phones.

1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
	60	

Final	
Overall	

- (1) Convert the following julia expressions to standard mathematical expressions. Use parentheses if necessary to clearly indicate the order of operations:

(a) $a+b/a-b/a$

$$a + \frac{b}{a} - \frac{b}{a}$$

(b) $\cos(1/2*x^2)/2x^2$

$$\frac{\cos\left(\frac{x^2}{2}\right)}{2x^2}$$

(2) Find all solutions (to at least 4 decimal places) to the equation

$$\frac{x}{x+1} \sin^2(x+1) = \frac{x}{3} - 10.$$

Write down the `julia` command you use.

$$f(x) = x/(x+1) * (\sin(x+1)^2) - x/3 + 10$$

`plot(f, -10, 10)`

`plot(f, -10, 100)`

`zeros(f, 20, 40)`

solutions: 30.1709
31.0667
32.4129

(3) Use `julia` to find

$$\lim_{x \rightarrow 0} \frac{\tan(2x^2) - 2\sin^2(x)}{e^{-3x^4} - 1},$$

by any method; write both the `julia` commands and your answers.

$$f(x) = (\tan(2x^2) - 2\sin(x)^2) / (exp(-3x^4) - 1)$$

$$\text{limit}(f, 0)$$

$$\text{answer} : -\frac{2}{9}$$

- (4) Consider the function $f(x) = (x^2 + x)e^{-x^2}$. Use `julia` to find all the critical points; write both the `julia` commands and your answers.

$$f(x) = (x^2 + x) \exp(-x^2)$$

$$\text{plot}(f, -10, 10)$$

$$\text{zeros}(f', -5, 5)$$

answer: -1.45161
 -0.403032
 0.854638

$$0 \leq x \leq 8$$

- (5) Consider a function $f(x)$ for which $f'(x) = 4\cos(x) + x$. Use julia to find all the intervals on which the function is concave up; write both the julia commands and your answers.

$$f(x) = 4\sin(x) + x$$

$$\text{plot}(f, 0, 8)$$

inflection points: $\text{zeros}(f', 0, 8)$

~~2.13555~~
3.4913

6.25268

2.88891

6.53587

concave up: 2nd derivative +ve
1st derivative increasing.

$$(0, 0.25268) \cup (2.88891, 6.53587).$$

- (6) Use the built in Newton's method `newton` to find all zeros of $f(x) = \log(x) + 2\sin(x)$; write both the julia commands and your answers.

$$f(x) = \log(x) + 2\sin(x)$$

`plot(f, 0, 10)`

`plot(f, 0, 20)`

`newton(f, 0.5)`

0.43247314216991267

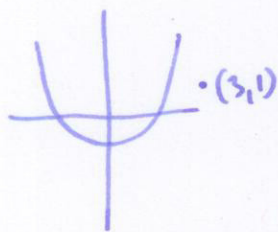
`newton(f, 4)`

3.8879038601975193

`newton(f, 5)`

5.297551446353841

- (7) Find the closest point on the parabola $y = x^2 - 1$ to the point $(3, 1)$. How far away is it? Write both the julia commands and your answers.



$$d = \sqrt{(x-3)^2 + (x^2-1-1)^2}$$

$$d(x) = \text{sqrt}((x-3)^2 + (x^2-2)^2)$$

$$\text{plot}(d, 0, 10)$$

$$\text{fzeros}(d', 0, 4)$$

$$\text{answer } x = 1.95102 \quad 1.56747$$

$$d = d(1.95102) = 7.276777141274085$$

$$1.5036477825343144$$

(8) Use `julia` to find the area under the curve of

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

between 2 and 4. Write both the `julia` commands and your answers.

$$f(x) = \exp(-x)/(x+2)$$

$$\text{quadgh}(f, 2, 4)$$

$$\text{area} = 0.025265177534731918$$