

Math 229 Calculus Computer Lab Fall 18 Final b

Name: Solutions

- I will count your best 8 of the following 10 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	
9	10	
10	10	
	80	

Final	
Overall	

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

(a)  $x+y/z-y/x$

$$x + \frac{y}{z} - \frac{y}{x}$$

(b)  $\cos(1/2*x^2)/4x^2$

$$\frac{\cos\left(\frac{x^2}{2}\right)}{4x^2}$$

1	10
2	10
3	10
4	10
5	10
6	10
7	10
8	10
9	10
10	10
80	

	Final
	Overall

(2) Write out the julia commands for the following mathematical expressions.

(a)  $f(x) = \frac{\sin^2(2x)}{\sqrt{x} + 1}$

$$f(x) = \sin(2x)^2 / (\sqrt{x} + 1)$$

(b)  $g(x) = \frac{\tan^{-1}(4x)}{\ln(x) + 2}$

$$g(x) = \text{atan}(4x) / (\log(x) + 2)$$

- (3) Using your answer to the previous question, compute the following to five decimal places:

(a)  $f(g(3))$

$$\frac{(x^2)^{1/2} \ln x}{1 + x\sqrt{x}} = (x)^{1/2} \ln(x)$$

$$(1 - 0.39652) \ln(3) \approx 0.60348 \ln(3) = (x)^{1/2}$$

(b)  $g(f'(5))$

$$\frac{(x^2)^{1/2} \ln x}{2 + (x)\ln^2} = (x)^{1/2} \ln(x)$$

$$(5 + (x)\ln^2) \ln(x) \approx 0.81156$$



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

$$\frac{x}{x+2} \cos^2(2x+1) = \frac{x}{4} - 10.$$

Write down the `julia` command you use.

40.21951

40.53217

41.56412

42.36426

42.94644

(5) Use `julia` to find

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

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

$$\frac{3}{8}$$

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

-0.80194

0.55496

2.24698

- (7) Consider a function  $f(x)$  for which  $f'(x) = 10 \sin(x) + x^2$ . Use `julia` to find all the intervals on which the function is concave down; write both the `julia` commands and your answers.

$$(-\infty, -1.30644)$$

$$(1.97738, 3.83747)$$



- (8) Use the built in Newton's method `newton` to find all zeros of  $f(x) = 4 \log(x) + 7 \sin(x)$ ; write both the `julia` commands and your answers.

0.45990

4.07309

5.08932

- (9) Find the closest point on the curve  $y = 4/x + 3$  to the point  $(5, 7)$ . How far away is it? Write both the julia commands and your answers.

$$(4.34842, 2.68991)$$

$$\text{distance} = 3.14829$$

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

$$f(x) = \frac{e^{-3x}}{\sqrt{x+1}}$$

between 1 and 4. Write both the `julia` commands and your answers.

6.01093