

Math 229 Calculus Computer Lab Fall 18 Final a

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) $\sin(1/3 * x^2) / 3x^2$

$$\frac{\sin\left(\frac{x^2}{3}\right)}{3x^2}$$

1	10
2	10
3	10
4	10
5	10
6	10
7	10
8	10
9	10
10	10
20	

	Final
	Overall

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

(a) $f(x) = \frac{\sin^2(3x)}{\sqrt{x} + 2}$

$$f(x) = (\sin(3x))^2 / (\sqrt{x} + 2)$$

(b) $g(x) = \frac{\tan^{-1}(3x)}{\ln(x) + 1}$

$$g(x) = \text{atan}(3x) / (\log(x) + 1)$$

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

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

$$0.26679$$

(b) $g(f'(5.5))$

$$1.79947$$

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

$$\frac{x}{x+2} \sin^2(2x+1) = \frac{x}{4} - 20.$$

Write down the `julia` command you use.

10.92691
81.51805
82.51308
83.34282
83.66363

(5) Use `julia` to find

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

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

$$\frac{8}{9}$$

- (6) Consider the function $f(x) = (x^2 + 3x)e^{-x^2}$. Use julia to find all the critical points; write both the julia commands and your answers.

-0.77640	-3.16621
0.61019	-0.61019
3.16621	0.77640

- (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 up; write both the `julia` commands and your answers.

$$(-3.83747, 1.97738)$$

⋈

$$(-\infty, -3.83747)$$

$$(-1.97738, 1.30644)$$

- (8) Use the built in Newton's method `newton` to find all zeros of $f(x) = 3\log(x) + 5\sin(x)$; write both the `julia` commands and your answers.

0.47006

4.17073

4.98297

- (9) Find the closest point on the curve $y = 3/x + 2$ to the point $(6, 4)$. How far away is it? Write both the julia commands and your answers.

$$(5.87038, 2.51104)$$

$$\text{distance} = 1.49459$$

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

$$f(x) = \frac{e^{-2x}}{\sqrt{x+3}}$$

between 1 and 5. Write both the `julia` commands and your answers.

0.03202