

Math 229 Calculus Computer Lab Spring 16 Midterm 1a

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 or notes.

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

Midterm 1	
Overall	

- (1) Convert the following julia expressions to standard mathematical expressions. Do not simplify.

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

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

(b) $\sin(x^2) / 4 * x$

$$\frac{x}{4} \sin(x^2)$$

1	10
2	10
3	10
4	10
5	10
6	10
7	10
8	10
9	10
10	10
11	10

	Algebra 1
	Overall

- (2) Convert the following julia expressions to standard mathematical expressions. Do not simplify.

(a) $\cos(4*x^2)^{2/2}$

$$\frac{1}{2} \cos^2(4x^2)$$

$$(0-x) \setminus (x+y)$$

(b) $x/y/z-1$

$$\frac{x}{yz} - 1 \quad (x - (y+1) \setminus d) \setminus 1$$

(3) Convert each of the following expressions to its julia equivalent:

(a) $\frac{y+x}{x-y}$

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

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

(b) $\frac{1}{\frac{b}{1+c} - a}$

$$1/((b/(1+c)) - a)$$

$$1 - \frac{x}{50}$$

(4) Convert each of the following expressions to its julia equivalent:

(a) $\frac{\tan^2(3x)}{3}$

$$\tan(3x)^2/3$$

(b) $\frac{e^{\sqrt{x-1}}}{2}$

$$\exp(\sqrt{x-1})/2$$

- (5) You want to compute a decimal approximate to $1/\sqrt{11}$. Explain what the following julia commands compute, or why they give an error.

(a) $1/\underbrace{11^{1/2}}$

$$1/11/2 = \frac{1}{22}$$

(b) $1/(\underbrace{11^{1/2}})$

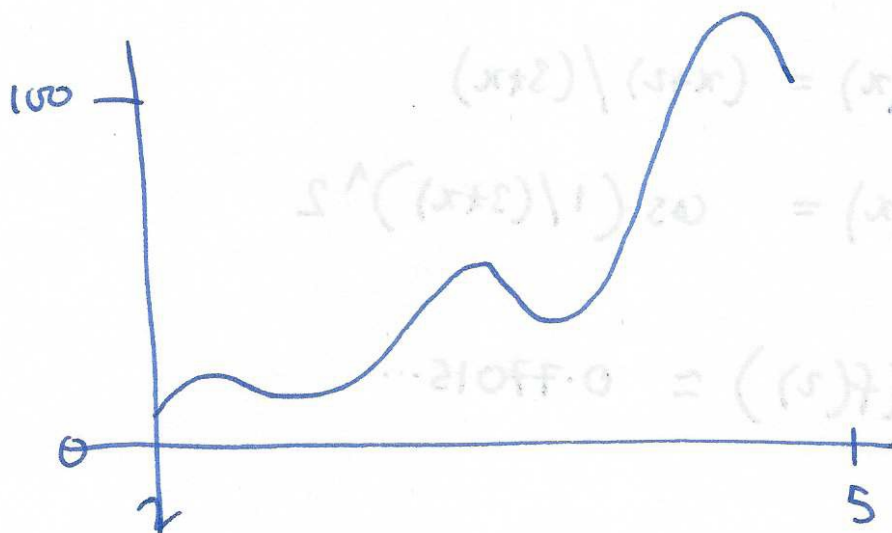
$$1/(11/2) = \frac{2}{11}$$

- (c) Write down a julia command which produces a decimal approximate to $1/\sqrt{11}$. Explain how to check your result.

$$1/\text{sqrt}(11) \approx 0.3015\dots$$

$$\text{check: } 1/(0.3015\dots)^2 \approx 11$$

- (6) Plot the function $f(x) = \frac{e^x}{\sin(5x) + 2}$ on the interval $(2, 5)$.
 (a) Sketch the graph.



- (b) How many local maxima are there for the function? (Exclude endpoints)

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- (7) Write down julia commands to define two functions $f(x) = \frac{x+2}{3x}$ and $g(x) = \cos^2(\frac{1}{3x})$, and compute $g(f(2))$.

$$f(x) = (x+2)/(3x)$$

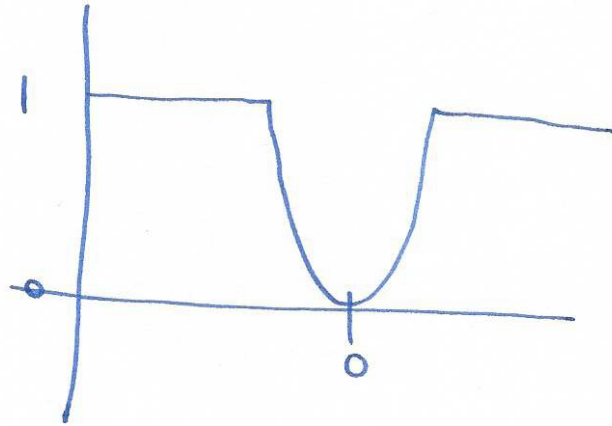
$$g(x) = \cos(1/(3x))^2$$

$$g(f(2)) \approx 0.77015\dots$$

- (8) Write down julia commands to define a function $f(x)$ which has value x^2 for $-1 \leq x \leq 1$ and 1 for other values of x , and plot its graph to check you are correct.

$$f(x) = \begin{cases} x^2 & -1 \leq x \leq 1 \\ 1 & \text{otherwise} \end{cases}$$

$$\text{plot}(f, -5, 5)$$



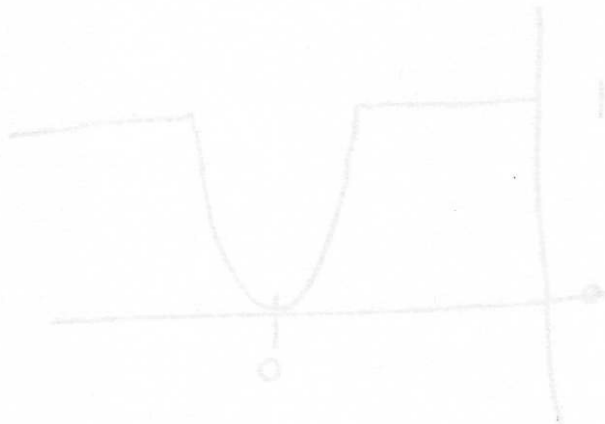
- (9) Write down julia commands to make a list of numbers from 1 to 15, and then a list of their cubes.

Hint: you may use linspace and map.

$x = \text{linspace}(1, 15, 15)$

$f(x) = x^3$

$\text{map}(f, x)$



- (10) Find the minimum value of $f(x) = e^x + 2/x^2$, for positive values of x , to two decimal places.

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

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

$$\text{plot}(f, 0.1, 6)$$

etc. then zoom in

$x \approx 1.10$ to 2 decimal places

min value of $f(x) \approx 4.66$