Math 229 Calculus Computer Lab Spring 15 Midterm 3b

Name: Solutions

- I will count your best 5 of the following 6 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	
	50	

Midterm 3	
Overall	

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

(a) `a-b/2c+b/2`

$$a - \frac{b}{2c} + \frac{b}{2}$$

(b) `cos(1/2*x^2)*1/2x^2`

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

(c) `z/y/x+y/2*3`

$$\frac{z}{yx} + \frac{3y}{2}$$

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

```
f(x) = e^(x/2)-2x-x^2
plot(f,-5,10)
fzero(D(f),0)  : -0.835356....
fzero(D(f),6)  :  6.908453...
```

(3) Consider a function $f(x)$ for that $f'(x) = 10\sin(x) - x^2$. Use `julia` to find all the critical points; write both the `julia` commands and your answers.

```
fp(x) = 10 sin(x) - x^2
plot(fp, -10, 10)
fzero(fp, 0) : 0
fzero(fp, 2) : 2.479481...
```

(4) Consider the function $f(x) = e^x - e^{-x} - 12x^2$. Where is the function concave up and concave down?

f(x) = e^(x) - e^(-x) - 12x^2

plot(f, -5, 7)

fzero(D(f,2), 0) : 3.179785....

$(-\infty, 3.179785\ldots)$ concave down

$(3.179785\ldots, \infty)$ concave up

(5) Use the built in Newton's method `newton(f, fp, x)` to find all zeros of $f(x) = x/3 - 2\sin(x)$, where `fp(x) = D(f)(x)`.

$f(x) = x/3 - 2\sin(x)$

plot(f, -10, 10)

newton(f, D(f), 2) : 2.678783...

newton(f, D(f), 0) : 0

newton(f, D(f), -2) : -2.678783...

(6) Use the built in Newton's method `newton(f, fp, x)` to find all zeros of $f(x) = 1/\sin(x) - 4/\cos(x)$, where `fp(x) = D(f)(x)`.

f(x) = 1/sin(x) − 4/cos(x)

plot(f, 0, 2pi−0.1)

newton(f, D(f), 1) : 0.321750…

newton(f, D(f), 4) : 3.463343…