MAT 191 Test 2 September 30, 2013 (9:00–9:50 AM)

Name: _____ Academic Integrity Signature: _____

I have abided by the UNCG Academic Integrity Policy.

Read all of the following information before starting the exam:

- It is to your advantage to answer ALL of the 9 questions.
- It is your responsibility to make sure that you have all of the problems.
- There is no need to complete the test in order. The problems are independent.
- Correct numerical answers with insufficient justification may receive little or no credit.
- Clearly distinguish your final answer from your scratch work with a box or circle.
- *Budget your time!*
- If you have read all of these instructions, draw a happy face here.

Page:	1	2	3	4	5	6	Total
Points:	20	25	15	25	9	6	100
Score:							

1. (a) (5 points) If $f(x)$ is a function, give the definition (as a limit) of the *derivative of* $f(x)$, denoted $f'(x)$.

   (b) (5 points) Let $f(x) = x^2 + 3x - 2$. Use the definition to prove that $f'(x) = 2x + 3$.

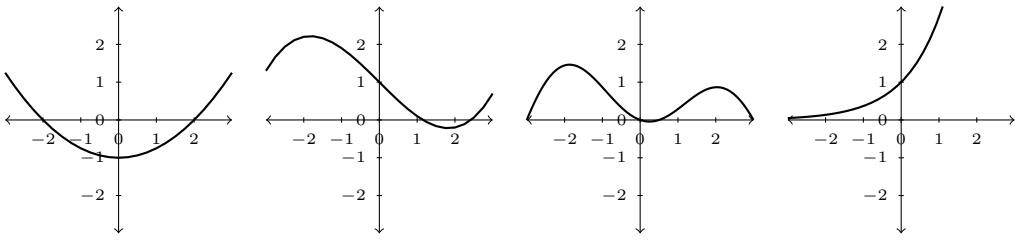
2. (10 points) Is there a value of a that will make

$$f(x) = \begin{cases} x + a & \text{if } x < 0, \\ \cos(x) & \text{if } x \geq 0 \end{cases}$$

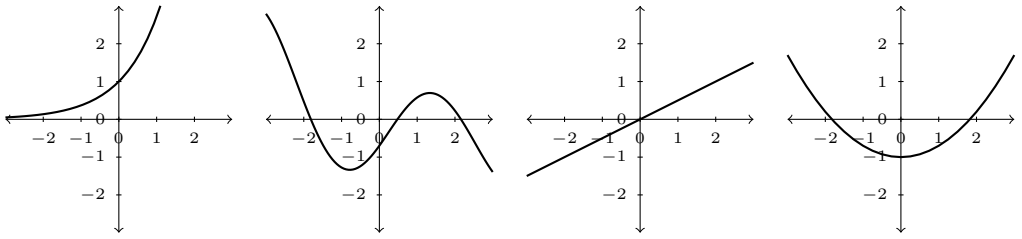
   continuous at $x = 0$? Justify.

 Points earned: _____ out of 20.

3. (15 points) Match the functions graphed in the first row with their derivatives graphed in the second row. No justification required.



A B C D



4. (10 points) Compute the derivative of $f(x) = \tan(x)$ using the definition of $\tan(x)$ in terms of $\sin(x)$ and $\cos(x)$. Simplify to show that $f'(x) = \sec^2(x)$.

5. Suppose f and g are differentiable functions whose values are given below.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
1	3	2	$\sqrt{5}$	π
2	1	3	$\sqrt{3}$	e
3	2	1	$\sqrt{2}$	$\ln(3)$

(a) (3 points) If $h(x) = 3f(x) + 5g(x)$, what is $h'(2)$?

(b) (3 points) If $k(x) = \dfrac{f(x)}{g(x)}$, what is $k'(2)$?

(c) (3 points) If $r(x) = f(g(x))$, what is $r'(2)$?

(d) (3 points) If $p(x) = f(x)g(x)$, what is $p'(2)$?

(e) (3 points) If $q(x) = x^2 g(x)$, what is $q'(2)$?

 Points earned: _____ out of 15.

6. (10 points) Let $f(x) = x^2 - 3x + 5$. Find the equation of the tangent line to $y = f(x)$ at the point $(1, 3)$.

7. (10 points) At what points does the graph of $g(x) = x^3 - 3x$ have horizontal tangents? Be sure to give the x and y coordinates of each point.

8. (5 points) Compute the average rate of change of $f(x) = x^3 + 1$ over the interval $[2, 3]$.

9. Find the derivatives of the following functions. Use the differentiation rules that apply. You do not have to further simplify the resulting derivative. [This problem continues on the next page.]

   (a) (3 points) $f(x) = (3x - 7)^9$

   (b) (3 points) $s(\theta) = \sin(2\theta - 3)$

   (c) (3 points) $h(t) = t^2 e^{\sin(t)}$

 Points earned: _____ out of 9.

(d) (3 points) $g(x) = \dfrac{1 + \sin(x)}{\cos(x)}$

(e) (3 points) $y(t) = \sqrt{t} + \dfrac{1}{2t} + \dfrac{1}{t^3} + \sqrt{3} + \pi^e$