

Math 141: Calculus I

Midterm 2

November 18, 2014

NAME (please print legibly): _____

Your University ID Number: _____

Indicate your instructor with a check in the appropriate box:

Prof. Kalyani Madhu	MWF 09:00 – 09:50 AM	
Prof. Alex Rice	TR 2:00 – 3:15 PM	
Prof. Saul Lubkin	MW 2:00 – 3:15 PM	
Prof. Evan Dummit	TR 4:50 – 6:05 PM	

- The presence of any electronic or calculating device at this exam is strictly forbidden, including (but not limited to) calculators, cell phones, and iPods.
- Show work and justify all answers. You may not receive full credit for a correct answer if insufficient work is shown or insufficient justification is given.
- You are responsible for checking that this exam has all 8 pages.

QUESTION	VALUE	SCORE
1	20	
2	10	
3	12	
4	18	
5	24	
6	16	
TOTAL	100	

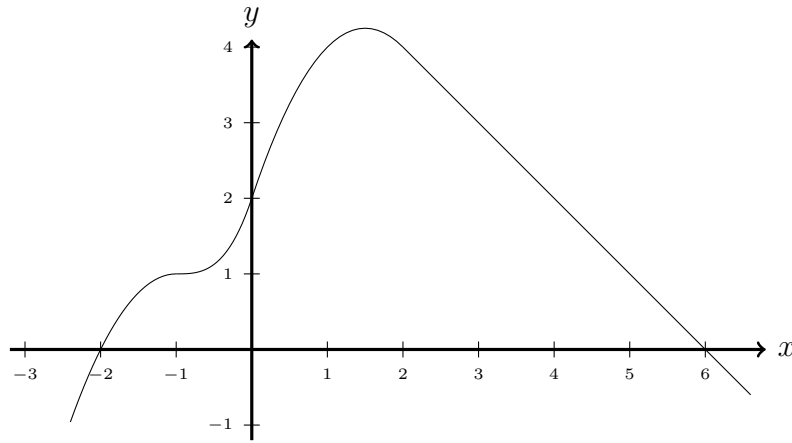
1. (20 points)

- (a) Complete the following definition: For a function $f(x)$, we define a new function, called the *derivative* of $f(x)$, by the formula

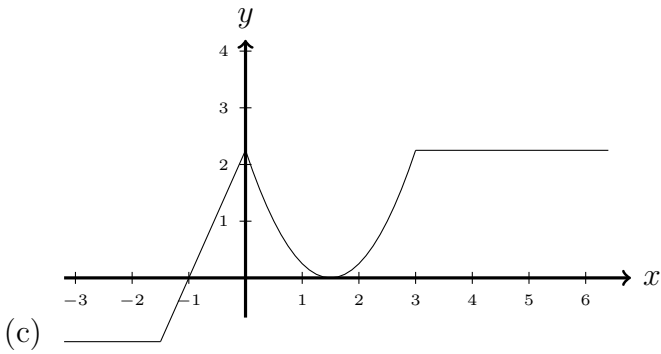
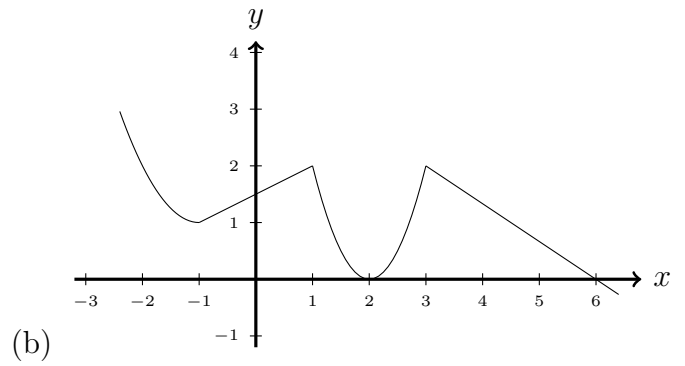
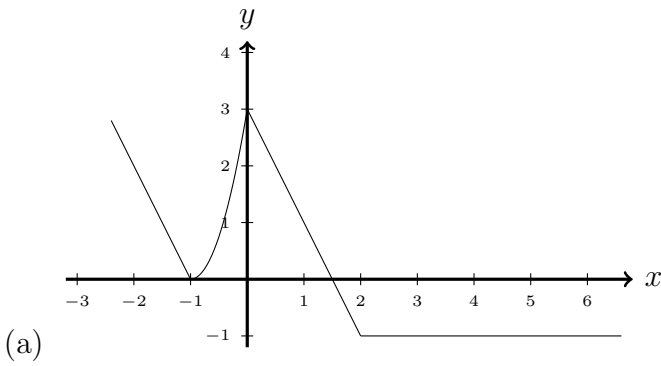
$$f'(x) =$$

- (b) USE THE DEFINITION ABOVE to find $f'(x)$ if $f(x) = \sqrt{1 - 2x}$.

2. (10 points) In the graph below, $y = f(x)$, where $f(x)$ is an unknown piece-wise function.



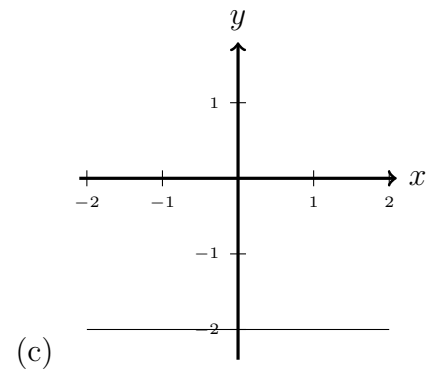
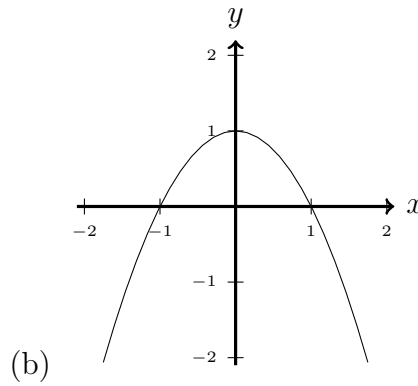
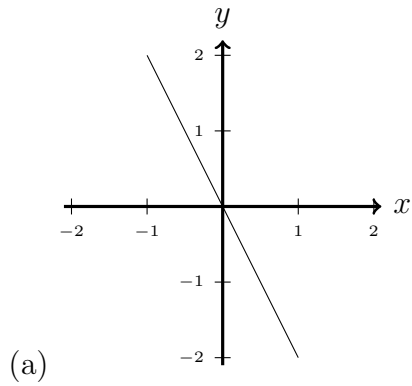
Which of these is the graph of $f'(x)$?



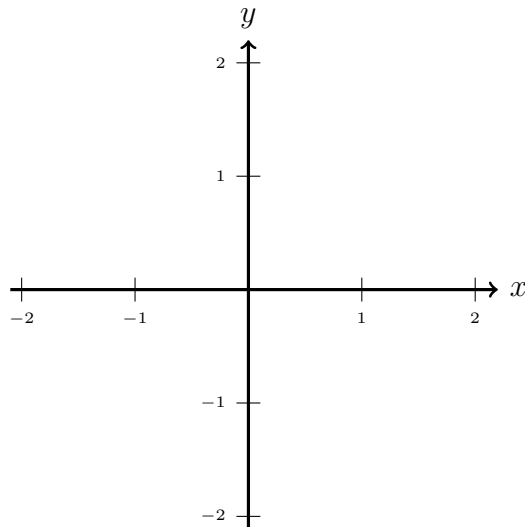
Answer: _____

3. (12 points)

- (a) The graphs below show $y = g(x)$, $y = g'(x)$, and $y = g''(x)$ for some function $g(x)$. Determine which is which. (You don't need to try to figure out a formula for $g(x)$)

 $g(x) :$ $g'(x) :$ $g''(x) :$

- (b) On the axes below, graph $y = g^{(3)}(x)$, the third derivative of g .



4. (18 points) Suppose that f and g are differentiable functions satisfying

$$f(2) = 0, \quad g(2) = a, \quad f'(2) = 1, \quad g'(2) = \pi, \quad f'(a) = 7$$

and assume $a \neq 0$.

(a) Let $h(x) = \frac{f}{g}(x)$. Find $h'(2)$ in terms of a .

(b) Let $h(x) = (f \circ g)(x)$. Find $h'(2)$ in terms of a .

(c) Let $h(x) = g(x)e^{f(x)}$. Find $h'(2)$ in terms of a .

5. (24 points)

(a) Find the derivative of $f(x) = x^3 + \cos(x) - e^x$ with respect to x .

(b) Find $h'(x)$ if $h(x) = \sin(\sqrt{\tan(x)})$.

(c) Compute the value of $g''(1)$, where $g(t) = \tan^{-1}(3t)$.

(d) Use logarithmic differentiation to find $\frac{dq}{dt}$ if $q = (t^5 + 1)^t$.

6. (16 points) Consider the implicit curve $C : 3x^3 + 4xy + y^5 = 8$. (You may assume this defines y implicitly as a function of x .)

(a) Find the implicit derivative $\frac{dy}{dx}$.

(b) Find an equation for the tangent line to the curve C at the point $(x, y) = (1, 1)$.