

Calculus I: Practice Midterm II

April 3, 2015

Name: _____

- Write your solutions in the space provided. Continue on the back for more space.
- Show your work unless asked otherwise.
- Partial credit will be given for incomplete work.
- The exam contains 5 problems.
- **Good luck!**

1. The following two tables denote the values of two functions and their derivatives at various values of x .

x	-2	-1	0	1	2
$f(x)$	3	-2	1	4	5
$f'(x)$	-5	-3	2	3	7

x	-2	-1	0	1	2
$g(x)$	5	0	2	2	6
$g'(x)$	-6	0	1	1	2

(a) Let $a(x) = f(x)g(x)$. Find $a'(-1)$.

(b) Let $b(x) = f(g(x))$. Find $b'(0)$.

(c) Let $c(x) = \frac{f(x)}{g(2x)}$. Find $c'(1)$.

2. Compute the following.

(a) $f'(x)$ where $f(x) = \sin(2x) + \ln(x^2 + 1)$

(b) $f'(1)$ where $f(x) = x^x + x^{-x}$.

(c) $\lim_{x \rightarrow 0} \frac{\ln(x^2 + 1)}{\sin x}$

(d) The slope of the tangent to the curve $x^3 + y^3 = xy + 1$ at the point $(1, 1)$.

3. Maeby is inflating a spherical balloon. Suppose the radius of the balloon at a particular instant is 10 cm and its volume is increasing at the rate of 30 mL/s.

(You may use $\text{Volume} = \frac{4}{3}\pi r^3$ and $\text{Surface area} = 4\pi r^2$)

- (a) At that instant, what is the rate at which the surface area is increasing?

- (b) Use your answer to approximate the surface area half a second afterwards.

4. Consider the function

$$f(x) = x^6 - 2x^3.$$

(a) Find the critical points of $f(x)$.

(b) Find the local minima and maxima of $f(x)$.

(c) Find the global minima and maxima of $f(x)$ (if they exist).

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5. At a party, there are two loud-speakers of power 2 watt and 16 watt, separated by 10 meters. Suppose the volume of the sound emitted by a speaker is directly proportional to the power of the speaker and inversely proportional to the distance from the speaker. Where is the quietest spot on the line joining the two speakers?