

Midterm Exam 2
Math 1
October 25, 2012

Name: _____

Please circle your instructor's name below:

Harnish

Zhao

Please read the following instructions before starting the exam:

- This exam is closed-book, with no calculators, notes, or books allowed. You may not give or receive any help on the exam, though you may ask the instructors for clarification if necessary.
- Be sure to show all your work wherever possible. Even if your final answer is incorrect, we can assign an appropriate amount of partial credit if we can see how you arrived at your answer.
- Please circle or otherwise indicate your final answer.
- This test has a total of 8 questions, worth a total of 100 points. Point values are indicated for each question.
- You will have two hours from the start of the exam to complete it.
- Good luck!

HONOR STATEMENT: I have neither given nor received any help on this exam, and I attest that all of the answers are my own work.

SIGNATURE: _____

This page is for grading purposes only.

Problem	Points	Score
1	12	
2	6	
3	10	
4	8	
5	15	
6	12	
7	24	
8	13	
Total	100	

1. [12 pts] **Multiple choice.** Circle the correct answer for each question. Each part is worth 3 points.

(a) If $f(x) = f'(x)$, then $f(x) =$

- A. x^e
- B. e^x
- C. $\sin x$
- D. 1

(b) Which of the following is $(\frac{f}{g})'$?

- A. $\frac{f'}{g'}$
- B. $\frac{fg' - gf'}{g^2}$
- C. $\frac{gf' - fg'}{g^2}$
- D. $\frac{f'g' - fg}{g^2}$

(c) $\lim_{x \rightarrow \infty} \cos x =$

- A. 1
- B. -1
- C. 0
- D. DNE

(d) Which of the following functions is differentiable on ALL of its domain?.

A. $f(x) = \sqrt{x}$

B. $f(x) = x|x|$

C. $f(x) = |x + 1|$

D. $f(x) = \begin{cases} 0 & \text{if } x \leq 0 \\ 1 & \text{if } 0 < x \leq 1 \\ 2 & \text{if } 1 < x \leq 2 \\ 3 & \text{if } 2 < x \leq 3 \\ \vdots & \vdots \end{cases}$

2. [6 pts] The gravitational force exerted by the planet Earth on a unit of mass at a distance r from the center of the planet is

$$F(r) = \begin{cases} \frac{GMr}{R^3} & \text{if } r < R \\ \frac{GM}{r^2} & \text{if } r \geq R \end{cases}$$

where M is the mass of Earth, R is its radius, and G is the gravitational constant. Is F a continuous function of r ? Explain.

3. [10 pts]

(a) [6 pts.] What are the vertical and horizontal asymptotes of $f(x) = \frac{2x^2 + 3x - 1}{x^2 - 7x + 10}$?

(b) [4 pts.] Find a formula for a function that has vertical asymptotes $x = 1$ and $x = 3$ and horizontal asymptote $y = 1$.

4. [8 pts] $f(x) = x^{-2}$
Use the limit definition of the derivative to find $f'(x)$.

5. [15 pts] The equation of motion of a particle is $s = t^3 - 3t$, where s is in meters and t is in seconds.

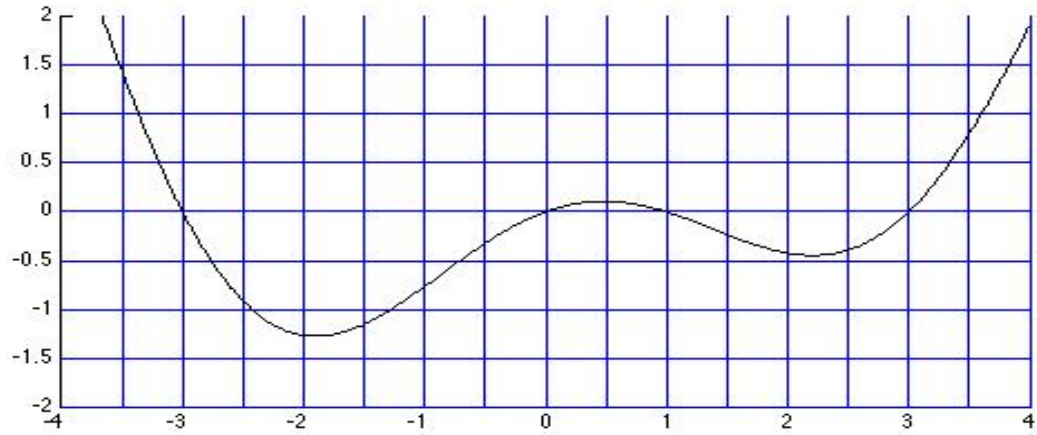
(a) [5 pts.] Find the velocity and acceleration as functions of t .

(b) [5 pts.] Find the acceleration at 2 seconds.

(c) [5 pts.] Find the acceleration when the velocity is 0.

6. [12 pts]

(a) [6 pts.] Use the given graph to

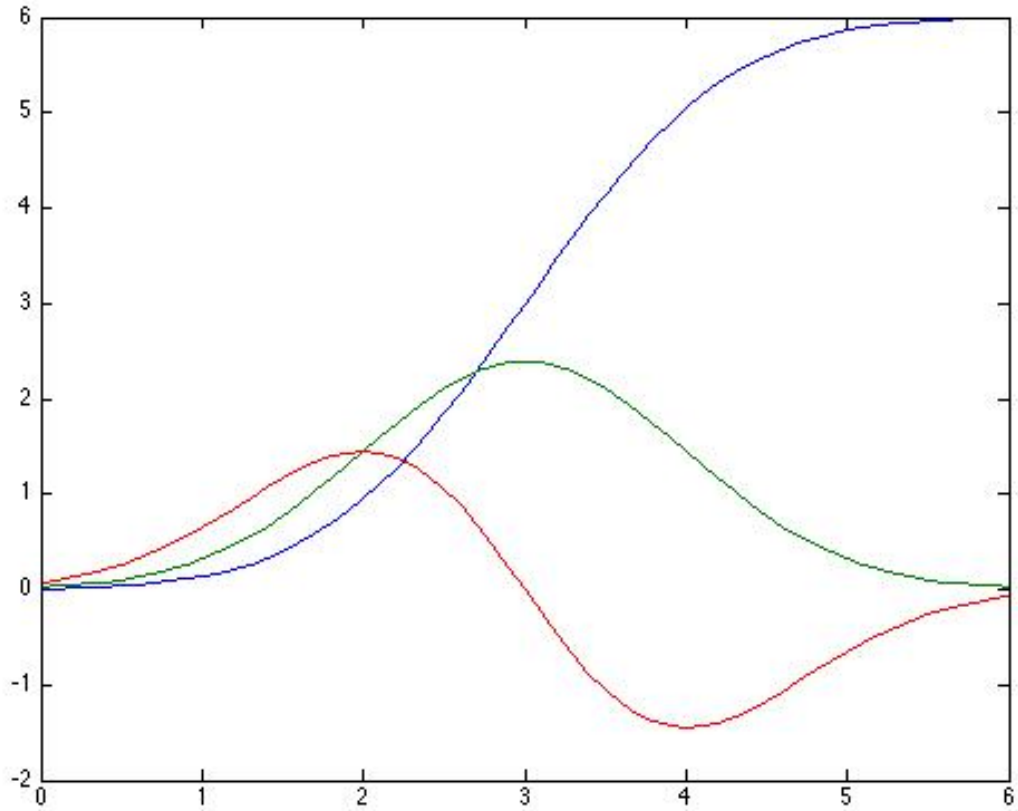


(a) find all the points on the graph where it has horizontal tangent lines.

(b) estimate the values of the derivative at $x = -3, -1, 1.5, 3$.

(c) sketch the graph of the derivative function.

- (b) [6 pts.] The following figure shows the graphs of three functions. One is the position function of a car, one is the velocity of the car, and one is its acceleration. Identify each curve, and explain your choices.



7. [24 pts]

(a) [8 pts.] Find the equation of the tangent line to $y = \frac{x+1}{x^3+x-2}$ at the point $(0, \frac{-1}{2})$.

(b) [8 pts.] $y = \tan(e^x) + e^{\tan x}$, what is y' ?

(c) [8 pts.] $y = \sec^2(5\theta)$, what is y' ?

8. [13 pts] $\lim_{h \rightarrow 0} \frac{\sin(\frac{\pi}{2} + h) - 1}{h}$

(a) [6 pts.] The limit above represents the derivative of some function f at some number a . State f and a . (Recall: $\sin(\frac{\pi}{2}) = 1$.)

(b) [4 pts.] Using the f and a from part (a), what is the exact value of $f'(a)$? (i.e. What is the value of the derivative of f at a .)

(c) [3 pts.] Based on parts (a) and (b), what is $\lim_{h \rightarrow 0} \frac{\sin(\frac{\pi}{2} + h) - 1}{h}$?

a

t

h

