MATH 1271 Spring 2012, Midterm #1 Handout date: Thursday 16 February 2012

PRINT YOUR NAME:

SOLUTIONS Version B

PRINT YOUR TA'S NAME:

WHAT SECTION ARE YOU IN?

Closed book, closed notes, no calculators/PDAs; no reference materials of any kind. Turn off all handheld devices, including cell phones.

Show work; a correct answer, by itself, may be insufficient for credit. Arithmetic need not be simplified, unless the problem requests it.

I understand the above, and I understand that cheating has severe consequences, from a failing grade to expulsion.

SIGN YOUR NAME:

I. Multiple choice

A. (5 pts) (no partial credit) A line passes through (1,40) and (3,80). Find its slope. Circle one of the following answers:

 $\frac{80-40}{3-1} = \frac{40}{2} = 20$

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- (a) 10
- (b)20
- (c) 30
- (d) 40
- (e) NONE OF THE ABOVE

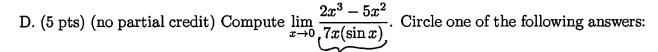
B. (5 pts) (no partial credit) A particle travels along a number line. Its position at time 1 is 40 and its position at time 3 is 80. Find its average velocity between time 1 and time 3. Circle one of the following answers:

- (a) 10
- (b) 20
 - (c) 30
 - (d) 40
 - (e) NONE OF THE ABOVE

C. (5 pts) (no partial credit) Compute the largest $\delta > 0$ such that: $0 < |x-1| < \delta$ implies |(2x+7)-9| < 0.05. Circle one of the following answers:

 $\frac{0.05}{2} = 0.025$

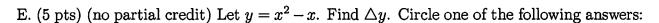
- (a) 0.2
- (b) 0.1
- (c)0.025
 - (d) 0.01
 - (e) NONE OF THE ABOVE



 $\frac{-5x^2}{7x \cdot x} \xrightarrow{x \to 0} -\frac{5}{7}$

$$(c) - 5/7$$

(d)
$$2/7$$



(a)
$$(x + \triangle x)^2 - (x + \triangle x)$$

(b)
$$[(x + \triangle x)^2 - (x + \triangle x)] + [x^2 - x]$$

(c)
$$[x^2 - x] - [(x + \triangle x)^2 - (x + \triangle x)]$$

$$(\widehat{(\mathrm{d})})[(x+\triangle x)^2-(x+\triangle x)]-[x^2-x]$$

(e) NONE OF THE ABOVE

F. (5 pts) (no partial credit) Assume that $\lim_{x\to 200}(f(x))=4$ and $\lim_{x\to 200}(g(x))=5$. At most one of the following statements must follow. If one does, circle it. Otherwise, circle Answer e.

(a)
$$\lim_{x \to 400} [(f(x)) + (g(x))] = 9$$

(b)
$$\lim_{x\to 200} [(f(x)) + (g(x))] = 20$$

(c)
$$\lim_{x \to 1} \left[\frac{f(x)}{g(x)} \right] = \frac{4}{5}$$

(d)
$$\lim_{x\to 300} [(f(x)) + (g(x))]$$
 does not exist

II. True or false (no partial credit):
a. (5 pts) The function $f(x) = x $ is continuous at every real number.
True
b. (5 pts) There is a function with five vertical asymptotes.
True
c. (5 pts) A tangent line to the graph of a function cannot intersect the graph of the function more than once.
False
d. (5 pts) For every real number x , $\ln(e^x) = 1$.
False
e. (5 pts) If a function is differentiable at 2, then it is continuous at 0.
False
THE BOTTOM OF THIS PAGE IS FOR TOTALING SCORES PLEASE DO NOT WRITE BELOW THE LINE
VERSION B
I. A,B,C
I. D,E,F
II. a,b,c,d,e
III. 1a,b
III. 2
III. 3
III. 4a,b

III. Computations. Show work. Unless otherwise specified, answers must be exactly correct, but can be left in any form easily calculated on a standard calculator.

1. a. (5 pts) Compute $\lim_{h\to 0} \frac{\sqrt{5+2h}-\sqrt{5-h}}{h}$. $\frac{\sqrt{5+2h}+\sqrt{5-k}}{\sqrt{5+2h}+\sqrt{5-h}}$ $\frac{\sqrt{5+2h}-\sqrt{5-h}}{h}$ $\frac{\sqrt{5+2h}-\sqrt{5-h}}{\sqrt{5+2h}+\sqrt{5-h}}$ $\frac{\sqrt{5+2h}+\sqrt{5-h}}{\sqrt{5+2h}+\sqrt{5-h}}$ $\frac{3h}{\sqrt{5+2h}+\sqrt{5-h}}$ $\frac{3h}{\sqrt{5+2h}+\sqrt{5-h}}$ $\frac{3h}{\sqrt{5+2h}+\sqrt{5-h}}$

 $\frac{3}{\sqrt{5}+\sqrt{5}} = \frac{3}{2\sqrt{5}}$

b. (5 pts) Compute $\lim_{h \to 0} \frac{\frac{1}{5+2h} - \frac{1}{5-h}}{h}$. $\frac{(5-k) - (5+2k)}{h} = \frac{-3k}{k(5+2k)(5-k)}$ $\frac{1}{k(5+2k)(5-k)} = \frac{-3k}{k(5+2k)(5-k)}$

2. (10 pts) Find all the horizontal asymptotes to
$$y = \frac{\sqrt{9x^2 + 5}}{x + 1}$$
.

$$\lim_{x \to \pm \infty} f(x) = \lim_{x \to \pm \infty} \frac{\sqrt{9x^2}}{x}$$

$$= \lim_{x \to \pm \infty} \frac{(3)(\pm x)}{x} = \pm 3$$

$$y=-3$$
 and $y=3$ are the horizontal asymptotes.

3. (10 pts) Compute
$$\lim_{x\to 0} \left(\frac{7x^3 + 4x^2}{8x \sin x} \right)$$
.

1/

$$\lim_{x\to 0} \frac{4x^2}{8x/(x)} = \frac{4}{8} = \frac{1}{2}$$

- 4. On the planet of Gallifrey, in an alternate universe, a dropped object travels $t^3 + t^2$ feet during its first t seconds of free fall.
- a. (10 pts) For $h \neq 0$, the average velocity between time t = 2 seconds and time t = 2 + h seconds is given by a quadratic polynomial in h of the form $ah^2 + bh + c$. Find the coefficients a, b and c.

$$\frac{\left[t^{3}+t^{2}\right]_{t:\rightarrow2+R}^{t:\rightarrow2+R}}{\left[t^{3}\right]_{t:\rightarrow2}^{t:\rightarrow2+R}} = \frac{\left[\left(2+h\right)^{3}+\left(2+h\right)^{2}\right]-\left[2^{3}+2^{2}\right]}{h}$$

$$=\frac{2^{3}+3\cdot 2^{2}\cdot k+3\cdot 2\cdot k^{2}+k^{3}+2^{2}+2\cdot 2\cdot k+k^{2}-2^{2}-2^{2}}{k}$$

$$= \frac{12h + 6h^2 + h^3 + 4h + h^2}{h}$$

$$= \frac{R^{3} + 7h^{2} + 16h}{h} \stackrel{\text{R+0}}{=} h^{2} + 7h + 16 \quad \text{A/sec}$$

$$a=1 \quad b=7 \quad c=16$$

b. (5 pts) Find the instantaneous velocity at time t = 2 seconds.

$$\lim_{h\to 0} \frac{\left[t^3 + t^2\right]_{t\to 2h}^{t\to 2h}}{\left[t\right]_{t\to 2}^{t\to 2h}} = \lim_{h\to 0} \left(h^2 + 7h + 16\right)$$