

Name: \_\_\_\_\_

Instructor and Class Time:     Bullwinkle    

Exam I  
September 19, 2000

- The Honor Code is in effect for this examination. All work is to be your own.
- No calculators.
- The exam lasts for one hour.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 11 pages of the test.

Good Luck!

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!					
1.	(a)	(b)	(c)	(d)	(e)
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9.	(a)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(d)	(e)

DO NOT WRITE IN THIS BOX!	
Total multiple choice:	_____
11.	_____
12.	_____
13.	_____
14.	_____
15.	_____
<b>Total:</b>	_____

### Multiple Choice

1.(5 pts.) Find the limit:

$$\lim_{x \rightarrow 3^+} \frac{x^2 + x - 12}{x^2 - 2x - 3}.$$

- (a)  $\infty$                       (b)  $\frac{7}{4}$                       (c) 1                      (d) 0                      (e) Does not exist

2.(5 pts.) Find the limit:

$$\lim_{x \rightarrow 2} \frac{x^3 - 2x + 4}{x^2 + 1}.$$

- (a) 0                      (b)  $\frac{4}{3}$                       (c)  $\infty$                       (d)  $\frac{8}{5}$                       (e) 1

3.(5 pts.) Find the average rate of change of  $f(x) = \sqrt{x+4}$  on the interval  $[0, 12]$ .

- (a)  $\frac{1}{16}$                       (b)  $\frac{1}{6}$                       (c) 0                      (d)  $\frac{3}{4}$                       (e)  $\frac{5}{12}$

4.(5 pts.) Find the limit

$$\lim_{w \rightarrow \infty} \frac{\sin w \cdot \cos w}{w}$$

**Hint:**  $-1 \leq \sin w \leq 1$ ;  $-1 \leq \cos w \leq 1$ . What do these say about  $\sin w \cdot \cos w$ ?

- (a)  $\infty$                       (b)  $-1$                       (c) 0                      (d) 1                      (e) Does not exist

5.(5 pts.) The set of vertical asymptotes for the graph

$$y = \frac{x^2 + 4x + 3}{x^2 - x - 2}$$

is which set below?

- (a)  $x = -1$                       (b)  $x = 1$                       (c)  $x = 2$   
(d)  $x = -1$  and  $x = 2$                       (e) No vertical asymptotes

6.(5 pts.) Which formula below is the derivative of  $(x + 1) \sin x$ ?

- (a)  $\cos x - (x + 1) \sin x$                       (b)  $(x + 1) \cos x + (x + 1)^2 \sin x$   
(c)  $\cos x + (x + 1) \sin x$                       (d)  $\sin x - (x + 1) \cos x$   
(e)  $\sin x + (x + 1) \cos x$

7.(5 pts.) If  $f(x)$  is a differentiable function such that  $f'(x) = f(x)$ , which expression below is the derivative of the square of  $f$ ?

I.E. Compute  $\frac{d(f(x))^2}{dx}$ .

- (a)  $(f(x))^2$                       (b)  $f(x)$                       (c)  $2(f(x))^2$                       (d)  $2f(x)$   
(e) Cannot be determined from the given information

8.(5 pts.) Find the derivative of  $\frac{\tan x}{1 + \sin x}$ .

- (a)  $\frac{\sec x \tan x(1 + \sin x) - \tan x \cos x}{(1 + \sin x)^2}$                       (b)  $\frac{\sec x \tan x(1 + \sin x) + \tan x \cos x}{(1 + \sin x)^2}$   
(c)  $\frac{\sec^2 x(1 + \sin x) + \tan x \cos x}{(1 + \sin x)^2}$                       (d)  $\frac{\sec^2 x(1 + \sin x) - \tan x \cos x}{(1 + \sin x)^2}$   
(e)  $\frac{\sec x \tan x(1 + \sin x) - \cot x \csc x}{(1 + \sin x)^2}$

9.(5 pts.) Which equation below is that of the tangent line to the graph of  $y = \frac{\sin x}{x}$  when  $x = \pi$ ?

- (a)  $y = -\frac{1}{\pi}x + 1$                       (b)  $y = x - \frac{1}{\pi}$                       (c)  $y = \pi x$                       (d)  $y = x + \frac{1}{\pi}$   
(e) There is a vertical tangent

10.(5 pts.) A particle begins to move up the  $y$  axis with a position of  $s(t) = t \cos t$  for  $t \geq 0$ . What is the first time that the particle begins to move down?

- (a) The smallest positive solution to the equation  $t = \cot t$
- (b) The smallest positive solution to the equation  $t = \sec t$
- (c) The largest positive solution to the equation  $t = \cos t$
- (d) The smallest positive solution to the equation  $t = \cos t$
- (e) The largest positive solution to the equation  $t = -\cot t$

### Partial Credit

11.(10 pts.) The function  $f(x)$  is defined by:

$$f(x) = \frac{x^2 - 4}{x - 5}$$

Find the vertical and oblique asymptotes of the graph of this function.

12.(10 pts.) Find the slope of the graph of the curve  $y = (x + 1)^2$  at the point  $(1, 4)$  **using the limit definition of slope**. No credit will be given for an answer that does not write down and evaluate the appropriate limit.

13.(10 pts.) You want to do an experiment to measure the acceleration of gravity  $g$ , near the surface of the earth. You have access to a deep well with water starting 100 ft. down. Assume sound travels at 1000 ft/sec. You drop a rock into the well and 2.6 seconds later you hear a splash. Assuming no air resistance, what is the value of  $g$  obtained from this experiment with these assumptions?

**Hint:** First calculate the time required for the rock to hit the water. Then recall that the distance that the rock has fallen in time  $t$  under these assumptions is given by  $s(t) = -\frac{1}{2}gt^2$ .

14.(10 pts.) Use the Intermediate Value Theorem to show that the equation

$$\cot t - t = 0$$

has a solution on the interval  $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ .

15.(10 pts.) The line  $y = 3x - 4$  is tangent to the graph  $y = f(x)$  at the point  $x = 2$ . What are the values of  $f(2)$  and  $f'(2)$ ? Why are they what you claim?

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