Your Name (Printed)

End Time

## Directions

- You will have **one** hour to complete the test. No extra time will be given, use your time wisely!
- This test is closed notes and closed book and you may **not** use a calculator.
- In order to receive full credit, you must **show your work** using correction notation. Please write out your computations on the exam paper. All answers should be simplified with the correct units where necessary.
- Label any diagrams so as to indicate axes labels and scale.
- Solutions must be clearly identified by **placing a box around** your final answer to each question, when appropriate.

Page Number	Total Points	Score
2	14	
3	14	
4	18	
5	16	
6	18	
7	10	
8	10	
Total	100	

- 1. (4 points) Evaluate the following expressions.
  - a)  $\sin(\cos^{-1}(1/2))$  b)  $\tan(\arcsin(x/3))$

2. (6 points) Solve each equation for *x*.

a)  $e^{\sqrt{x+1}} - 2 = 5$ b)  $\ln x + \ln(x-3) = 0$ 

- 3. (4 points) A contractor purchases a piece of equipment for \$15,500 that costs an average of \$ 9.50 per hour for fuel and maintenance. The equipment operator is paid \$13.50 per hour, and customers are charged \$30 per hour.
  - (a) Write an equation for the cost C of operating this equipment for t hours.
  - (b) Write an equation for the revenue R derived from t hours of use.
  - (c) Find the break even point by finding the time at which R = C.

4. (3 points) Expand and simplify the expression  $\ln\left(\frac{e^8\sqrt{x^2-9}}{(x^7+4)^3}\right)$ 

- 5. (6 points) Given  $f(x) = \sin x$  and  $g(x) = \ln x$  find the following functions and their domains.
  - a)  $f \circ g$  b)  $g \circ f$

6. (5 points) Find the inverse of  $f(x) = \frac{3x-2}{2x+5}$  and state the domain and range of  $f^{-1}$ .

7. (4 points) Evaluate the following limits.

a) 
$$\lim_{x \to 2} (2x^2 + 4x + 1)$$
 b)  $\lim_{x \to 3} \sec\left(\frac{\pi x}{2}\right)$ 

8. (6 points) Evaluate the following limits.

a) 
$$\lim_{x \to -2} \frac{x^2 - 3x - 10}{x + 2}$$
 b)  $\lim_{h \to 0} \frac{(3 + h)^2 - 9}{h}$ 

9. (8 points) Evaluate the following limits.

a) 
$$\lim_{x \to 1} \frac{\sqrt{x^2 + x - 1} - x}{x - 1}$$
 b)  $\lim_{x \to 3} \frac{\sqrt{x + 6} - x}{x^3 - 3x^2}$ 

10. (8 points) Evaluate the following limits.

a) 
$$\lim_{x \to 0} \frac{1 - e^{-x}}{e^x - 1}$$
 b)  $\lim_{x \to \pi/2} \frac{\cos^2 x}{\sin x - 1}$ 

11. (8 points) Evaluate the following limits.

a) 
$$\lim_{x \to -\infty} \frac{\sqrt{x^2 - 9}}{2x + 5}$$
 b)  $\lim_{x \to \infty} (\sqrt{x^2 + 4x + 1} - x)$ 

12. (6 points) Find the following infinite limits. Explain your reasoning.

a) 
$$\lim_{x \to 4^+} \frac{5-x}{x-4}$$
 b)  $\lim_{x \to 9} \frac{\sqrt{x}}{(x-9)^4}$ 

13. (4 points) Given the function 
$$f(x) = \begin{cases} x^2 - 3x & \text{if } x < 4\\ 2x - 5 & \text{if } x \ge 4 \end{cases}$$

a) Sketch the graph of f(x)

## (8 points) Also, evaluate the following.

b) f(4) c) f(0) d) f(-1)

e) 
$$\lim_{x \to -4} f(x)$$
 f)  $\lim_{x \to 0} f(x)$  g)  $\lim_{x \to 4} f(x)$ 

h)  $\lim_{x\to-\infty} f(x)$  i)  $\lim_{x\to\infty} f(x)$ 

14. (6 points) Find and any discontinuities of the following functions. Then, using the definition of continuity explain why the function is discontinuous at each point of discontinuity.

a) 
$$f(x) = \frac{3x^2 - x - 2}{x - 1}$$
  
b)  $g(x) = \begin{cases} \sqrt{-x} & \text{if } x < 0\\ 3 - x & \text{if } 0 \le x \le 3\\ (x - 3)^2 & \text{if } x > 3 \end{cases}$ 

15. (4 points) For what value of the constant *b* is the function  $f(x) = \begin{cases} x^2 + bx & x \le 5\\ 5\sin(\frac{\pi}{2}x) & x > 5 \end{cases}$  continuous?

16. (5 points) Use the definition of the derivative to find f'(x) if  $f(x) = 3x - \frac{1}{x}$ 

17. (5 points) Use the definition of the derivative to find the equation of the tangent line of  $f(x) = x^2 + 4x - 1$  at the point (4, 31).