Your Name (Printed)
$\square$

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) $\sin \left(\cos ^{-1}(1 / 2)\right)$
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 $\ln \left(\frac{e^{8} \sqrt{x^{2}-9}}{\left(x^{7}+4\right)^{3}}\right)$
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 $f(x)=\frac{3 x-2}{2 x+5}$ and state the domain and range of $f^{-1}$.
7. (4 points) Evaluate the following limits.
a) $\lim _{x \rightarrow 2}\left(2 x^{2}+4 x+1\right)$
b) $\lim _{x \rightarrow 3} \sec \left(\frac{\pi x}{2}\right)$
8. (6 points) Evaluate the following limits.
a) $\lim _{x \rightarrow-2} \frac{x^{2}-3 x-10}{x+2}$
b) $\lim _{h \rightarrow 0} \frac{(3+h)^{2}-9}{h}$
9. (8 points) Evaluate the following limits.
a) $\lim _{x \rightarrow 1} \frac{\sqrt{x^{2}+x-1}-x}{x-1}$
b) $\lim _{x \rightarrow 3} \frac{\sqrt{x+6}-x}{x^{3}-3 x^{2}}$
10. (8 points) Evaluate the following limits.
a) $\lim _{x \rightarrow 0} \frac{1-e^{-x}}{e^{x}-1}$
b) $\lim _{x \rightarrow \pi / 2} \frac{\cos ^{2} x}{\sin x-1}$
11. (8 points) Evaluate the following limits.
a) $\lim _{x \rightarrow-\infty} \frac{\sqrt{x^{2}-9}}{2 x+5}$
b) $\lim _{x \rightarrow \infty}\left(\sqrt{x^{2}+4 x+1}-x\right)$
12. (6 points) Find the following infinite limits. Explain your reasoning.
a) $\lim _{x \rightarrow 4^{+}} \frac{5-x}{x-4}$
b) $\lim _{x \rightarrow 9} \frac{\sqrt{x}}{(x-9)^{4}}$
13. (4 points) Given the function $f(x)=\left\{\begin{array}{lll}x^{2}-3 x & \text { if } \quad x<4 \\ 2 x-5 & \text { if } \quad x \geq 4\end{array}\right.$
a) Sketch the graph of $f(x)$
(8 points) Also, evaluate the following.
b) $f(4)$
c) $f(0)$
d) $f(-1)$
e) $\lim _{x \rightarrow-4} f(x)$
f) $\lim _{x \rightarrow 0} f(x)$
g) $\lim _{x \rightarrow 4} f(x)$
h) $\lim _{x \rightarrow-\infty} f(x)$
i) $\lim _{x \rightarrow \infty} f(x)$
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) $f(x)=\frac{3 x^{2}-x-2}{x-1}$
b) $g(x)=\left\{\begin{array}{lll}\sqrt{-x} & \text { if } & x<0 \\ 3-x & \text { if } & 0 \leq x \leq 3 \\ (x-3)^{2} & \text { if } & x>3\end{array}\right.$
15. (4 points) For what value of the constant $b$ is the function $f(x)= \begin{cases}x^{2}+b x & x \leq 5 \\ 5 \sin \left(\frac{\pi}{2} x\right) & x>5\end{cases}$ continuous?
16. (5 points) Use the definition of the derivative to find $f^{\prime}(x)$ if $f(x)=3 x-\frac{1}{x}$
17. (5 points) Use the definition of the derivative to find the equation of the tangent line of $f(x)=x^{2}+4 x-1$ at the point $(4,31)$.
