Calculus I
Exam 1

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Answer all of the following questions. Additional sheets are available if necessary. No books or notes may be used. You may use a calculator. You may not use a calculator which has symbolic manipulation capabilities. When answering these questions, please be sure to 1) check answers when possible, 2) clearly indicate your answer and the reasoning used to arrive at that answer *(unsupported answers may not receive credit).*
Each question is followed by space to write your answer. Please lay out your solutions neatly in the space below the question. You are not expected to write each solution next to the statement of the question.
You are to answer three of the last four questions. Please indicate which problem is not to be graded by crossing through its number on the table below.

Name ____________________

Section __________

Last four digits of student identification number __________

Question	Score	Total
p. 1		10
p. 2		10
p. 3		10
p. 4		10
p. 5		15
Q12		15
Q13		15
Q14		15
Q15		15
		100

1. Find the equation of the line which is perpendicular to $y = 2x + 1$ and passes through $(2, -1)$. Put your answer in the form $y = mx + b$.

$y =$ ______________

2. If $f(x) = x^2 + 1$ and $g(x) = 1/x$, find $f(g(2))$ and $g(f(2))$.

$f(g(2)) =$ ______________, $g(f(2)) =$ ______________

3. At time $t = 0$ an object on the ground is thrown in the air so that its height at time t seconds is $h(t) = -5t^2 + 50t$ meters. Give the length of time that the object is above the ground.

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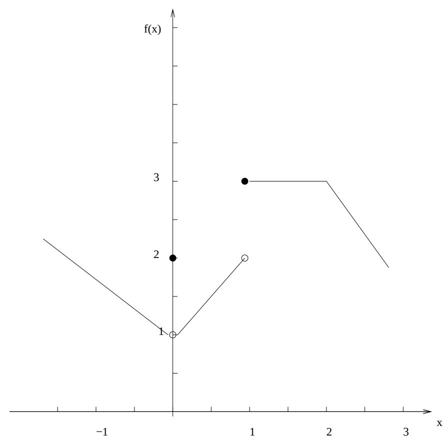
4. Use the graph to find $\lim_{x \to 0} f(x)$, $\lim_{x \to 1} f(x)$ and $\lim_{x \to 2} f(x)$. If a limit does not exist, explain why.



$\lim_{x \to 0} f(x) =$ ______________, $\lim_{x \to 1} f(x) =$ ______________,

$\lim_{x \to 2} f(x) =$ ______________.

5. Find
$$\lim_{x\to -1} \frac{x}{x+1}.$$
If the limit does not exist, explain why.

$\lim_{x\to -1} \frac{x}{x+1} =$ ______________

6. Find
$$\lim_{x\to 2} \frac{x^2+2x+3}{x^2+3x+2}$$
If the limit does not exist, explain why.

$\lim_{x\to 2} \frac{x^2+2x+3}{x^2+3x+2} =$ ______________

7. The function

$$f(x) = \frac{x^2 - 2x + 1}{x^2 - 1}$$

is not defined at $x = 1$. We define a new function g by

$$g(x) = \begin{cases} f(x), & x \neq 1 \\ C, & x = 1 \end{cases}$$

Find a value for C so that the function g is continuous at $x = 1$.

$C =$ ____________

8. Find the equation of the tangent line to the graph of $f(x) = x^2 - 2x$ at $x = 3$. Put your answer in the form $y = mx + b$.

$y =$ ____________

9. Find all points on the graph of $f(x) = 1/x$ where the tangent line to the graph is parallel to $y = -4x + 2$.

$(x, y) =$ ____________

10. If $f(x) = |x + 2|$, what is the domain of $f'(x)$?

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11. If $f(x) = \frac{x}{4-x^2}$, find $f'(3)$.

$f'(3) =$ ____________

Answer three of the following four questions. Indicate clearly which question is not to be graded by drawing a line through the question number in the table on the front of the exam.

12. (a) State the principle of mathematical induction. Use complete sentences.

    (b) Use the principle of mathematical induction to prove that

$$\frac{d}{dx}x^n = nx^{n-1}, \qquad \text{for } n = 1, 2, 3, \ldots.$$

    You may assume that this formula is true for $n = 1$.

13. Find all tangent lines to the graph of $y = x^2$ which pass through the point $(0, -1)$.

14. (a) State the definition of the derivative of a function f at a point a. Use complete sentences.

    (b) Use the definition of the derivative to find the derivative of $f(x) = \frac{1}{2x+3}$.

    (c) Give the domain of the derivative, f'.

15. (a) State the intermediate value theorem. Use complete sentences.

(b) Use the intermediate value theorem to find an interval $[a, b]$ so that the equation $x^5 + 2x^3 = 3 - x$ has a root in the open interval (a, b).