

Name _____

Block (please circle) G H

June 9, 2003

Honors Pre-Calculus Test

sections 9.4 and 10.3

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Part A (40%)	_____
Part B (30%)	_____
Part C (30%)	_____
grade	_____

Part A. Limits

Directions for questions 1–3: Determine each limit using any method. If a limit is not a finite number, give one of the following answers: ∞ , $-\infty$, or undefined. You do not have to show work.

answers

1. $\lim_{x \rightarrow 0} \frac{x + \sin x}{2x}$

1. _____

2. $\lim_{x \rightarrow (-3)^-} \frac{x^2 + 5x + 6}{x^2 - 9}$

2. _____

3. $\lim_{x \rightarrow -\infty} \frac{x}{|x|}$

3. _____

4. Suppose $f(x) = \begin{cases} x^2 - 5 & \text{for } x < 1 \\ n & \text{for } x = 1 \\ 2x + k & \text{for } x > 1 \end{cases}$. Find the values of k and n that make f a continuous function.

5. Sketch a graph of a function $F(x)$ having the following properties:

$$\lim_{x \rightarrow -\infty} F(x) = 4, \lim_{x \rightarrow 0} F(x) = -\infty, \text{ and } \lim_{x \rightarrow 2} F(x) \neq F(2).$$

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Part B. Sequences

1. Write an explicit formula for the n th term of each of the following sequences.

No justification is required.

a. an arithmetic sequence in which $t_{20} = 80$ and $t_{30} = 40$ $t_n =$ _____

b. the sequence $8, -4, 2, -1, \frac{1}{2}, -\frac{1}{4}, \dots$ $t_n =$ _____

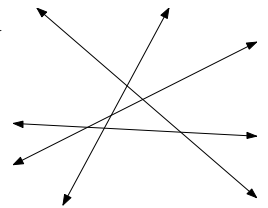
c. a sequence defined recursively by $t_1 = 4$ and $t_{n+1} = (t_n)^2$ $t_n =$ _____

2. Let R_n represent the maximum number of regions into which a plane can be divided using n lines. For example, $R_4 = 11$, as shown by the 11 regions in the diagram.

a. Give the values of the first 6 terms of the R_n sequence (R_1 through R_6).

_____, _____, _____, _____, _____, _____

b. Write a recursive formula for R_n . Justify your answer geometrically.



3. Suppose that $\{a_n\}$ is an arithmetic sequence with d as the difference between terms.

Prove that $\{10^{a_n}\}$ is a geometric sequence, and find the ratio for this geometric sequence.

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Part C. Series

1. a. Rewrite this series without using summation (Σ) notation, then find the sum:

$$\sum_{n=2}^5 \frac{1}{n+1}$$

- b. Rewrite this series using summation (Σ) notation:

$$4 + 4\sqrt{2} + 8 + 8\sqrt{2} + \cdots + 64\sqrt{2} + 128$$

- c. Find the sum of the series from part b.

2. The series $\sum_{n=1}^{\infty} x^n$ converges (i.e., has a sum) for certain values of x , and diverges (i.e., does not have a sum) for other values of x .

- a. For what values of x does the series converge? Explain how you get your answer.

- b. Assuming that x has a value as described in your answer to part a, find the sum of the series.

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3. Albert and Barbara play a game. Albert goes first, and the two players take turns rolling a 6-sided die (with faces labeled 1 through 6). The first person to roll a "6" wins the game. What is the probability that Albert wins the game, and what is the probability that Barbara wins the game?