BC Calculus Name_____Pd.___
Limits & Continuity: Review Date_____Seat #___

Please start off every review with reading your notecards for that unit several times!!!!! This is a very limited review!!!!

Limit-intended height (y-value) of the functions.

Properties- add, subtract, multiply, divide, multiply constant & raise to power.

Techniques to Evaluate-

- Direct Substitution-plug the x-value in… if you get a number you are done… If you get an indeterminant form….
  1. Try to factor the expression. Cancel common factors & direct substitution.
  2. Try table or graphs… try plugging in a number close to the x-value on the right/left
  3. L'Hopital's Rule

One Sided limits- Right sided: $\lim_{x\to c^+} f(x)$ Left sided: $\lim_{x\to c^-} f(x)$ If $\lim_{x\to c^+} f(x) = \lim_{x\to c^-} f(x)$ *Then* $\lim_{x\to c} f(x) = exists$

Infinite Limits- $\lim_{x\to\infty} f(x) =$ EndBehavior $HA: y = 0/\#$ $\lim_{x\to c} \frac{\#}{x-c} = \pm\infty$ $VA: x = c$

- (Ladies) J-Lo=0 Marilyn=Leading Coeff Dolly = $\pm\infty$ (plug in #)
- Plug in #

Practice: Non-Calculator Active-2008 (1-3) Calculator Active (4-5)

Key:
1.B
2.A
3.A
4.C
5.E

1. $\lim_{x\to\infty} \frac{(2x-1)(3-x)}{(x-1)(x+3)}$ is
   a. -3
   b. -2
   c. 2
   d. 3
   e. nonexistent

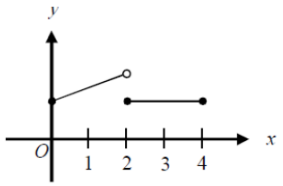
2. $\lim_{x\to 0} \frac{5x^4+8x^2}{3x^4-16x^2}$ is
   a. -1/2
   b. 0
   c. 1
   d. 5/3 + 1
   e. Nonexistent

3. Let f be the function defined to the right. Which of the following statements about f are true?
   I. f has a limit at x=2.
   II. f is continuous at x=2.
   III. f is differentiable at x=2.

$$f(x) = \begin{cases} \frac{x^2-4}{x-2} & \text{if } x \neq 2 \\ 1 & \text{if } x = 2 \end{cases}$$

   a. I only
   b. II only
   c. III only
   d. I & II only
   e. I, II, & III

4. The figure to the right shows the graph of a function f with domain $0 \le x \le 4$. Which of the following statements are true?
   I. $\lim_{x\to 2^-} f(x)$ exists
   II. $\lim_{x\to 2^+} f(x)$ exists
   III. $\lim_{x\to 2} f(x)$ exists



   a. I only
   b. II only
   c. I & II only
   d. I & III only
   e. I, II, & III

5. The function f is continuous for $-2 \le x \le 2$ and $f(-2) = f(2) = 0$. If there is no c, where $-2 < c < 2$ for which $f'(c) = 0$, which of the following statements must be true?
   a. For $-2 < k < 2$, $f'(k) > 0$.
   b. For $-2 < k < 2$, $f'(k) < 0$.
   c. For $-2 < k < 2$, $f'(k)$ exists.
   d. For $-2 < k < 2$, $f'(k)$ exists, but f' is not continuous.
   e. For some k, where $-2 < k < 2$, f'(k) does not exist.

BC Calculus Name_____Pd.___

Limits & Continuity: Review Date_____Seat #___

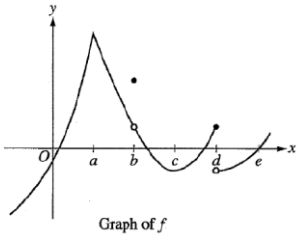
Practice: Non-Calculator Active-2003 (6-9) Calculator Active (10)

Key:
6. E
7. C
8. A
9. D
10. D

6. For $x \geq 0$, the horizontal line y=2 is an asymptote for the graph of the function f. Which of the following must be true?
   a. $f(0) = 2$
   b. $f(x) \neq 2$ for all $x \geq 0$
   c. $f(2)$ is undefined
   d. $\lim_{x \to 2} f(x) = \infty$
   e. $\lim_{x \to \infty} f(x) = 2$

7. $\lim_{x \to \infty} \frac{x^3 - 2x^2 + 3x - 4}{4x^3 - 3x^2 + 2x - 1} =$
   a. 4
   b. 1
   c. 1/4
   d. 0
   e. -1

8. The graph of a function f is shown above. At which value of x is f continuous, but not differentiable?
   a. a
   b. b
   c. c
   d. d
   e. e



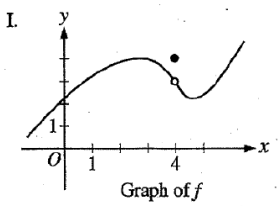
Graph of f

9. Let f be the function given to the right. Which of the following statements are true about f?
   I. $\lim_{x \to 3} f(x)$ exists.
   II. f is continuous at x=3.
   III. f is differentiable at x=3.

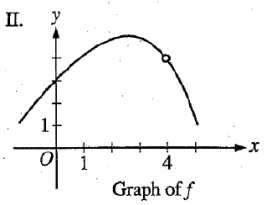
$$f(x) = \begin{cases} x + 2 & \text{if } x \leq 3 \\ 4x - 7 & \text{if } x > 3 \end{cases}$$

   a. None
   b. I only
   c. II only
   d. I & II only
   e. I, II, & III

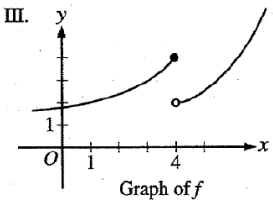
10. For which of the following does $\lim_{x \to 4} f(x)$ exist?
   a. I only
   b. II only
   c. III only
   d. I & II only
   e. I & III only



Graph of f



Graph of f



Graph of f

Free Response Practice

Free Response 2011 #6 **Non-Calculator**

11. Let f be a function defined by

$$f(x) = \begin{cases} 1 - 2\sin x & \text{for } x \leq 0 \\ e^{-4x} & \text{for } x > 0 \end{cases}$$

a.) Show that f is continuous at x=0.

Free Response 2011B #2 **Calculator**

12. A 12,000 liter tank of water is filled to capacity. At t=0, water begins to drain out of the tank at a rate modeled by r(t), measured in liters per hour, where r is given by the piecewise-defined function

$$r(t) = \begin{cases} \frac{600t}{t+3} & \text{for } 0 \leq t \leq 5 \\ 1000e^{-0.2t} & \text{for } t > 5 \end{cases}$$

a.) Is r continuous at t=5? Show the work that leads to your answer.

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Name_____Pd.___
Date_____Seat #___

Free Response 2008 #6 **Non-Calculator**

13. Let f be the function given by $f(x)=\frac{\ln x}{x}$ for all x>0. The derivative of f is given by $f'(x)=\frac{1-\ln x}{x^2}$,

a) Find $\lim_{x\to 0^+} f(x)$

Free Response 2003 #6 **Non-Calculator**

14. Lef f be the function defined by $f(x)=\begin{cases}\sqrt{x+1} & \text{for } 0\le x\le 3\\ 5-x & \text{for } 3<x\le 5\end{cases}$.

a.) Is f continuous at x=3? Explain why or why not?

Free Response Practice **Non-Calculator**

15. Given the function $f(x)=\frac{x^3+2x^2-3x}{3x^2+3x-6}$.

a.) What are the zeros of f(x)?

b.) What are the vertical asymptotes of f(x)?

c.) The end behavior model of f(x) is the function g(x). What is g(x)?

d.) What is $\lim_{x\to\infty} f(x)$? What is $\lim_{x\to\infty}\frac{f(x)}{g(x)}$?