AP Calculus
Unit 1 – Limits & Continuity

Day 4 Notes: Limit-Based Continuity

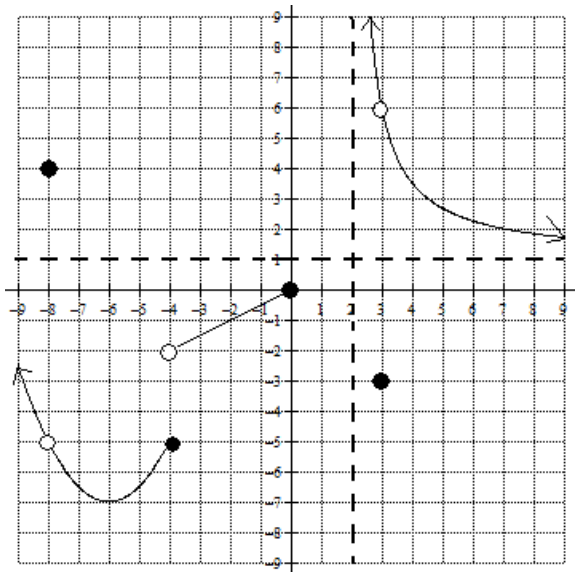
Three Part Definition of Continuity:
(used to determine if a function, f(x), is continuous or not at x = a.)

I.

II.

III.

Example 1: The graph of the function, $G(x)$, pictured below has several x – values at which the function is not continuous. For each of the following x – values, use the three part definition of continuity to determine if the function is continuous or not.



a) x = -8

b) $x = -6$

c) $x = -4$

<u>Example 2</u>: Use the three part definition of continuity to determine if the given functions are continuous at the indicated values of *x*.

a) $f(x) = \begin{cases} -2\sqrt{x+6}, & x < -2 \\ 3x+2, & x = -2 \\ e^x + \cos(\pi x), & x > -2 \end{cases}$ at $x = -2$

b) $g(x) = \begin{cases} e^x \cos x, & x < \pi \\ e^x \tan\left(\frac{3x}{4}\right), & x \geq \pi \end{cases}$ at $x = \pi$

<u>Example 3</u>: Consider the function, *f*(*x*), to the right to answer the following questions.

$$f(x)=\begin{cases} 2, & x\le -1 \\ mx+k, & -1<x<3 \\ -2, & x\ge 3 \end{cases}$$

a. What two limits must equal in order for *f*(*x*) to be continuous at *x* = –1?

b. What two limits must equal in order for *f*(*x*) to be continuous at *x* = 3?

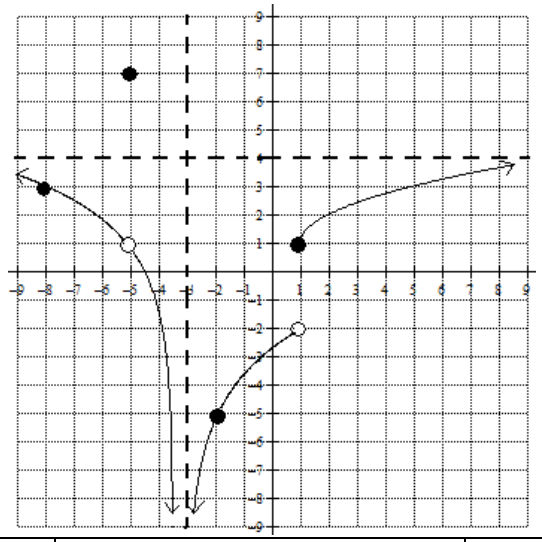
c. Determine the values of *m* and *k* so that the function is continuous everywhere.

AP Calculus AB **Name: _____**

Unit 1 – Day 4 – Assignment

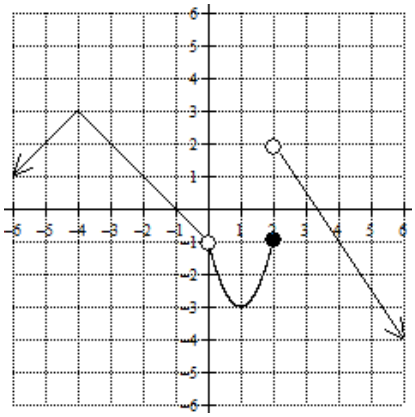
Limit – Based Continuity

For exercises 1 – 3, determine if the function is continuous at each of the indicated values below. Use the three part definition of continuity to perform your analysis.



1. $x = -5$	2. $x = 1$	3. $x = -2$

4. Use the three part definition of continuity to graphically justify why $p(x)$ is discontinuous at $x = 0$ and $x = 2$.



5. For what values of k and m is the function $g(x)$ everywhere continuous? Use limits to set up your work.

$$g(x) = \begin{cases} kx^2 + m, & x < -1 \\ e^{\ln(2x+3)}, & -1 \le x \le 3 \\ kx - m, & x > 3 \end{cases}$$

Find the value of a that makes each of the functions below everywhere continuous. Write the two limits that must be equal in order for the function to be continuous.

6. $f(x) = \begin{cases} 4 - x^2, & x < -1 \\ ax^2 - 1, & x \ge -1 \end{cases}$

7. $f(x) = \begin{cases} x^2 + x + a, & x < 2 \\ ax^3 - x^2, & x \ge 2 \end{cases}$