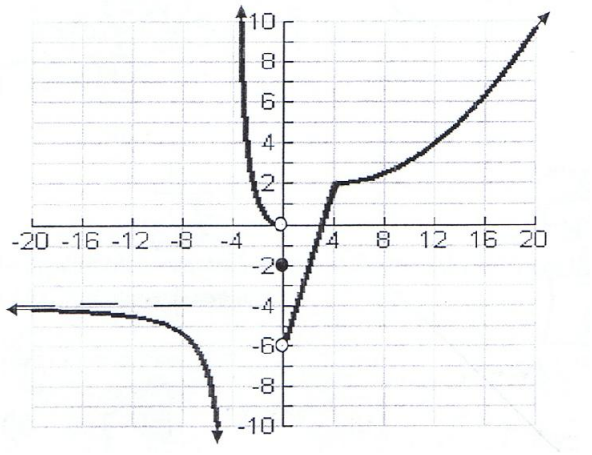
AB Calculus
Limits and Tangents Lab
Part I: Non Calculator

1. Use the graph of y = f(x) below to estimate the answers questions 1 and 2.



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

b) $f(0) =$ _____

c) $\lim_{x\to 0^-} f(x) =$ _____

d) $\lim_{x\to 4^-} f(x) =$ _____

e) $\lim_{x\to -\infty} f(x) =$ _____

e) $\lim_{x\to -4} f(x) =$ _____

2. Is f(x) continuous at the given x-value? Answer yes or no and use the definition of continuity to give reasons for your answer.

x = 0 _____, _____

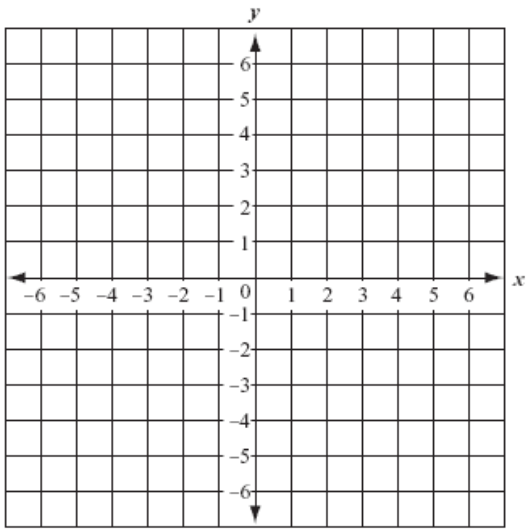
x = 4 _____, _____

3. Sketch a function that satisfies each of the following conditions:

$\lim_{x\to 0^+} f(x) = 4$ $f(0) = 2$ $\lim_{x\to 0^-} f(x) = -1$ $\lim_{x\to 4^-} f(x) = \infty$

$\lim_{x\to \infty} f(x) = -1$ $\lim_{x\to 4^+} f(x) = -\infty$

$\lim_{x\to -\infty} f(x) = \infty$



4. Evaluate the following limits. Classify any non-existent limits whenever possible. Show your work or explain your reasoning.

a. $\lim_{x\to 0}\dfrac{(3+x)^2-9}{x}$

b. $\lim_{x\to -\infty}\left(\dfrac{\sqrt{2x^4-5x^2+10}}{1-x^2}\right)$

c. $\lim_{x\to 2^-}\left|\dfrac{x+2}{x^2-4}\right|$

d. $\lim_{h\to 0}\dfrac{\sqrt{1+h}-1}{h}$

e. $\lim_{x\to 0}\dfrac{\sin 4x}{5x}$

5. Find all the EXACT values of c so that $f(x)=\begin{cases} c & ,x<2 \\ 2\sqrt{cx}-1, & x\geq 2 \end{cases}$ is continuous at x = 2.

Show all work.

AB Calculus - Limits Lab
Part II: Calculator

6. Given $f(x)=\dfrac{2x^2-4x}{|2-x|}$, use the table provided below to compute the following limits.

Choose appropriate values for x.

	Left:				Right:			
x								
y								

a) $\lim\limits_{x\to 2^+} f(x)=$ _____ b) $\lim\limits_{x\to 2^-} f(x)=$ _____ $\lim\limits_{x\to 2} f(x)=$ _____

7. Prove that the function $f(x)=2x^3+x^2+2$ has at least one root on the interval [-2, -1]. Hint: You must use a theorem in your proof.

8. Let $g(x)=\begin{cases} 2x-x^2 & \text{if } 0\leq x\leq 2 \\ 2-x & \text{if } 2<x\leq 3 \\ x-4 & \text{if } 3<x<4 \\ \pi & \text{if } x\geq 4 \end{cases}$

   a. Prove or disprove the function is continuous at the following points, using the formal definition of continuity.
      i. 0
      ii. 2
      iii. 3
      iv. 4
   b. Sketch the graph of g

9. Given the function: $f(x)=\dfrac{x^3-x}{x^2-6x+5}$
   a. Find all asymptotes
   b. Find the roots of the function
   c. Find the domain of the function

10. Find the values of a and b that make f continuous everywhere

$$f(x)=\begin{cases} \dfrac{x^2-4}{x-2} & \text{if } x<2 \\ ax^2-bx+3 & \text{if } 2<x<3 \\ 2x-a+b & \text{if } x\geq 3 \end{cases}$$