AP Calculus / 1.5 Limits at Infinity Name: ________________________ Date: ______

Consider the function $f(x)=\frac{2}{x-3}$ and complete the following table:

x	f(x)
2	
2.9	
2.99	
2.999	
2.9999	
2.99999	
3	
3.00001	
3.0001	
3.001	
3.01	
3.1	
4	

1. As $x \to 3^-$, $f(x) \to$ ________

2. As $x \to 3^+$, $f(x) \to$ ________

3. Which of the following limits exists?

   a. $\lim_{x \to 3^-} f(x)$ ________

   b. $\lim_{x \to 3^+} f(x)$ ________

   c. $\lim_{x \to 3} f(x)$ ________

4. We could write the following to indicate how the function is behaving as x approaches the following values:

   a. $\lim_{x \to 3^-} f(x) =$ ________

   b. $\lim_{x \to 3^+} f(x) =$ ________

   c. NOTE: the equals sign does NOT mean that the limit exists, rather it tells how the limit fails to exist.

5. A limit in which *f(x)* increases or decreases without bound as $x \to c$ is called an <u>infinite limit</u>.

6. What feature does the graph possess at $x = 3$? ____________________________

7. Generalize: If $f(x) \to$ _____ or _____ as $x \to c$ from the ________ or the ________, then the line ________ is a _________________ of the graph of *f(x)*.

8. Based on the information above, sketch a graph of $f(x)=\frac{2}{x-3}$ on the axes above.

9. Try the following basic examples (do not rely on the graph of the function):

a. $\lim_{x \to 1^-} \frac{1}{x-1} =$ ________

b. $\lim_{x \to 1^+} \frac{1}{x-1} =$ ________

c. $\lim_{x \to 1^-} \frac{-1}{x-1} =$ ________

d. $\lim_{x \to 1^+} \frac{-1}{x-1} =$ ________

e. $\lim_{x \to 1^-} \frac{1}{(x-1)^2} =$ ________

f. $\lim_{x \to 1^+} \frac{1}{(x-1)^2} =$ ________

g. $\lim_{x \to 1} \frac{1}{(x-1)^2} =$ ________

h. $\lim_{x \to 1} \frac{-1}{(x-1)^2} =$ ________

Identify the vertical asymptotes for the following functions:

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

j. $f(x) = \cot(x)$