Names _____ Aug 29,2019

# The Connection Between Asymptotes and Limits

**Part I:** For each question, describe what the given information tells you about the graph of $y = f(x)$. Then, decide whether the given information allows you to identify a horizontal or vertical asymptote for the graph of $y = f(x)$. If there is sufficient information, state the equations of any asymptotes.

**Example:** $\lim_{x \to 2} f(x) = \infty$

- Explain what this tells you about the graph of $y = f(x)$

  As $x$ gets closer to 2, both from the left and from the right, the $y$-coordinates are unbounded, getting larger and larger in the positive direction.

- Vertical asymptote(s)? ☐ No ☑ Yes, equation(s): ___**x = 2**_____
- Horizontal asymptote(s)? ☑ No ☐ Yes, equation(s): _____

**1.** $\lim_{x \to 3^-} f(x) = +\infty, \lim_{x \to 3^+} f(x) = -\infty$

- Explain what this tells you about the graph of $y = f(x)$

- Vertical asymptote(s)? ☐ No ☐ Yes, equation(s): _____
- Horizontal asymptote(s)? ☐ No ☐ Yes, equation(s): _____

**2.** $\lim_{x \to +\infty} f(x) = 2$

- Explain what this tells you about the graph of $y = f(x)$

- Vertical asymptote(s)? ☐ No ☐ Yes, equation(s): _____
- Horizontal asymptote(s)? ☐ No ☐ Yes, equation(s): _____

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

- Explain what this tells you about the graph of $y = f(x)$

- Vertical asymptote(s)? ☐ No ☐ Yes, equation(s): _____
- Horizontal asymptote(s)? ☐ No ☐ Yes, equation(s): _____

**4.** $\lim_{x\to+\infty} f(x) = 2, \lim_{x\to-\infty} f(x) = 4$

- Explain what this tells you about the graph of $y = f(x)$

- Vertical asymptote(s)? ☐ No ☐ Yes, equation(s): _____
- Horizontal asymptote(s)? ☐ No ☐ Yes, equation(s): _____

**5.** $\lim_{x\to4^-} f(x) = 2, \lim_{x\to4^+} f(x) = 3$

- Explain what this tells you about the graph of $y = f(x)$

- Vertical asymptote(s)? ☐ No ☐ Yes, equation(s): _____
- Horizontal asymptote(s)? ☐ No ☐ Yes, equation(s): _____

**6.** $\lim_{x\to1} f(x) = +\infty, f(1) = 4$ .

- Explain what this tells you about the graph of $y = f(x)$

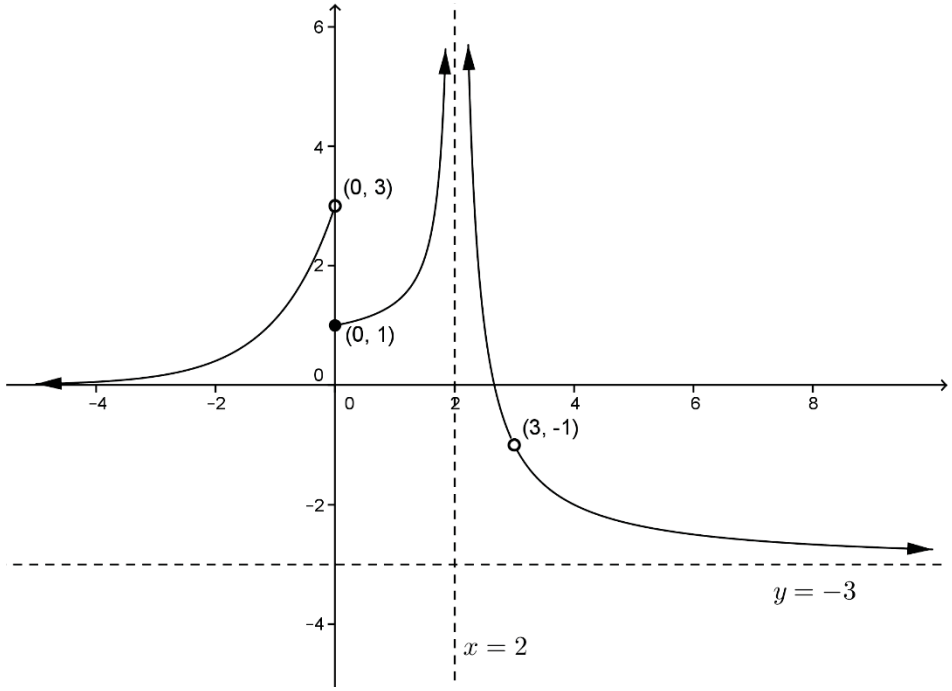
- Vertical asymptote(s)? ☐ No ☐ Yes, equation(s): _____
- Horizontal asymptote(s)? ☐ No ☐ Yes, equation(s): _____

**7.** $\lim_{x\to2^+} f(x) = -\infty, \lim_{x\to3^-} f(x) = +\infty, \lim_{x\to+\infty} f(x) = +\infty, \lim_{x\to-\infty} f(x) = -\infty$

- Explain what this tells you about the graph of $y = f(x)$

- Vertical asymptote(s)? ☐ No ☐ Yes, equation(s): _____
- Horizontal asymptote(s)? ☐ No ☐ Yes, equation(s): _____

**Part II:** This part of the activity concentrates on writing correct notation for limit statements as well as making the connection between limits and graphical behavior. Shown below is the graph of a function $f(x)$. There are eleven limit statements, including one-sided and two-sided limits, based on the labeled points and lines on this graph. Write at least ten of these limit statements.




1._____ 6._____

2._____ 7._____

3._____ 8._____

4._____ 9._____

5._____ 10._____

11._____