AP Calc WS#5 Limits involving Infinity Name: \_\_\_\_\_\_

Limits by algebraic simplification: The substitution rule cannot be used to evaluate $\lim\_{x\to c}f(x)$ if c is not in the domain of the function f (for instance, if it produces a zero in the denominator).

 



The symbol for infinity (∞) does not represent any real number. When we say “the limit of f as x approaches infinity” we mean the limit of function f as x moves increasingly far to the right on the number line.

 Facts: When the *denominator* approaches zero then the *fraction* approaches infinity

 When the *denominator* approaches infinity then the *fraction* approaches zero

$\lim\_{x\to +\infty }\frac{1}{x}=?$ $\lim\_{x\to -\infty }\frac{1}{x}=?$ We say $\lim\_{x\to \infty }\frac{1}{x}=?$

We say the line y = 0 is a **horizontal asymptote** of the graph f(x) = 1/x.

 Check with your calculator.

Prove the horizontal asymptote of $f(x)=2+\frac{1}{x}$ is the line y = 2

Use graphs and tables to find $\lim\_{x\to +\infty }f(x)$,$\lim\_{x\to -\infty }f(x)$ identify all horizontal asymptotes of $f(x)=\frac{x}{\sqrt{x^{2}+1}}$

Find the following limit and sketch its graph to support your answer

$\lim\_{x\to 0}\frac{1}{x}=$ $\lim\_{x\to \infty }(1+\frac{1}{x})=$ $\lim\_{x\to \infty }\frac{\sqrt{3}}{x^{2}}=$

$\lim\_{x\to 0+.}(\frac{1}{x^{{1}/{3}}})=$ $\lim\_{x\to 0-.}(\frac{1}{x^{{1}/{3}}})=$ $\lim\_{x\to 1+.}(\frac{1}{x-1})=$ $\lim\_{x\to 1-.}(\frac{1}{x-1})=$

We say the line x = a is a **vertical asymptote** of the graph f(x) if either

 $\lim\_{x\to a^{+.}}f(x)=\pm \infty $or $\lim\_{x\to a^{-.}}f(x)=\pm \infty $

Find the vertical asymptotes of the following, Describe the behavior to the left and right of each vertical asymptotes

 a. $f(x)=\frac{1}{x^{2}}$ b. f(x) = tan x

Find the following limits. Hint divide

a. $\lim\_{x\to -\infty }\frac{-15x}{7x+4}=?$ b. $\lim\_{x\to \infty }\frac{5x^{2}+8x-3}{3x^{2}+2}=?$

c. $\lim\_{x\to -\infty }\frac{11x+2}{2x^{3}-1}=?$ d. $\lim\_{x\to \infty }\frac{2x^{2}-3}{7x+4}=?$

e. $\lim\_{x\to \infty }\frac{-4x^{3}+7x}{2x^{2}-3x-10}=?$ f. $\lim\_{x\to -\infty }\frac{-4x^{3}+7x}{2x^{2}-3x-10}=?$

Find the following limits. Hint: Using properties (cheatsheet)

 $\lim\_{x\to -\infty }\frac{5x+sin(x)}{x}$ $\lim\_{x\to -\infty }\frac{xsinx+2sinx}{2x^{2}}$

 $\lim\_{x\to -\infty }\left(\frac{2}{x}+1\right)\left(\frac{5x^{2}-1}{x^{2}}\right)$ $\lim\_{x\to -\infty }\left(2-\frac{x}{x+1}\right)\left(\frac{x^{2}}{5+x^{2}}\right)$

 $\lim\_{x\to -\infty }\frac{ln(x^{2})}{ln(x)}$ $\lim\_{x\to -\infty }\frac{ln(x+1)}{ln(x)}$ $\lim\_{x\to -\infty }\frac{ln(x)}{log(x)}$









Use squeeze theorem to show that

There are functions that you can't take limit algebraically, then using tabular method will help.

a. $\lim\_{x\to 1}x^{{1}/{(x-1)}}=?$ Use 6 decimals number

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 0.9 | 0.99 | 0.999 | 1 | 1.001 | 1.01 | 1.1 |
|  |  |  |  |  |  |  |

b. $\lim\_{x\to 0}\frac{3^{x}-1}{x}=?$Use 6 decimals number

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| -0.1 | -0.01 | -0.001 | 0 | 0.001 | 0.01 | 0.1 |
|  |  |  |  |  |  |  |

c. $\lim\_{x\to 0}\frac{1-cos(x)}{x^{2}}=?$Radian mode. Use 6 decimals number

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| -0.1 | -0.01 | -0.001 | 0 | 0.001 | 0.01 | 0.1 |
|  |  |  |  |  |  |  |

d. $\lim\_{x\to 0}\frac{tan(2x)}{5x}=?$Radian mode. Use 6 decimals number

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| -0.1 | -0.01 | -0.001 | 0 | 0.001 | 0.01 | 0.1 |
|  |  |  |  |  |  |  |