Name:_____ Date:_____

Limit Review

1. Find the limit numerically.

$$\lim_{x\to 3}\frac{\frac{1}{x+1}-\frac{1}{4}}{x-3}$$

x	2.9	2.99	2.999	3.001	3.01	3.1
$f(x)$						

$$\lim_{x\to 0}\frac{\cos(3x)-1}{3x}$$

x	-0.1	-0.01	-0.001	0.001	0.01	0.1
$f(x)$						

2. Find the limit analytically. Show your work.

$$\lim_{x\to 2}\left(2x^2-x-1\right)$$

$$\lim_{x\to 3}\left(\frac{2x}{x-1}\right)$$

$$\lim_{x\to \frac{3\pi}{4}}\sin x$$

$$\lim_{x\to -3}\left(\frac{x^2+5x+6}{x+3}\right)$$

$$\lim_{x\to -2}\left(\frac{3x^2+5x-2}{x+2}\right)$$

$$\lim_{x\to -4}\left(\frac{x^2+6x+8}{x+4}\right)$$

$$\lim_{x\to 0}\frac{3(1-\cos x)}{x}$$

$$\lim_{x\to 0}\frac{\sin x}{5x}$$

$$\lim_{x\to -5}\frac{\sqrt{x+6}-1}{x+5}$$

$$\lim_{x\to 5}\frac{\sqrt{x+4}-3}{x-5}$$

3. Find the one sided limit. Show your work.

$\lim_{x\to 11^+} \frac{11-x}{x^2-121}$

$\lim_{x\to 6^+} \frac{2}{x-6}$

$\lim_{x\to 3^-} \frac{4}{x-3}$

$\lim_{x\to -3^+} \frac{x}{\sqrt{x^2-9}}$

$\lim_{x\to 1^-} f(x) = \begin{cases} x^3+10, & x<1 \\ x+10, & x\geq 1 \end{cases}$

$\lim_{x\to 2^+} f(x) = \begin{cases} -2x+4, & x<2 \\ x^2+2 & x\geq 2 \end{cases}$

4. Find the limit as x approach infinity. Show your work. (No L'Hopital's Rule)

$\lim_{x\to\infty} \left(\frac{5x^5-2x}{x^3+x+12}\right)$

$\lim_{x\to\infty} \frac{2x^2+x}{x^3-10}$

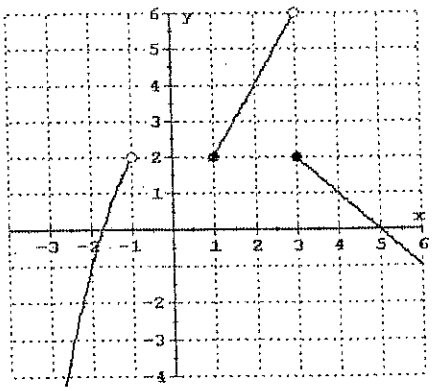
$\lim_{x\to\infty} \left(5+\frac{3}{x^2}\right)$

$\lim_{x\to -\infty} \frac{2x^4-5}{6x^4+7x}$

$\lim_{x\to\infty} \left(\frac{6x^5-3x}{3x^9+10x-2}\right)$

$\lim_{x\to\infty} \left(\frac{3x^4+x}{2x^2-12}\right)$

5. The function $f(x)$ is represented on the graph at the right, find the limit of the following:



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

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

c. $\lim_{x\to -1^-} f(x)$

d. $\lim_{x\to -2} f(x)$

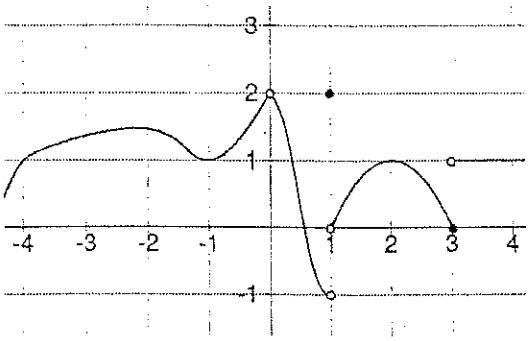
e. $\lim_{x\to 3^-} f(x)$

f. $\lim_{x\to 1} f(x)$

g. $\lim_{x\to 4} f(x)$

h. $\lim_{x\to 1^+} f(x)$

6. The function *f(x)* is represented on the graph at the right, find the limit of the following:



a. $\lim_{x\to 1} f(x)$

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

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

d. $\lim_{x\to 1^+} f(x)$

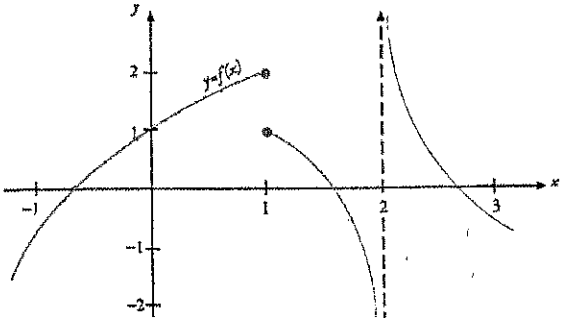
e. $\lim_{x\to 0} f(x)$

f. $\lim_{x\to -4} f(x)$

g. $\lim_{x\to 1^-} f(x)$

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

7. The function *f(x)* is represented on the graph at the right, find the limit of the following:



a. $\lim_{x\to 1^+} f(x)$

b. $\lim_{x\to 2} f(x)$

c. $\lim_{x\to 2^-} f(x)$

d. $\lim_{x\to 1^-} f(x)$

e. $\lim_{x\to 2^+} f(x)$

f. $\lim_{x\to 1} f(x)$

8. Find the limit. Use L'Hopital's Rule if it applies.

$\lim_{x\to 0} \frac{\sin x}{x}$

$\lim_{x\to 0} \frac{e^x - 1}{x^3}$

$\lim_{x\to 0} \frac{x}{e^x}$

$\lim_{x\to 0} \frac{\tan x}{x^2}$

$$\lim_{x\to 0}\frac{13x-7}{2x-11}$$

$$\lim_{x\to 0} x\cot x$$

$$\lim_{x\to\infty}\frac{\frac{1}{x}}{\tan\frac{2}{x}}$$

$$\lim_{x\to 0^+}\frac{\ln x}{\csc x}$$

$$\lim_{x\to 0}\frac{1}{x}-\frac{1}{\sin x}$$

$$\lim_{x\to\infty}\frac{\sin\frac{2}{x}}{\frac{1}{x}}$$

$$\lim_{x\to 1^+}\left(\frac{3}{\ln x}-\frac{2}{x-1}\right)$$

$$\lim_{x\to-\infty} x^2e^x$$

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Mean Value Theorem

1. When $x = -1/2$, what is the instantaneous rate of change for $f(x)=\frac{x}{x+1}$?

2. When $x = -2$, what is the instantaneous rate of change for $f(x)=\sqrt{2-x}$?

3. On the interval [0, 2], what is the average rate of change for $f(x)=x^4-8x$?

4. On the interval [0, 6], what is the average rate of change for $f(x)=x^4-2x^3+x^2$?

5. Determine whether the Mean Value Theorem can be applied to f on the closed interval [a, b]. **If yes**, find all values of c in the open interval (a, b) such that the instantaneous rate of change is equal to the average rate of change. **If not**, explain why.

   $f(x)=x^3+2x$, [-2, 1]

6. Determine whether the Mean Value Theorem can be applied to f on the closed interval [a, b]. **If yes**, explain why and find all values of c in the open interval (a, b) such that the instantaneous rate of change is equal to the average rate of change. **If not**, explain why.

$f(x) = 2x^3$, [0, 6]