

# Examples for:

# Continuity and Limits.

Name: \_\_\_\_\_

Find  $\lim_{x \rightarrow 1} f(x)$  if  $f(x) = \begin{cases} x^2 + 4, & x \neq 1 \\ 2, & x = 1. \end{cases}$

2. Explore limits at infinity or "end behavior models"

a) Describe and compare the "end behavior" of the functions  $P(x) = 4x^5$  and  $Q(x) = 4x^5 - 5x^3 + 2x$  by graphing both functions on the window  $[-5, 5]$  by  $[-5, 5]$  and then on the window  $[-10, 10]$  by  $[-10, 000, 10000]$ .

b) Describe the "end behavior" of the following functions:

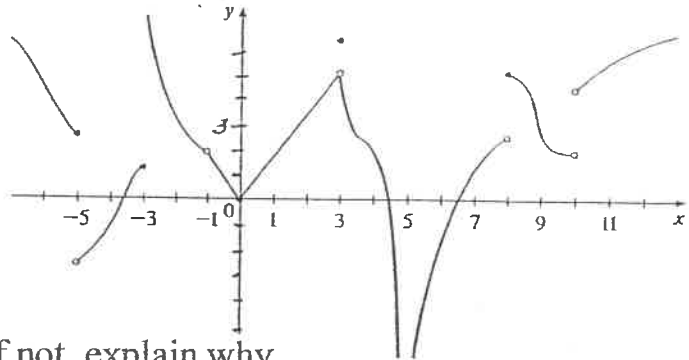
i)  $f(x) = \frac{x+3}{x^2-3x+7}$

ii)  $f(x) = \frac{x^3-4}{x^2-2x+5}$

iii)  $f(x) = \frac{x-5}{\sqrt{4x^2+3x+2}}$

iv)  $f(x) = \frac{x^3}{x-2}$

3. Understanding limits and continuity



a) State the value of the limit if it exists. If not, explain why.

$\lim_{x \rightarrow -3^-} f(x) = \underline{\hspace{2cm}}$	$\lim_{x \rightarrow -3^+} f(x) = \underline{\hspace{2cm}}$	$\lim_{x \rightarrow -3} f(x) = \underline{\hspace{2cm}}$	$\lim_{x \rightarrow -1^-} f(x) = \underline{\hspace{2cm}}$
$\lim_{x \rightarrow -1^+} f(x) = \underline{\hspace{2cm}}$	$\lim_{x \rightarrow -1} f(x) = \underline{\hspace{2cm}}$	$\lim_{x \rightarrow 3^-} f(x) = \underline{\hspace{2cm}}$	$\lim_{x \rightarrow 3^+} f(x) = \underline{\hspace{2cm}}$
$\lim_{x \rightarrow 3} f(x) = \underline{\hspace{2cm}}$	$\lim_{x \rightarrow 9^-} f(x) = \underline{\hspace{2cm}}$	$\lim_{x \rightarrow 9^+} f(x) = \underline{\hspace{2cm}}$	$\lim_{x \rightarrow 9} f(x) = \underline{\hspace{2cm}}$

b) From the graph, state the numbers at which  $f(x)$  is discontinuous. Explain why.

c) For each of the values stated in part b, determine whether  $f(x)$  is continuous from the right or from the left or neither.

4. Find  $\lim_{x \rightarrow -3^+} \sqrt{2x-1}$

6. Find  $\lim_{x \rightarrow 0} \frac{x}{\sin 3x}$

5. Find  $\lim_{x \rightarrow -1^-} \frac{1}{x+1}$

7. Find  $\lim_{\Delta x \rightarrow 0} \frac{\sqrt{x+\Delta x} - \sqrt{x}}{\Delta x}$

Hint: let  $\Delta x = .001$