1. (16pts) Use the graph of the function to answer the following. Justify your answer if a limit does not exist.

$\lim\limits_{x\to5+} f(x) =$

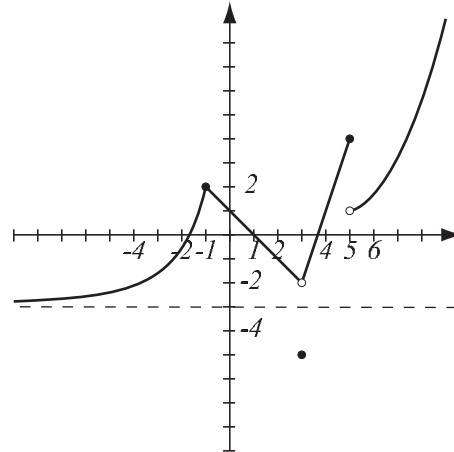$\lim\limits_{x\to5-} f(x) =$

$\lim\limits_{x\to5} f(x) =$

$\lim\limits_{x\to-\infty} f(x) =$

$\lim\limits_{x\to\infty} f(x) =$

$\lim\limits_{x\to3} f(x) =$

List points in domain of f where f is not continuous and justify why it is not continuous at those points.

2. (8pts) Draw the graph of a function $f(x)$ defined on the interval $(1,6)$ which satisfies:

$\lim\limits_{x\to6-} f(x) = -\infty$

$\lim\limits_{x\to1+} f(x) = \infty$

f is discontinuous at $x = 3$, continuous elsewhere

the equation $f(x) = 4$ has no solution

3. (10pts) Find $\lim\limits_{x\to\infty} \dfrac{3 + \cos x}{x^2}$. Use the theorem that rhymes with a dairy product people often put in sandwiches.

Find the following limits algebraically. Do not use the calculator.

4. (5pts) $\lim\limits_{x \to 5} \dfrac{x^2 - 25}{x^2 + 2x - 35} =$

5. (7pts) $\lim\limits_{x \to \infty} \dfrac{x + 2}{x^2 - 3x + 1} =$

6. (6pts) $\lim\limits_{x \to 3^-} \dfrac{x - 4}{6 - 2x} =$

7. (7pts) $\lim\limits_{x \to 4} \dfrac{x - 4}{\sqrt{x} - 2} =$

8. (7pts) $\lim\limits_{x \to 0} \dfrac{\sin(2x)\sin x}{3x^2} =$

9. (14pts) The equation $2^x = 5 - x$ is given.

a) Use the Intermediate Value Theorem to show it has a solution in the interval $(0, 2)$.

b) Use your calculator to find an interval of length at most 0.01 that contains a solution of the equation. Then use the Intermediate Value Theorem to justify why your interval contains the solution.

10. (10pts) Consider the limit $\lim\limits_{x \to 0} (1 - 2x)^{\frac{1}{x}}$. Use your calculator (don't forget parentheses) to estimate this limit with accuracy 3 decimal points. Write a table of values that will support your answer.

x	$(1-2x)^{\frac{1}{x}}$		x	$(1-2x)^{\frac{1}{x}}$

11. (10pts) Consider the function defined below.
a) Explain why the function is continuous on intervals $(-\infty, 1)$ and $(1, \infty)$
b) Is the function continuous at point $x = 1$?

$$f(x) = \begin{cases} 4x - 5, & \text{if } x \leq 1 \\ x^2 - 2x, & \text{if } x > 1. \end{cases}$$

Bonus. (10pts) Evaluate the function at the given x's. Then, based on the table, state what $\lim\limits_{x \to 0} \dfrac{(x^4 + 2)^3 - 8}{x^4}$ appears to be. Explain any strange numbers you are getting.

x	$\dfrac{(x^4 + 2)^3 - 8}{x^4}$
0.1	
0.01	
0.001	
10^{-4}	
10^{-5}	
10^{-6}	