

★ ALWAYS Justify your answer. ★

1. (10 pts) Suppose that  $f(x) = \frac{1}{x-1} + 2$ .

(a) (6 pts) Evaluate the difference quotient

$$\frac{f(a+h) - f(a)}{h}.$$

Simplify your answer as much as possible so that your final answer is a simple fraction.

(b) (4 pts) Use your answer from part (a) to compute  $\lim_{h \rightarrow 0} \frac{f(3+h) - f(3)}{h}$ .

2. (a) (5 pts) Compute  $\lim_{x \rightarrow 5} \frac{x^2 - 4x - 5}{x^2 - 25}$ . Show your work.

(b) (5 pts) Compute  $\lim_{x \rightarrow -\infty} \frac{-x^3 + 5x^2 + 4}{7x + 3x^2}$ . Show your work.

3. (10 pts) Use the TABLE command on your calculator to approximate the limit

$$\lim_{x \rightarrow 3} \frac{\sqrt{3} - \sqrt{x}}{3 - x}$$

to four decimal places. Write down five lines from the TABLE window that justify your answer.

4. (5 pts) Give the precise definition of “The function  $f$  is continuous at the number  $a$ ”.

5. (10 pts) Determine a value for the constant  $k$  such that the function

$$g(x) = \begin{cases} |x| & x < 1 \\ 4 - kx^2 & x \geq 1 \end{cases}$$

is continuous for all  $x$ . You must explain why  $g(x)$  is continuous **everywhere!**

6. (10 pts) Give a formula of a function  $f(x)$  that has 5 vertical asymptotes. Explain why your function satisfies the requirements.

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