Show all work, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical notation, identifying expressions by their proper symbols (introducing them if necessary), and use arrows and equal signs when appropriate. Always simplify expressions. BOX final short answers. LABEL parts of problem. [See long instructions on reverse.]

a) Sketch the graph of \( g(x) = \begin{cases} 2x - x^2, & 0 \leq x \leq 2 \\ 2 - x, & 2 < x \leq 3 \\ x - 4, & 3 < x < 4 \\ 0, & x \geq 4 \end{cases} \)

b) For each of the numbers 2, 3, and 4, discuss whether \( g \) is continuous from the left, continuous from the right, continuous at the number, or none of the above. State the appropriate limit notation condition that corresponds to each of your conclusions.

c) Is there any way you can reasonably decide if \( g \) is differentiable at \( x = 2 \)? Explain and do so if you can.

For the function \( f(x) = \frac{1+2x}{3-4x} \),

a) Find the \( x \) and \( y \) intercepts of the graph \( y = f(x) \).

b) State and evaluate all the limits needed to identify the horizontal asymptotes and vertical asymptotes and in addition, evaluate the one-sided limits for the latter to see how the curve approaches them. State the equations of all asymptotes, labeling them HA and VA.

c) Make a completely labeled (cartoon) sketch of the graph, including the intercepts (•) and asymptotes (—), and fill in the graph of the function aided by technology.

Let \( f(x) = \frac{4}{x} \).

a) State the limit definition of \( f'(x) \) and evaluate it.

b) Write the pt-slope equation for the tangent line to \( f \) at \( x = 2 \) (justifying each number that enters the process) and simplify it to slope-intercept form.

c) Show a sequence of numerical input and output numbers which test the slope limit needed for evaluating the tangent line slope for b) that convince you your slope value is correct (or not). Comment.

Let \( B(t) \) be the total value (in millions of dollars) of US banknotes in circulation at the end of the year \( t \), tabulated to the left for selected years from 1980 to 1998. Estimate the value \( B'(1995) \) and state the interpretation of this number in layman's terms (like you might find in a newspaper article).

Trace the graph of \( f \) on your paper and then sketch the graph of its derivative \( f' \) below it on new axes. Label key points and values in your graph. Comment on all of its key features.