

(6) 1. Compute the derivatives of the following functions:

a) $xe^{\cos x}$

b) $\tan^3(x^3)$

(8) 2. Compute the following limits:

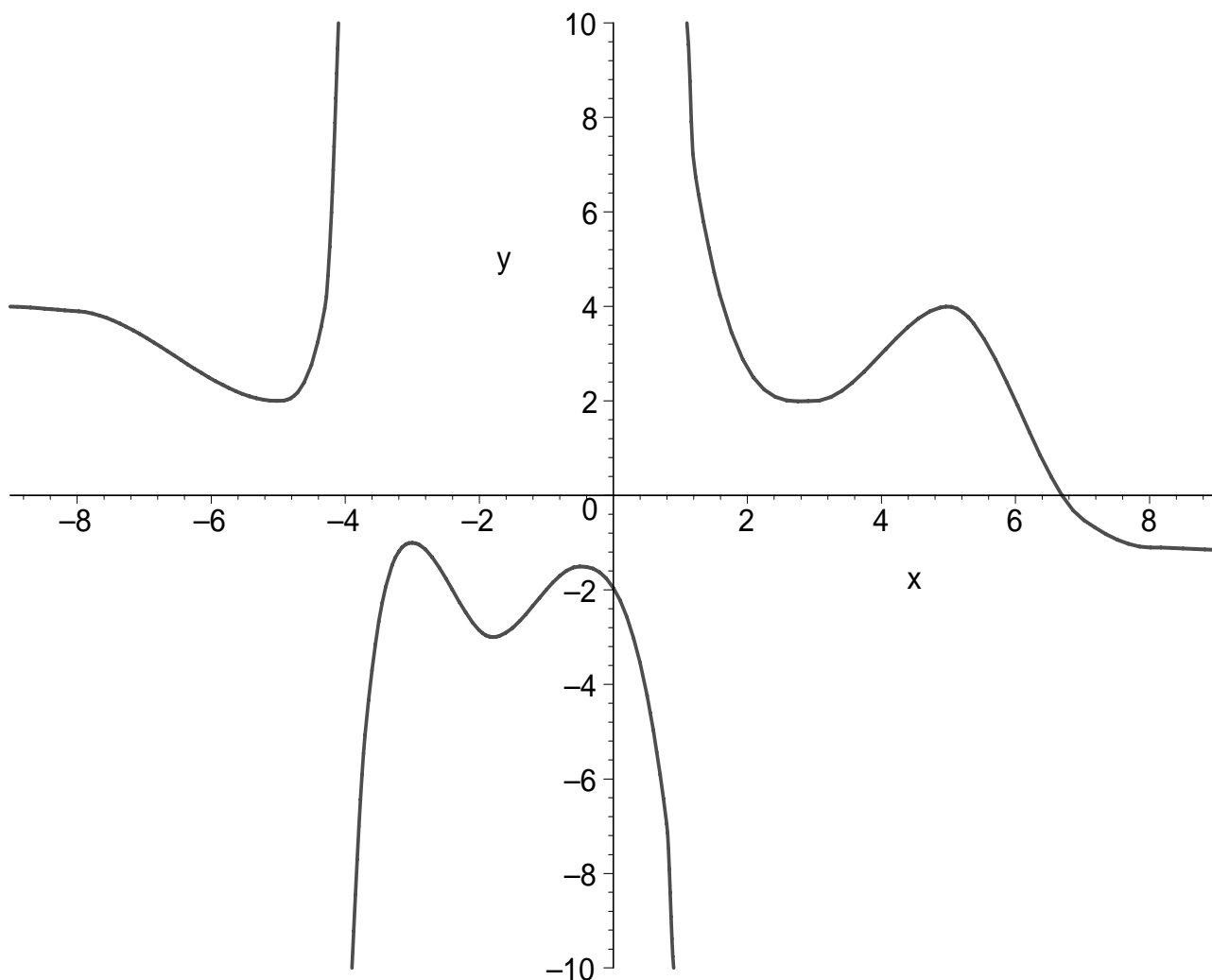
a) $\lim_{x \rightarrow 0} \frac{e^{5x} - 5x - 1}{x^2}$

b) $\lim_{x \rightarrow 1} \frac{x^2 + 1}{x + 1}$

(13) 3. Find an equation for the line tangent to the graph of $\ln y + x^3 + 2xy = 10$ at the point $(2, 1)$.

(8) 4. A certain function $f(x)$ is defined and differentiable for all real numbers x . If $f(1) = 2$ and $|f'(x)| \leq 3$ for $1 < x < 3$, what is the largest possible value of $f(3)$? What is the smallest possible value of $f(3)$? Give brief explanations of your answers.

- (10) 5. Below is a portion of the graph of a function f .
- a) On the plot, draw lines that appear to be vertical asymptotes of the graph. Label each of the lines with the letter V.
 - b) On the plot, draw lines that appear to be horizontal asymptotes of the graph. Label each of the lines with the letter H.
 - c) On the graph of the function, place a small dot at each place the function has a relative maximum. Label each of these points with the letter A.
 - d) On the graph of the function, place a small dot at each place the function has a relative minimum. Label each of these points with the letter Z.
 - e) On the graph of the function, place a small dot at each place the function has a point of inflection. Label each of these points with the letter I.



- (15) 6. What are the absolute maximum and the absolute minimum of the function $x^3 - 3x^2 + 7$ on the interval $[1, 4]$?

- (10) 7. Suppose that $f(x) = e^{3x^2 - 3}$.

Compute $f(1)$.

Compute $f'(1)$.

Use the linearization (differential, tangent line approximation) of f at $x = 1$ to estimate $f(1.05)$.

- (15) 8. For some mysterious reason the dimensions of a rectangular box are changing. At a certain moment, the length is increasing at a rate of 2 feet per hour, the width is decreasing at a rate of 3 feet per hour, and the height is increasing at a rate of 4 feet per hour. If at that moment the length is 5 feet, the width is 6 feet, and the height is 3 feet, how fast is the volume of the box changing? (Be sure to give the units.) Is the volume increasing or decreasing? (Note: The volume of a rectangular box is the product of the length, the width, and the height.)

- (15) 9. A manufacturer can produce shoes at a cost of \$50 a pair and estimates that if the shoes are sold for p dollars a pair, then consumers will buy approximately

$$1000e^{-0.1p}$$

pairs of shoes each week. At what price should the manufacturer sell the shoes to maximize profits?