(1) (15 pts.)
(a) Find the linearization $L(x)$ of the function $f(x) = x^7$ at $a = 10$.
(b) Approximate $(9.9)^7$ using differentials.

(2) (10 pts.) Find the limit $\lim_{x \to \infty} \left(1 - \frac{3}{x}\right)^{-x}$
(3) (15 pts.) Find the absolute maximum and minimum values on the interval [0, 15] for the function \( f(x) = \frac{1}{x + 1} + \frac{x}{15} \).

(4) (10 pts.) Find the limit \( \lim_{x \to 0} \frac{1 - \cos 3x}{x \sin x} \).
(5) (25 pts.) For the function $f(x) = \frac{x}{x^2 + 4}$, find the following.

(a) The $x$-intercepts.
(b) The asymptotes.
(c) The first and second derivatives.
(d) The critical points and all possible inflection points.
(e) The intervals of increase or decrease.
(f) The intervals of concavity.
(g) The local extrema. Classify each as a maximum or minimum.
(h) The inflection points.
(i) Sketch the graph of $y = f(x)$
(6) (25 pts.) In the figure, $a = 13$, $b = 17$, and $c = 31$ are constants. The two vertical lines are perpendicular to the horizontal line. Find the position of the point $A$ such that the sum $y + z$ is minimized.