1 Basic Definitions

1. Rewrite the following using mathematical notation.
   (a) The function f has a root at $x = 7$.
   (b) The slope of f at $x = -1$ is 12.
   (c) Let $v(t)$ be the velocity of a volleyball at time t. The volleyball traveled 12 meters over the first 4 seconds.
   (d) There exists a point c such that the area under the curve of f from 2 to c is positive.
   (e) The function is increasing on the positive real numbers.
   (f) The set of all real numbers not strictly between 4 and 5.
   (g) The function f is positive on the positive real numbers.
   (h) The function f has slope 3 at some point c.
   (i) The area under the curve of f over $(-1, 4)$ is 12.
   (j) There exists a point c such that the function f evaluated at c is equal to 1.
   (k) Let $h(t)$ be the height of a volleyball at time t. The volleyball is decreasing by 25 feet per second.

2. Rewrite the following using **only** the English language.
   (a) Solve $f(x) = 2$.
   (b) $f'(0) = 9$.
   (c) $\frac{1}{b-a} \int_a^b f(x)dx = 2$.
   (d) $f(x) = 4$ on $x \in \{-1, 3, 6\}$.
   (e) $x = 2 \implies x^2 = 4$.
   (f) $\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$.

2 Calculus knowledge

3. Explain the algebraic significance of the following statements about the graph of f.
   (a) f has a local max at $x = 2$.
   (b) f has a cusp at $x = 5$.
   (c) f has a vertical asymptote at $x = 3$.
   (d) f is decreasing on $(-3, 5)$.

4. Draw a valid graph of f from the previous problem.

5. Describe how to solve each of the problems using your own words.
   (a) Find all points x such that the slope of f is 7.
   (b) Find the critical points of $f(x) = x^4 - 3x^2 + x + 1$.
   (c) $\max x^3 + y$ subject to $x + y = 6$.
   (d) Approximate $\int_{-2}^2 x^3 dx$ using the midpoint Riemann sums with $n = 4$ subintervals.