

**Exercise 1: Basic Function Analysis**

Let  $f(x) = 3x^2 - 5x + 2$ .

- Find the domain and range of  $f(x)$ .
- Calculate  $f(2)$  and  $f(-3)$ .
- Find the x-intercepts (the values of  $x$  when  $f(x) = 0$ ).
- Sketch the graph of  $f(x)$  and identify any turning points.

**Exercise 2: Composite Functions**

Let  $f(x) = 2x + 1$  and  $g(x) = x^2 - 4$ .

- Find the composite function  $(f \circ g)(x)$  and simplify it.
- Find the composite function  $(g \circ f)(x)$  and simplify it.
- Determine if  $(f \circ g)(x)$  is equal to  $(g \circ f)(x)$ .
- Find the domain of each composite function.

**Exercise 3:**

Consider  $f(x) = \frac{1}{x}$ .

- **Domain:** Find the domain of  $f(x)$ .
- **Range:** Determine the range of  $f(x)$ .
- **Graph:** Sketch the graph of  $f(x) = \frac{1}{x}$ .
- **Increasing/Decreasing:** Identify whether  $f(x)$  is increasing or decreasing on the intervals  $(-\infty, 0)$  and  $(0, \infty)$ .
- **Odd or Even:** Prove whether  $f(x) = \frac{1}{x}$  is an odd or even function.

**Exercise 4: Reciprocal of a Transformed Function**

Consider  $f(x) = \frac{1}{x^2 - 4}$ .

- **Domain:** Identify the domain of  $f(x)$ , considering the points where the denominator is zero.
- **Range:** Find the range of  $f(x)$ .
- **Graph:** Sketch the graph of  $f(x)$ , paying attention to vertical asymptotes and horizontal behavior.
- **Increasing/Decreasing:** Analyze the intervals where the function is increasing and decreasing.
- **Odd or Even:** Determine whether the function is odd, even, or neither.

**Exercise 5:**  $f(x) = \frac{1}{|x|}$

- **Domain:** What is the domain of  $f(x) = \frac{1}{|x|}$ ? Are there values that make the function undefined?
- **Range:** Identify the range of  $f(x) = \frac{1}{|x|}$ . What values does the function approach as  $x \rightarrow 0^+$  or  $x \rightarrow \infty$ ?
- **Graph:** Draw the graph of  $f(x) = \frac{1}{|x|}$ . How does the graph differ for positive and negative values of  $x$ ?
- **Behavior:** Describe how the function behaves as  $x$  increases or decreases. What happens to the function as  $x$  approaches 0 or as  $x$  gets very large?