Worksheet 1/30

1. Verify that \( f(x) = |x| \) is not differentiable at the origin.

In 2–4, use the shape of the graph of \( f(x) \) to plot \( f'(x) \). Do not use any formulas.

2. \( f(x) = |x|, \quad -1 \leq x \leq 1 \).
3. \( f(x) = x^2, \quad -1 \leq x \leq 1 \).
4. \( f(x) = \sin x, \quad 0 \leq x \leq \pi \).

5. Find the derivative of \( f(x) = x^5 \) directly by definition.

In 6–9, find the derivative using any of the following rules: \( c' = 0 \), \((x^p)' = px^{p-1}\), \((c f(x))' = c f'(x)\), \((f(x) + g(x))' = f'(x) + g'(x)\), where \( c \) and \( p \) are constants.

6. \( f(x) = (\sqrt{2} + 1)^{10} \)
7. \( f(x) = x^4 - x^3 + x^2 - x + 999 \) (find \( f', f'', f''' \), \( f^{(4)} \), \( f^{(5)} \))
8. \( f(x) = (3x + 5)^2 \)
9. \( f(x) = \sqrt{\sqrt{x}} \)

10. Find the 9th derivative of \(((x + 1)^2 + 1)^2 \).
11. Find the 8th derivative of \(((x + 1)^2 + 1)^2 \).