1. Sketch a function that is continuous on \((-\infty, \infty)\) with the following conditions: \(f'(-1)\) is undefined; \(f'(x) > 0\) on \((-\infty, -1)\); \(f'(x) < 0\) on \((-1, \infty)\).

2. On what intervals is \(f(x)\) increasing / decreasing? On what intervals is the function concave up / concave down? Identify all critical points and inflection points. Use the second derivative test to classify critical points if possible.
   
   (a) \(f(x) = x^4 - 4x^3\)
   (b) \(f(x) = \cos^2 x\) on \([-\pi, \pi]\)
   (c) \(f(x) = x^2 - 2\ln x\)

3. Explain why the following statements are true, or provide a counterexample.
   
   (a) If \(f''(a) = 0\), then \(f\) has an inflection point at \(a\).
   (b) If \(f(x) = g(x) + c\) for some constant \(c\), then \(f\) and \(g\) increase and decrease on the same intervals.
   (c) If \(f\) and \(g\) both increase on an interval, then the product \(fg\) also increases on that interval.

4. Can a continuous function on \((-\infty, \infty)\) have exactly four zeros and two local extrema?

5. For a general parabola \(f(x) = ax^2 + bx + c\), for what values of \(a, b\) and \(c\) is the parabola concave up, and for what values is it concave down?