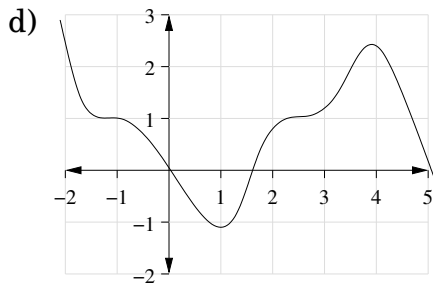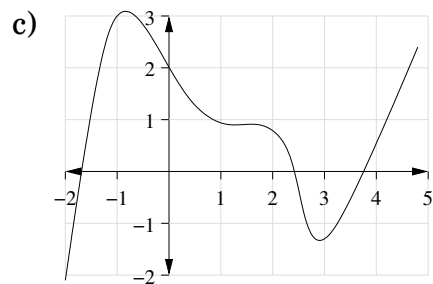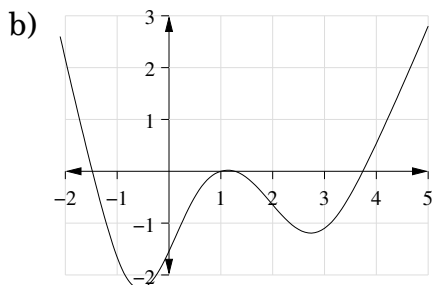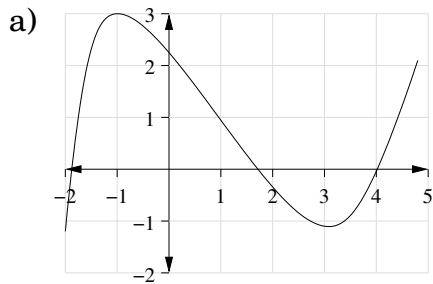# Essentials of Calculus
**Homework 4.1**
Local extrema

1. For each part, let f be the function with the given graph. Find all critical points, and classify each one as a local maximum, local minimum, or neither.

a)

b)

c)

d)
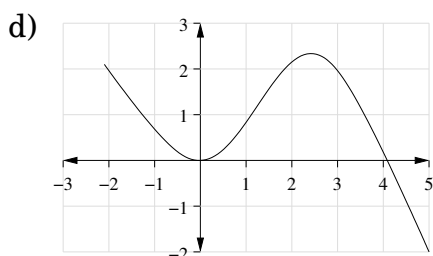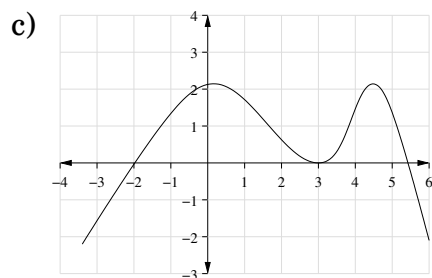
2. For each part, find the critical points of the given function, and classify each one as a local maximum, local minimum, or neither.

    a) $f(x) = x^2 - 4x + 1$

    b) $f(x) = 2x^3 - 3x^2 + 4$

    c) $f(x) = x^4 - 2x^2 + 1$

    d) $f(x) = 3x^5 - 5x^3 + 9$

    e) $f(x) = x^5 - 10x^4 + 9$

    f) $f(x) = 4x^3 + 6x^2 - 24x + 10$

    g) $f(x) = x^3 + 9x^2 + 24x + 2$

    h) $f(x) = 2x^3 + 9x^2 + 12x + 8$

3. For each part, the graph is the graph of $f'(x)$. Find all critical points, and classify each one as a local maximum, local minimum, or neither.

a)

b)

c)

d)
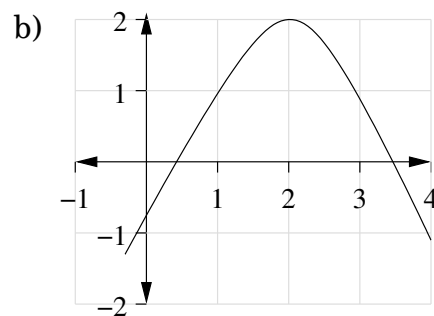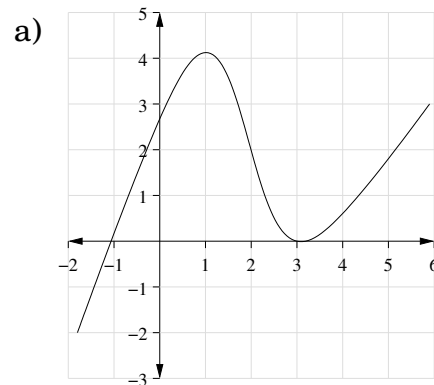
4. For each part, the given function as the given critical point. Use the second derivative test to determine if the critical point is a local maximum or a local minimum.

a) $f(x) = 6x^5 - 15x^4 + 20x^3 - 45x^2 - 60x + 4$ has a critical point at $x = 2$.

b) $f(x) = 5x^6 + 12x^5 + 15x^4 + 40x^3 + 15x^2 + 60x + 20$ has a critical point at $x = -2$.