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.



Numeric answer: *f* has critical points at x = -1 and x = 3x = -1 is a local maximum. x = 3 is a local minimum.



Numeric answer: *f* has critical points at x = -0.5, x = 1 and x = 2.5x = -0.5 is a local minimum x = 1 is a local maximum x = 2.5 is a local minimum



- x = 3 is a local maximum
- 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)
$$f(x) = x^2 - 4x + 1$$

Numeric answer: f has a critical point at x = 2

x = 2 is a local minimum.

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

Numeric answer: *f* has critical points at x = 0 and x = 1 x = 0 is a local maximum

x = 1 is a local minimum

c) $f(x) = x^4 - 2x^2 + 1$ **Numeric answer:** *f* has critical points at x = -1, x = 0and x = 1x = -1 is a local minimum. x = 0 is a local maximum. x = 1 is a local minimum. d) $f(x) = 3x^5 - 5x^3 + 9$ **Numeric answer:** *f* has critical points at x = -1, x = 0and x = 1x = -1 is a local maximum. x = 0 is not a local extremum x = 1 is a local minimum e) $f(x) = x^5 - 10x^4 + 9$ **Numeric answer:** *f* has critical points at x = 0 and x = 8x = 0 is a local maximum x = 8 is a local minimum f) $f(x) = 4x^3 + 6x^2 - 24x + 10$ **Numeric answer:** *f* has critical points at x = -2 and x = 1x = -2 is a local maximum x = 1 is a local minimum g) $f(x) = x^3 + 9x^2 + 24x + 2$ **Numeric answer:** *f* has critical points at x = -2 and x =-4x = -2 is a local maximum. x = -4 is a local minimum. h) $f(x) = 2x^3 + 9x^2 + 12x + 8$ **Numeric answer:** *f* has critical points at x = -1 and x =-2x = -1 is a local minimum x = -2 is a local maximum

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.



x = 5.5 is a local maximum



Numeric answer: *f* has critical points at x = 0 and x = 4 x = 0 is not a local extremum.

- x = 4 is a local maximum
- 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.

Numeric answer: x = 2 is a local minimum.

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

Numeric answer: x = -2 is a local minimum.