

4.1 Nonlinear Functions & Their Graphs

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Definition

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A polynomial function has the form

$$f(x) = a_n x^n + a_{n-1} x^{n-1} + a_{n-2} x^{n-2} + \dots + a_2 x^2 + a_1 x + a_0$$

where $a_0, a_1, a_2, \dots, a_n$ are constants

Examples: $x^5 + 5x^2 - 3$

$$x^3 - 2x^2 + 1$$

$$7x^2 - 2$$

$$13$$



Degree of a Polynomial

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In a polynomial containing only one variable, the greatest exponent that appears on the variable is called the degree of the polynomial

Examples: $x^8 - 3x^2 + 1$ is degree 8

$-2x^4 - x^6$ is degree 6

5 is degree 0

x is degree 1



Absolute and Local Extrema

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ABSOLUTE AND LOCAL EXTREMA

Let c be in the domain of f .

$f(c)$ is an **absolute (global) maximum** if $f(c) \geq f(x)$ for all x in the domain of f .

$f(c)$ is an **absolute (global) minimum** if $f(c) \leq f(x)$ for all x in the domain of f .

$f(c)$ is a **local (relative) maximum** if $f(c) \geq f(x)$ when x is near c .

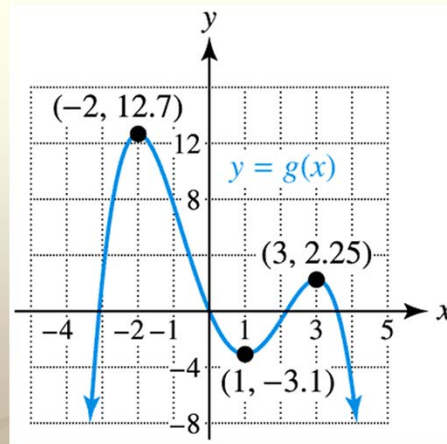
$f(c)$ is a **local (relative) minimum** if $f(c) \leq f(x)$ when x is near c .

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From *Precalculus with Modeling and Visualization* 3rd ed. by Rockswold, 2006, p.245

Absolute and Local Extrema

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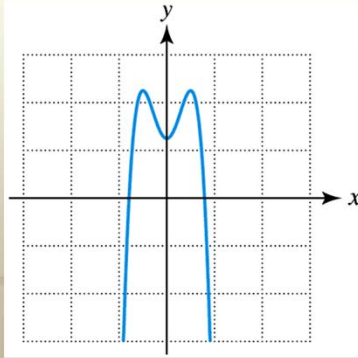
From *Precalculus with Modeling and Visualization* 3rd ed. by Rockswold, 2006, p.245

Even Function

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EVEN FUNCTION

A function f is an **even function** if $f(-x) = f(x)$ for every x in its domain. The graph of an even function is symmetric with respect to the y -axis.



From *Precalculus with Modeling and Visualization* 3rd ed. by Rockswold, 2006, p.247

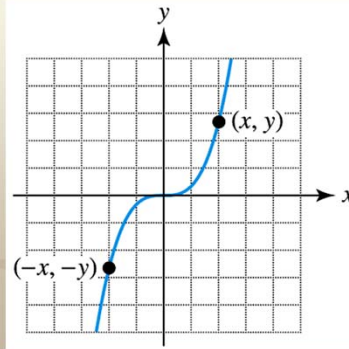
Odd Function

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ODD FUNCTION

A function f is an **odd function** if $f(-x) = -f(x)$ for every x in its domain. The graph of an odd function is symmetric with respect to the origin.



From *Precalculus with Modeling and Visualization* 3rd ed. by Rockswold, 2006, p.248

Examples

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Determine if the function is even, odd, or neither.

a. $f(x) = x^4 - 5x^2 + 2$

b. $g(x) = x^3 - 2x^2 + 5$

c. $h(x) = x^3 - 3x + 1$

d. $k(x) = \frac{1}{x} + 5$

e. graphically

