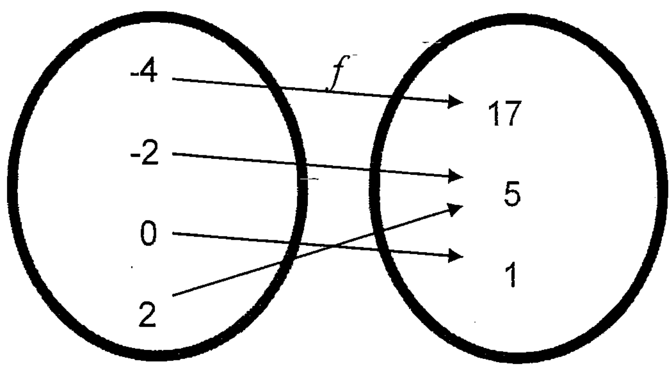
1.2 FUNCTIONS AND THEIR PROPERTIES (Part 1)

Function, Domain, and Range

A **function** consists of

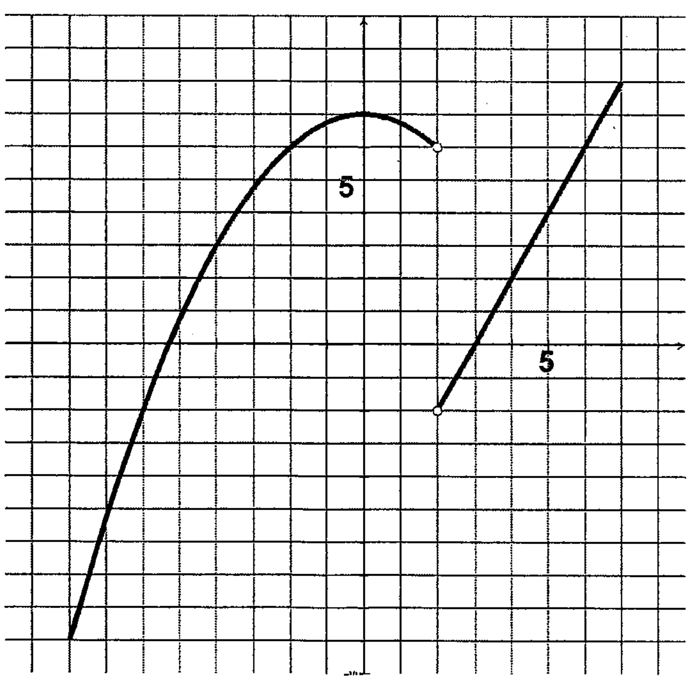
- a set of inputs, called the **domain**
- a rule by which each input determines one and only one output
- set of outputs, called the **range**



Domain
$\{-4, -2, 0, 2\}$

Range
$\{17, 5, 1\}$

Determining Domain and Range on a Graph



Domain

____

Range

____

Finding the Domain of a Function Algebraically

Restrictions on the Domain

- **Don't divide by zero**
- **Don't take an even root of a negative number**
- **Don't take a log of zero or a negative number**

Examples

1. $f(x) = \sqrt{x+3}$

2. $f(x) = \dfrac{x^2 - 2x}{2x^2 - x - 6}$

3. $f(x) = \ln(x-5)$

4. $f(x) = \dfrac{\sqrt{x+1}}{x-5}$

5. $f(x) = \dfrac{1}{\sqrt{x^2 - 9}}$

Local Extremes

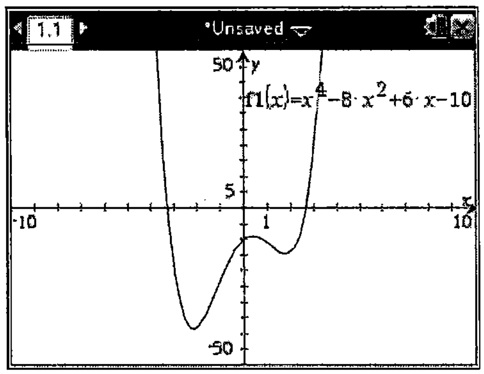
A <u>local</u> <u>maximum</u> (or relative maximum) of a function f is a value $f(c)$ that is greater than or equal to all values in the range of f on some open interval containing c.

A <u>local</u> <u>minimum</u> (or relative minimum) of a function f is a value $f(c)$ that is less than or equal to all values in the range of f on some open interval containing c.

The best method for identifying extreme values of a function involves using Calculus. In Precalculus, we will approximate the local extrema using the graphing calculator.

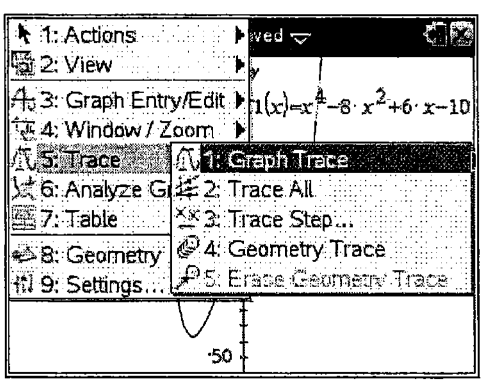
Example: Find the local extreme values of $f(x)=x^4-8x^2+6x-10$.

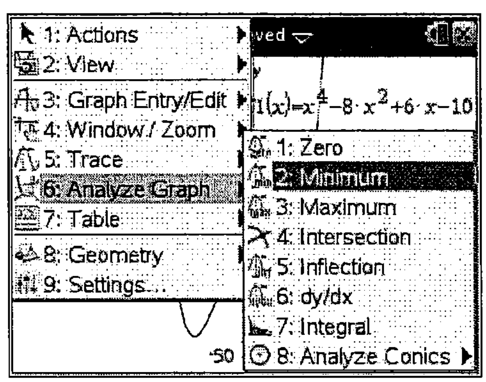
Graph the function using a window that shows a complete graph.

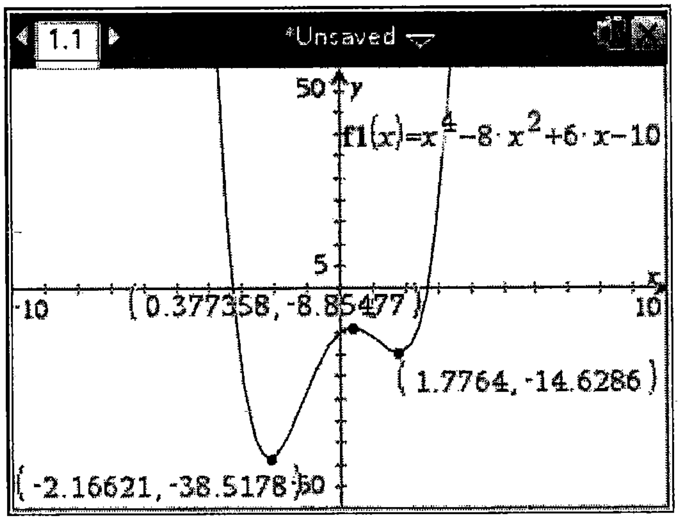


To locate the local extremes, select

Menu/**Trace**/Graph Trace or Menu/**Analyze Graph**/Minimum







$f(x)$ has a **local minimum** at ______________ and ________________.

The **absolute minimum value** of $f(x)$ is ________________.

$f(x)$ has a **local maximum** at ______________.

$f(x)$ does not have an absolute maximum value.

$f(x)$ is **decreasing** on ___________________ and ___________________.

$f(x)$ is **increasing** on ___________________ and ___________________.

Algebraic Test for Even or Odd Functions

1. Find $f(-x)$ and simplify.
2. Compare $f(-x)$ with $f(x)$.
3. If $f(-x)=f(x)$, then $f(x)$ is **even**;
   If $f(-x)=-f(x)$, then $f(x)$ is **odd**.

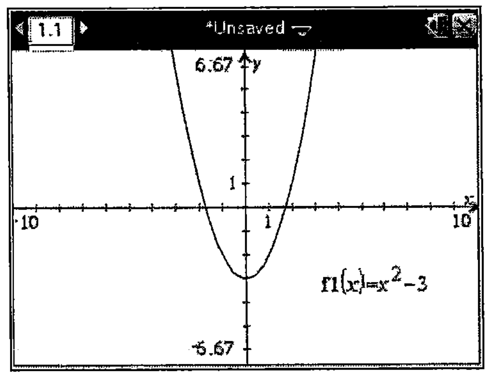
Even Functions and Symmetry

Algebraically: A function $f(x)$ is an **even** function if $f(-x)=f(x)$.

Graphically: An **even** function has symmetry with respect to the ***y*-axis**.

equal → ***even*** → ***y-axis***

Example: $f(x)=x^2-3$



Odd Functions and Symmetry

Algebraically: A function $f(x)$ is an **odd** function if $f(-x)=-f(x)$.

Graphically: An **odd** function has symmetry with respect to the **origin**.

opposites → ***odd*** → ***origin***

Example: $f(x)=\dfrac{x^3}{4-x^2}$