1.4 Graphs of Functions

EXAMPLE 1  For what intervals is the following function increasing, decreasing or constant? Locate and identify any relative extrema. Give the domain and range in interval notation.
1.4 Graphs of Functions

EXAMPLE 2  For what intervals is the following function increasing, decreasing or constant? Locate and identify any relative extrema. Give the domain and range in interval notation.

\[ f(x) = |x + 1| + |x - 1| \]
Increasing on:

Decreasing on:

Constant on:

Relative Maxima:

Relative Minima:

Domain:

Range:
1.4 Graphs of Functions

EXAMPLE 3  For what intervals is the following function increasing, decreasing or constant? Locate and identify any relative extrema. Give the domain and range in interval notation.

\[ f(x) = \begin{cases} 
  x + 2 & \text{if } x \leq 0 \\
  3 & \text{if } 0 < x < 3 \\
  8x - x^2 - 8 & \text{if } x \geq 3 
\end{cases} \]
Increasing on:

Decreasing on:

Constant on:

Relative Maxima:

Relative Minima:

Domain:

Range:
1.4 The greatest integer function

EXAMPLE 4 Suppose that the cost of sending an overnight package from New York to Atlanta is $9.80 for any package weighing under one pound and $2.50 for each pound or portion of a pound. Use the greatest integer function to create a model for the cost $C$ of overnight delivery of a package weighing $x$ pounds. Sketch a graph.
\[ f(x) = \begin{cases} 
2x + 3 & x < 0 \\
3 - x & x \geq 0 
\end{cases} \]
\[ g(x) = \begin{cases} 
\ x + 5 & \text{if } x \leq -3 \\
\ -2 & \text{if } -3 < x < 1 \\
\ x^4 & \text{if } x \geq 1 
\end{cases} \]
1.4 Even vs Odd Functions

**EVEN**

\[ y = x^2 \]

Symmetric about y-axis

**ODD**

\[ y = x^3 \]

Symmetric about origin

To see if function is odd or even, neither

\[ f(-x) = \begin{cases} f(x) & \text{even} \\ -f(x) & \text{odd} \end{cases} \]

\[ f(x) = x^2 \]

\[ f(-x) = (-x)^2 = x^2 = f(x) \]

\[ f(x) = x^3 \]

\[ f(-x) = (-x)^3 = -x^3 = -f(x) \]
\[ f(t) = t^2 + 2t - 3 \]
\[ f(-t) = (-t)^2 + 2(-t) - 3 \]
\[ = t^2 - 2t - 3 \]

Neither

\[ g(x) = x^3 - 5x \]
\[ g(-x) = (-x)^3 - 5(-x) \]
\[ = -x^3 + 5x \]

Odd
$f(x)$

Inverse
EXAMPLE 5

Determine whether the following functions are even, odd or neither.

(a) \( f(x) = x^3 - 5x \)
   \[ f(-x) = (-x)^3 - 5(-x) = -x^3 + 5x \] odd

(b) \( f(x) = x^3 + 2x^2 \)
   \[ f(-x) = (-x)^3 + 2(-x)^2 = -x^3 + 2x^2 \] neither

(c) \( f(x) = 2x^2 - 5 \)
   \[ f(-x) = 2(-x)^2 - 5 = 2x^2 - 5 \] even

(d) \( f(x) = x^2 - 0.02x + 3.0001 \)
   neither