A family of functions is a group of functions with graphs that display one or more similar characteristics.

A Parent Function is the simplest function in a family of functions that is transformed to create other members in that family of functions.

8 of the most commonly used parent functions:

- **Constant function**: $f(x) = \#$
- **Identity function**: $f(x) = x$
- **Quadratic function**: $f(x) = x^2$
- **Cubic function**: $f(x) = x^3$
- **Square root function**: $f(x) = \sqrt{x}$
- **Reciprocal function**: $f(x) = 1/x$
- **Absolute value function**: $f(x) = |x|$
- **Greatest Integer function**: $f(x) = [x]$
Each of these parent functions has its own set of characteristics.

For example: \( f(x) = \sqrt{x} \)

- **Domain:** \([0, \infty)\)
- **Range:** \([0, \infty)\)
- **x-intercept:** 0
- **y-intercept:** 0
- **Symmetry:** None
- **Continuity:** It is continuous for all values in its domain
- **Limit:** \(\lim_{x \to \infty} f(x) = \infty\)
- **Behavior:** Increasing on the interval \((0, \infty)\)

Describe the characteristics of \( f(x) = |x| \)

- **Domain:** \(\mathbb{R} \cup (-\infty, \infty)\)
- **Range:** \(\{y | y \geq 0\} \cup [0, \infty)\)
- **x-intercept:** 0
- **y-intercept:** 0
- **Symmetry:** about the y-axis
- **Continuity:** yes
- **Limit:** \(\lim_{x \to \infty} f(x) = \infty\) \(\lim_{x \to -\infty} f(x) = \infty\)
- **Behavior:**
  - **Dec:** \((-\infty, 0)\)
  - **Inc:** \((0, \infty)\)
Parent functions can be transformed to create other members in a family of graphs.

(3 kinds of transformations: Translations, Reflections, Dilations)

**Transformations:** affect the appearance of the parent graph.

<table>
<thead>
<tr>
<th>Rigid Transformations:</th>
<th>Nonrigid Transformations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>change only the position of the graph. It leaves the size and shape unchanged.</td>
<td>distort the shape of the graph.</td>
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Ex

<table>
<thead>
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<td>parent</td>
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**Info on Transformations:**

<table>
<thead>
<tr>
<th>Translations</th>
<th>Reflections</th>
<th>Dilations</th>
</tr>
</thead>
<tbody>
<tr>
<td>$g(x) = f(x) + k$ is the graph of $f(x)$ translated... $k$ units up when $k &gt; 0$</td>
<td>$g(x) = -f(x)$ is the graph of $f(x)...$ ...reflected in the x-axis</td>
<td>$g(x) = a \times f(x)$ is the graph of $f(x)...$ ...expanded vertically if $a &gt; 1$</td>
</tr>
<tr>
<td>$\Rightarrow x + f$</td>
<td>$g(x) = f(-x)$ is the graph of $f(x)...$ ...reflected in the y-axis</td>
<td>$g(x) = f(ax)$ is the graph of $f(x)...$ ...compressed horizontally if $a &gt; 1$</td>
</tr>
<tr>
<td>$\Rightarrow x - u$</td>
<td>$h$ units right when $h &gt; 0$</td>
<td>$h$ units left when $h &lt; 0$</td>
</tr>
<tr>
<td>$h$ units right when $h &gt; 0$</td>
<td>$\left{x - 4\right}$</td>
<td>$\left{x + 4\right}$</td>
</tr>
</tbody>
</table>
Translations: a rigid transformation that shifts the graph of a function

Vertical translation: shifts the graph up or down
Horizontal translation: shifts the graph left or right

Vertical translation: the graph of \( f(x) \) translated
*up \( k \) units when \( k > 0 \)
*down \( k \) units when \( k < 0 \)

Horizontal translation: the graph of \( f(x) \) translated
*right \( h \) units when \( h > 0 \)
*left \( h \) units when \( h < 0 \)

Use the graph of \( f(x) = |x| \) to graph each function.

a.) \( g(x) = |x| + 4 \)

b.) \( h(x) = |x + 3| \)

c.) \( j(x) = |x - 2| - 1 \)
Reflection: a type of rigid transformation that produces a mirror image of the graph with respect to a given line.

Ex: $f(x)$

\[ g(x) = -f(x) \]

(Reflected in the x-axis)

Ex: $f(x)$

\[ g(x) = f(-x) \]

Reflected in the y-axis

A dilation is a nonrigid transformation that compresses or expands the graphs of functions vertically or horizontally.
A(n) ________________ translation is a rigid transformation that has the effect of shifting the graph of a function up, down, left, or right.

A(n) ________________ parent function is the simplest of the functions in a family.

A(n) ________________ reflection is a rigid transformation which produces a mirror image of the graph of a function with respect to a specific line.

The ________________ identity function f(x) = x passes through all points with coordinates (a,a).

A(n) ________________ transformations of a parent function affects the appearance of the parent graph.

The ________________ absolute value function, denoted as f(x) = |x|, is a V-shaped function.

Identify the parent function.

![Graphs of functions](image)

Abs value  Cube  Reciprocal

Define the three different transformations discussed

Translation: ________________ rigid transformation that shifts a graph up/down, left/right

Reflection: ________________ type of rigid transformation that produces a mirror image

Dilation: ________________ non-rigid transformation that compresses or expands