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

**The Parent Function** is the simplest function with the defining characteristics of the family. Functions in the same family are transformations of their parent functions.

|  |  |  |
| --- | --- | --- |
| **Family - Constant Function** | **Family - Linear Function** | **Family - Quadratic Function** |
| **Graph** | **Graph** | **Graph** |
| **Rule**  **Domain**  **Range** | **Rule**  **Domain**  **Range** | **Rule**  **Domain**  **Range** |
| **Family - Cubic Function** | **Family - Square Root Function** | **Family - Reciprocal Function** |
| **Graph** | **Graph** | **Graph** |
| **Rule**  **Domain**  **Range** | **Rule**  **Domain**  **Range** | **Rule**  **Domain**  **Range** |

|  |  |
| --- | --- |
| **Family – Absolut Value Function** | **Family -**  **Greatest Integer Function** |
| **Graph** | **Graph** |
| **Rule**  **Domain**  **Range** | **Rule**  **Domain**  **Range** |

***Transformations***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Transformations***  A change in the size or position of a figure or graph of the function is called a transformation. | | | | |
| ***Rigid transformations*** change only the position of the graph, leaving the size and shape unchanged. | | | | |
|  | **Appearance in Function** | **Transformation of Graph** | **Transformation of Point** | |
| ***Vertical Translations*** |  |  |  | |
| ***Horizontal Translations*** |  |  |  | |
| ***Reflections in x-axes*** |  |  |  | |
| ***Reflections in y-axes*** |  |  |  | |
| ***Non rigid transformations*** distort the shape of the graph. | | | | |
|  | **Appearance in Function** | **Transformation of Graph** | | **Transformation of Point** |
| ***Vertical***  ***Dilations*** |  |  | |  |
| ***Horizontal***  ***Dilations*** |  |  | |  |

**Sample Problem 1: Identify the parent function and describe the transformations.**

|  |  |  |
| --- | --- | --- |
| **a.** |  | **Parent :**  **Transformation:**  Translation 1 unit right |
| **b.** |  | **Parent :**  **Transformation:**  Translation 5 units down |
| **c.** |  | **Parent :**  **Transformation:**  Reflection in x-axis  Translation 4 units left |
| **d.** |  | **Parent :**  **Transformation:**  Expand vertically by a factor of 3  Translation 7 units up |

**Sample Problem 2**: **Given the parent function and a description of the transformation, write the equation of the transformed function .**

|  |  |  |
| --- | --- | --- |
| **a.** | **Quadratic** - **expanded horizontally by a factor of 2, translated 7 units up.** |  |
| **b.** | **Cubic - reflected over the x axis and translated 9 units down.** |  |
| **c.** | **Absolute value - translated 3 units up, translated 8 units right.** |  |
| **d.** | **Reciprocal -** **translated 1 unit up.** |  |

**Sample Problem 3:**  **Use the graph of parent function to graph each function. Find the domain and the range of the new function.**

|  |  |  |  |
| --- | --- | --- | --- |
| **a.** |  |  |  |
|  | **Parent function**  **Transformation:**  Expand vertically by a factor of 2  Translated 2 units down  Translated 3 units right |  |  |
| **b.** |  |  |  |
|  | **Parent function**    **Transformation:**  Translated 3 units up  Translated 5 units right |  |  |
| **c.** |  |  |  |
|  | **Parent function**    **Transformation:**  Reflected in the x axis  Translated 1 unit down  Translated 4 units left |  |  |

**Transformations with Absolute Value**

This transformation reflects any portion of the graph of that is below the -axis so that it is above the -axis.

This transformation results, in the portion of the graph of that is to the left of the -axis, being replaced by a reflection of the portion to the right of the -axis.

**Sample Problem 4:**  **Graph each function.**

|  |  |  |  |
| --- | --- | --- | --- |
| **a.** |  |  |  |
|  |  |  |  |
| **b.** |  |  |  |
|  |  |  |  |

**Graph a Piecewise-Defined Function**

**Sample Problem 5:**  **Graph each piecewise function.**

|  |  |  |
| --- | --- | --- |
| **a.** |  |  |
| **b.** |  |  |