Intro to Functions

Anna Denisova

2023

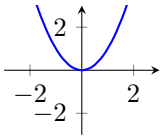
Contents

1 Function Definitions

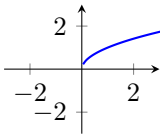
2 Function Notation

3 Parent Functions

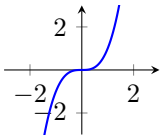
Quadratic Function
$y = x^2$
Key Points = {(-2,4), (-1,1), (0,0), (1,1), (2,4)}
Domain = $\{\mathbb{R}\}$
Range = $\{y \epsilon \mathbb{R} | y \geq 0\}$



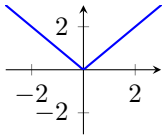
Root Function
$y = \sqrt{x}$
Key Points = {(0,0), (1,1), (4,2), (9,3)}
Domain = $\{x \epsilon \mathbb{R} | x \geq 0\}$
Range = $\{y \epsilon \mathbb{R} | y \geq 0\}$



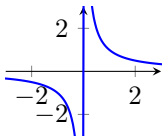
Cubic Function
$y = x^3$
Key Points = {(-2,-8), (-1,-1), (0,0), (1,1), (2,8)}
Domain = $\{\mathbb{R}\}$
Range = $\{\mathbb{R}\}$



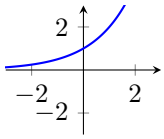
Absolute Value Function
$y = |x|$
Key Points = {(-2,2), (-1,1), (0,0), (1,1), (2,2)}
Domain = $\{\mathbb{R}\}$
Range = $\{y \epsilon \mathbb{R} | y \geq 0\}$



Reciprocal Function
$y = \frac{1}{x}$
Key Points = {(-2,-$\frac{1}{2}$), (-1,-1), (-$\frac{1}{2}$,-2), ($\frac{1}{2}$,2), (1,1), (2,$\frac{1}{2}$)}
Domain = $\{ x \epsilon \mathbb{R} | x \neq 0\}$
Range = $\{ y \epsilon \mathbb{R} | y \neq 0\}$



Exponential Function
$y = 2^x$
Key Points = {(-2, 1/4), (-1, 1/2), (0,1), (1,2), (2,4)}
Domain = $\{\mathbb{R}\}$
Range = $\{ y \epsilon \mathbb{R} | y > 0\}$



4 Domain and Range

5 The Inverse Function

6 Transformations

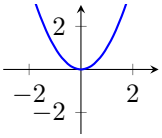
$$y = af(k(x - d)) + c$$

Where:

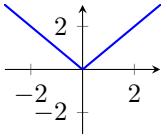
- a and c affect the y-coordinate
- k and d affect the x-coordinate

Functions

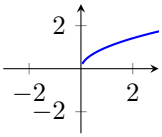
Quadratic Function
$y = x^2$
$y = a(k(x - d))^2 + c$



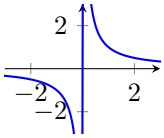
Absolute Value Function
$y = |x|$
$y = a|k(x - d)| + c$



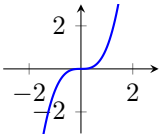
Root Function
$y = \sqrt{x}$
$y = a\sqrt{k(x - d)} + c$



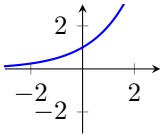
Reciprocal Function
$y = \frac{1}{x}$
$y = \frac{a}{k(x-d)} + c$



Cubic Function
$y = x^3$
$y = a(k(x - d))^3 + c$



Exponential Function
$y = 2^x$
$y = a2^{k(x-d)} + c$



Effects of Letters

a:

`0 < |a| < 1`

Vertical compression by a factor of $|a|$
Multiply y values by $|a|$

`|a| > 1`

Vertical stretch by a factor of $|a|$
Multiply y values by $|a|$

`a < 0`

Reflection over the x-axis
Multiply y values by -1

k:

`0 < |k| < 1`

Horizontal stretch by a factor of $\frac{1}{|k|}$
Multiply x values by $\frac{1}{|k|}$

`|k| > 1`

Horizontal compression by $\frac{1}{|k|}$
Multiply x values by $\frac{1}{|k|}$

`k<0`

Reflection over the y-axis
Multiply x values by -1

c:

`c > 0`

Shift up c units
Add c to y values

`c < 0`

Shift down c units
Add c to y values

d:

`d > 0`

Shift right d units
Add d to x values

`d < 0`

Shift left d units
Add d to x values

Notes:
- k must be factored out in order to determine the value of d
- The order to complete transformations is:

```
1) Stretch/Compress
2) Reflect
3) Shift
```