

# 1 Intro to Functions

## 1.1 Transformations

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

Where:

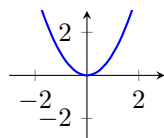
- a and c affect the y-coordinate
- k and d affect the x-coordinate

### Functions

Quadratic Function

$$y = x^2$$

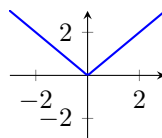
$$y = a(k(x - d))^2 + c$$



Absolute Value Function

$$y = |x|$$

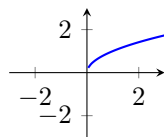
$$y = a|k(x - d)| + c$$



Root Function

$$y = \sqrt{x}$$

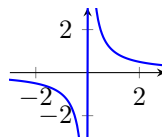
$$y = a\sqrt{k(x - d)} + c$$



Reciprocal Function

$$y = \frac{1}{x}$$

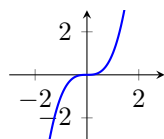
$$y = \frac{a}{k(x - d)} + c$$



Cubic Function

$$y = x^3$$

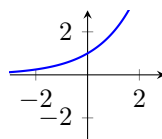
$$y = a(k(x - d))^3 + c$$



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

c:

$$c > 0$$

Shift up c units  
Add c to y values

$$c < 0$$

Shift down c units  
Add c to y values

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

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**