

Objectives for Section 1.6

1. To be able to identify the location of a , d and c in a function.
2. To understand how a , d and c affect the function graphically and in terms of its coordinates.
2. To be able to describe in words how a function has transformed in terms of a , d and c .
3. To have t-tables (starting points) for parent functions.

1.6 - Exploring Transformations of Parent Functions

The function defined by $g(x) = af(x - d) + c$ describes a transformation of the graph f .

When $f(x) = x^2$,

$$g(x) = a(x - d)^2 + c.$$

When $f(x) = \sqrt{x}$,

$$g(x) = a\sqrt{x - d} + c.$$

When $f(x) = \frac{1}{x}$,

$$g(x) = \frac{a}{x - d} + c.$$

When $f(x) = |x|$,

$$g(x) = a|x - d| + c.$$

Transformation can be applied to the parent function following the order of operations:

$a > 1$ stretch $0 < a < 1$ compress $a < 0$ reflection

1. Vertical stretches/compressions/reflections (a) - which you **multiply** the y-coordinate.
always move the opposite direction it looks like
2. Horizontal translations (d) - which you **add/subtract** the opposite to the x-coordinate.
3. Vertical translations (c) - which you **add/subtract** to the y-coordinate.

t- Tables for Parent Functions

Quadratic Function

$$f(x) = x^2$$

x	y
-2	4
-1	1
0	0
1	1
2	4

Square Root Function

$$f(x) = \sqrt{x}$$

x	y
0	0
1	1
4	2
9	3

Absolute Function

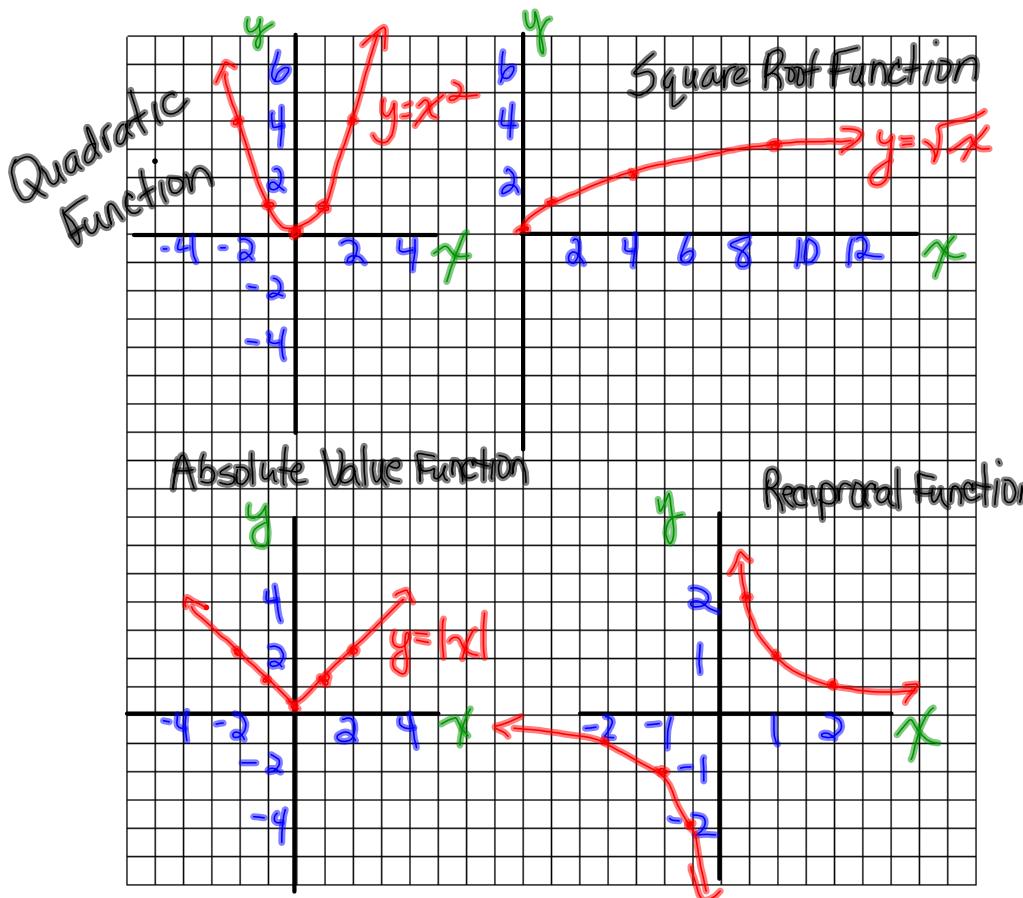
$$f(x) = |x|$$

x	y
-2	2
-1	1
0	0
1	1
2	2

Reciprocal Function

$$f(x) = \frac{1}{x}$$

x	y
2	0.5
1	1
0.5	2
-0.5	-2
-1	-1
-2	-0.5

The Quadratic Function

$f(x) = 3x^2$

$f(x) = x^2$	$a = 3$
(-2, 4)	(-2, 12)
(-1, 1)	(-1, 3)
(0, 0)	(0, 0)
(1, 1)	(1, 3)
(2, 4)	(2, 12)

Stretched by a factor of 3.

$f(x) = \frac{1}{2}x^2$

$f(x) = x^2$	$a = 0.5$
(-2, 4)	(-2, 2)
(-1, 1)	(-1, 0.5)
(0, 0)	(0, 0)
(1, 1)	(1, 0.5)
(2, 4)	(2, 2)

Compressed by a factor of $\frac{1}{2}$.

$f(x) = -2x^2$

$f(x) = x^2$	$a = -2$
(-2, 4)	(-2, -8)
(-1, 1)	(-1, -2)
(0, 0)	(0, 0)
(1, 1)	(1, -2)
(2, 4)	(2, -8)

Reflected in x-axis
stretched by a factor of 2.

$f(x) = 3x^2 - 1$

$f(x) = x^2$	$a = 3$
(-2, 4)	(-2, 11)
(-1, 1)	(-1, 2)
(0, 0)	(0, -1)
(1, 1)	(1, 2)
(2, 4)	(2, 11)

stretched by a factor of 3
Translated 1 unit down.

$f(x) = 3(x - 2)^2 + 2$

$f(x) = x^2$	$a = 3$
(-2, 4)	(-2, 12)
(-1, 1)	(-1, 3)
(0, 0)	(0, 0)
(1, 1)	(1, 3)

stretched by a factor of 3
Translated 2 units to the right.

Complete: p. 51 #1 - 3