parabolas

Basic Shape: ∪
important info: vertex (h, k)

Standard form (readable)

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

vertex $= (h, k)$

general form (not readable)

$y = ax^2 + bx + c$

$h = \frac{-b}{2a}$

$k =$ plug h (the x value) into original equation

a (for both cases)

"a" gives 2 categories of information

sign of a ← ① parabola opens up or down (reflection)

size of $|a|$ ← ② parabola is wide, narrow or standard (compressed) (stretched)

If $a > 0$ (+) opens up
$a < 0$ (−) opens down ↔ reflected across x-axis

If $0 < |a| < 1$ "wide" or compressed
$|a| = 1$ "standard"
$|a| > 1$ "narrow" or stretched

Note The general form can be converted to the standard form using completing the square

Graphing Other Functions

Basic Shapes

$y = x$ 

$y = x^2$ 

$y = x^3$ 

$y = \sqrt{x}$ 

$x = y^2$

$x = y^3$ 

$y = |x|$ 

$y = x^4$ 

$y = -x^3$ 

When graphing, think about the symmetry, the central point, and the orientation of the graph.
(up/down wns)

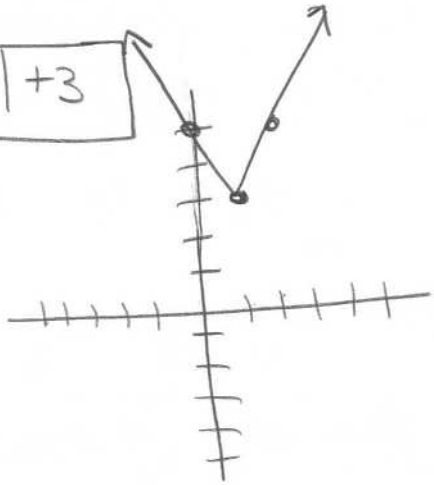
Example 1 — Graph $y = 2|x-1|+3$

Basic shape: 

"vertex" = (1, 3)

$a = 2$ + up, 2 narrow (stretched)

x	y
-1	
0	5
1	3
2	5
3	



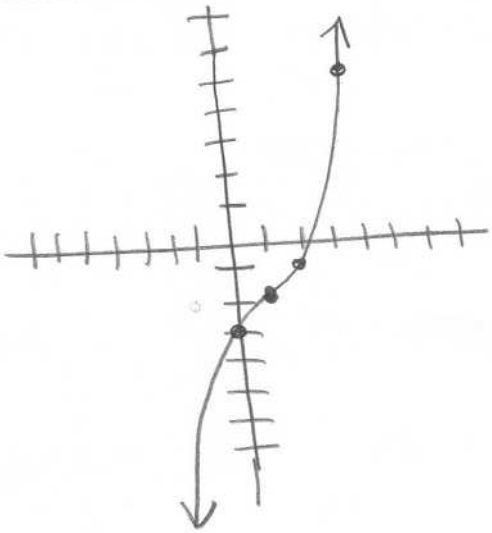
Example 2 — Graph $y = (x-1)^3 - 2$

Basic shape: 

"vertex" = (1, -2)

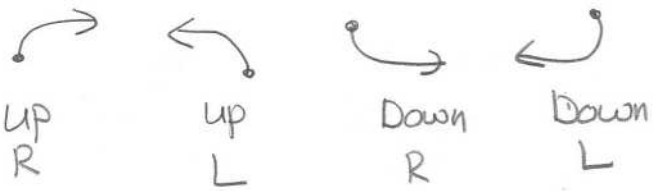
$a = 1$ + up, 1 standard

x	y
-1	-10
0	-3
1	-2
2	-1
3	6



All about $y = \sqrt{x}$

4 possible orientations



$$y = a\sqrt{x-h} + k$$

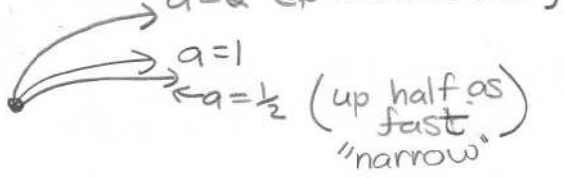
a

up (+)
down (−)

x

$+x \Rightarrow R$
$-x \Rightarrow L$

The stretched and compressed is actually "opposite" to that of a $y = x^2$ type parabola



Example 1

$$y = -2\sqrt{x-3} + 5$$

basic shape:

"vertex": (3,5)

$a = -2$ down. looks stretched (wide)

$x = +$ R

x	y
2	$\sqrt{-1}$ = DNE
3	5
4	3
5	$-2\sqrt{2} + 5$
6	$-2\sqrt{3} + 5$
7	$-2\sqrt{4} + 5 = 1$
12	−1

nice points

$x - 3 = 0$

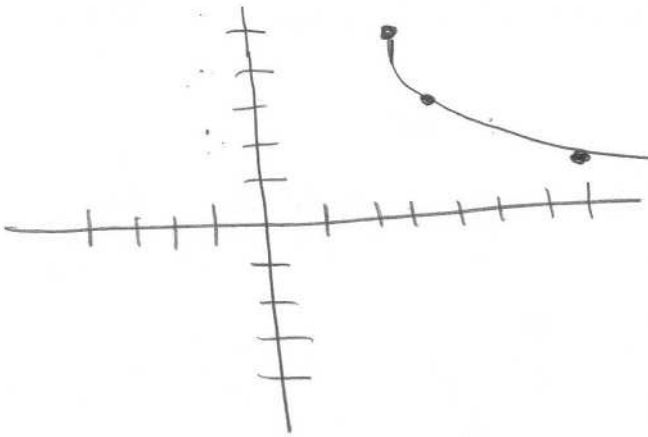
$x - 3 = 1$

$x - 3 = 4$

$x - 3 = 9$

$x - 3 = 16$

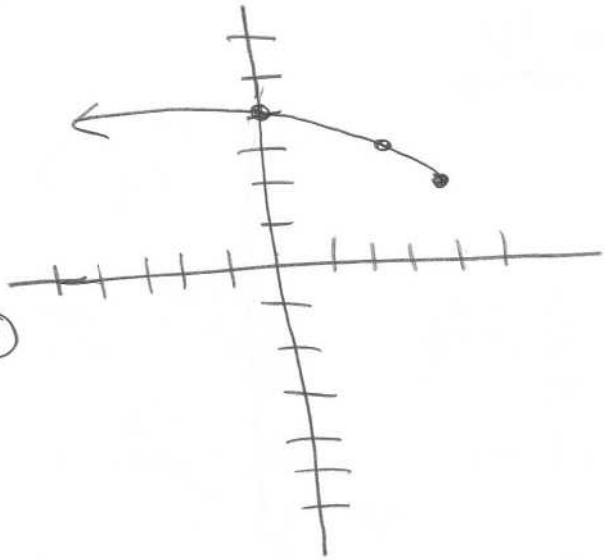
etc



Example 2 Graph $y = \sqrt{4-x} + 2$

basic shape: ↪
"vertex": (4, 2)
$a = 1$ up
5
$x = -$ Left

x	y
0	$2+2=4$
3	$1+2=3$
4	2
5	$\sqrt{-1}+2$ DNE



$4-x=0 \Rightarrow 4$
$4-x=1 \Rightarrow 3$
$4-x=4 \Rightarrow 0$

Recall for vertex: $4-x=0$
$4=x$ not -4

Example 3 Graph $y = -\sqrt{-x+2} - 1$

basic shape: ↪
"vertex" = (2, −1)
$a = -1$ down (+)
standard (1)
$x \to -$ opens L

only has points going in 1 direction!
no symmetry for this one

x	y
−2	−3
1	$-\sqrt{1}-1=-2$
2	−1
3	$\sqrt{-1}$ = DNE

$-x+2=0$
$-x=-2$
$x=2$

$-x+2=1$
$-x=-1$
$x=1$

$-x+2=4$
$-x=2$
$x=-2$