Section 3.3: Analyzing Graphs of Quadratic Functions

Friday, January 23, 2015
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Assign 2 due on:
Tues, Feb 3

Quiz 2 on: Thurs, Feb 5

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consider the parabola in the form:

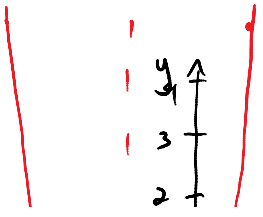
$$f(x) = a(x-h)^2 + k$$

it is just the graph of $y = x^2$ but

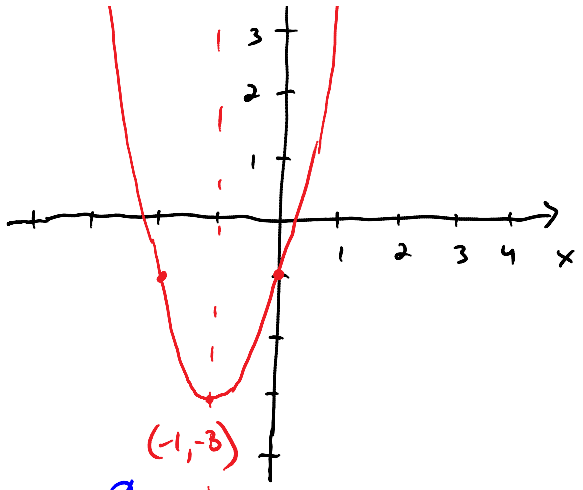
1. shifted up by k units
2. shifted right by h units
3. stretched by a factor of $|a|$
   (if $|a| < 1$, then parabola is shallower, and if $|a| > 1$, steeper)
4. if $a < 0$ (a is negative), then also opens downwards (flipped over the x-axis)

example: sketch $f(x) = 2(x+1)^2 - 3$

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



vertex:



vertex:
$(h, k) = (-1, -3)$

flipped over x? no

$f(0) = -1$
$f(1) = 5$

max or min?

min

← axis of symmetry
$x = -1$

domain: $\mathbb{R}$

range: $[-3, \infty)$
or $\{y \mid y \geq -3\}$

note on set-builder notation

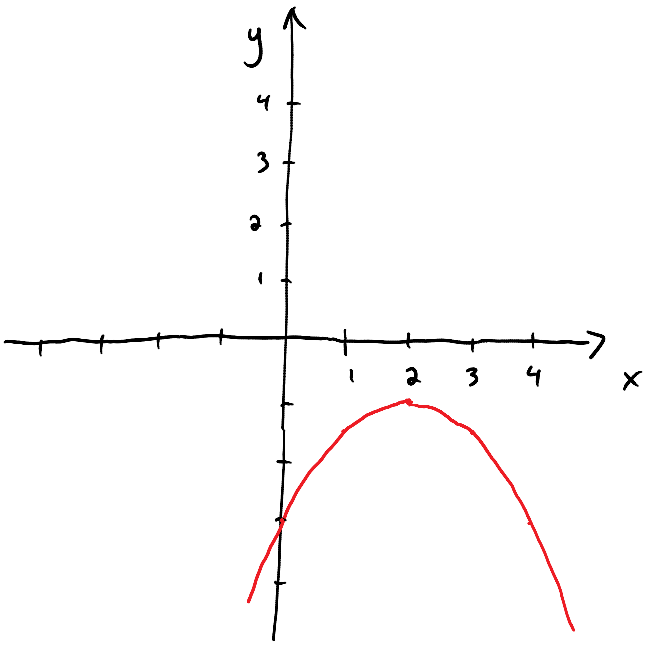
$\mathbb{Q}$ = set of rational numbers

$= \left\{ \frac{a}{b} \mid a \text{ and } b \text{ are integers and } b \neq 0 \right\}$

straight lines: $\{(x, y) \mid x + 3y = 7\}$

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

example: sketch $f(x) = -\frac{1}{2}(x-2)^2 - 1$
and state the vertex, the axis of symmetry, whether the vertex is a maximum or minimum, and also give the range.



vertex:
$(h, k) = (2, -1)$

axis of symmetry:
$x = 2$

vertex: max

range: $\{y \mid y \leq -1\}$

$(-\infty, -1]$

find the coordinates of the vertex for the parabola:

$$f(x) = x^2 + 6x + 2$$

$$= (x^2 + 6x + \underline{\quad 9 \quad}) + 2 - \underline{\quad 9 \quad}$$

↑ divide by two and square to get what goes in the first blank

$$= (x+3)^2 - 7$$

vertex: $(-3, -7)$

$$f(x) = x^2 - 7x - 11$$

$$= \left(x^2 - 7x + \underline{\quad \tfrac{49}{4} \quad}\right) - 11 - \underline{\quad \tfrac{49}{4} \quad}$$

$= a(-7/2)^2$

$= \left(x - \frac{7}{2}\right)^2 - \frac{44}{4} - \frac{49}{4}$

$= (x - 7/2)^2 - \frac{93}{4}$

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

vertex: $\left(\frac{7}{2}, -\frac{93}{4}\right)$

$f(x) = -3x^2 + 12x - 13$

$= -3(x^2 - 4x + \underline{4}) - 13 - \underline{(-3)(4)}$

$= -3(x-2)^2 - 13 + 12$

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

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

vertex: $(2, -1)$

nifty trick:

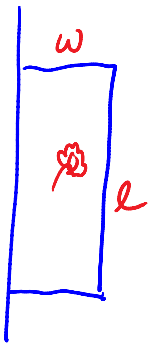
the x-coord of the vertex is at

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

then plug that x-value in to $f(x)$ to get the y-coord

rectangular

A fourth-grade class wants to fence in a garden, using the wall of the school as one of the sides of the garden. There is 14 m of fencing available. What is the maximum area the students can fence in?



$P = l + 2w$

$14 = l + 2w$

$l = 14 - 2w$

$A = lw$

$A = (14 - 2w)w$

$A = 14w - 2w^2$

this is a parabola