

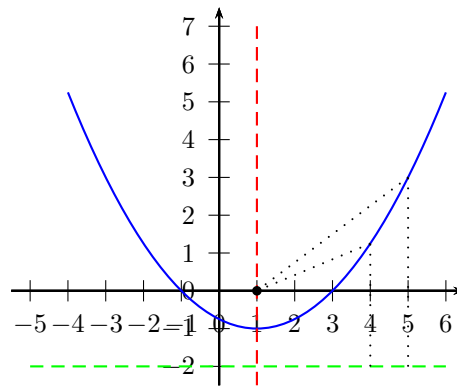
MATH 7: HANDOUT 20
COORDINATE GEOMETRY 4: PARABOLAS. ADDITION OF GRAPHS

PROPERTIES OF A PARABOLA

A parabola is the set of all points in a plane that are equally distant away from a given point and a given line (see black dotted lines).

This given point is called the **focus** (black dot) of the parabola and the line is called the **directrix** (green line).

If the parabola is of the form $(x-h)^2 = 4p(y-k)$, the vertex is (h,k) , the focus is $(h, k+p)$ and directrix is $y = k-p$



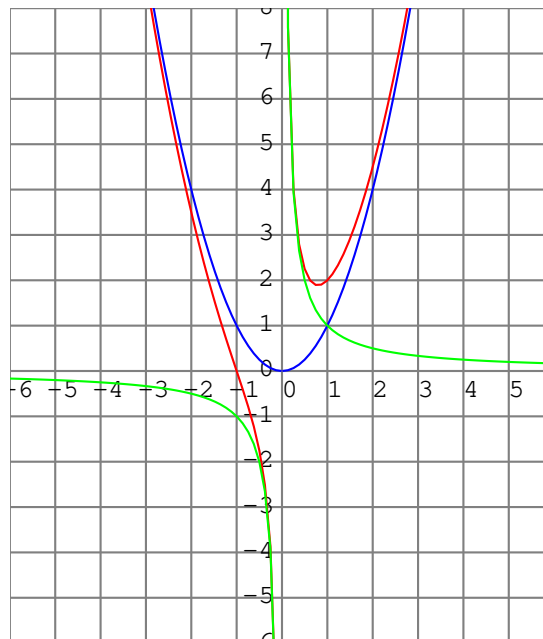
ADDING GRAPHS

Now that we know how to draw a lot of basic graphs and how to use transformations, we can draw more complicated graphs — that is, graphs that are we get by adding two functions.

For example, if we want to draw a graph of a function

$$y = x^2 + \frac{1}{x}$$

we can carefully examine graphs of $y = x^2$ (blue) and $y = 1/x$ (green), and then see what happens if one adds these two graphs (red).



HOMEWORK

1. Graph $x^2 = 4y$. What is the focus, directrix and vertex of the parabola?

2. Sketch the following functions:

(a) $y = |x| + |x + 1|$

(b) $y = |x - 1| + |x + 1|$

(c) $y = |x - 1| - |x + 1|$

(d) $|y| = x$

[Hint for this problem and the next one: Draw the graphs of each of the summands separately, and then try to add the graphs.]

3. Sketch the following functions:

(a) $y = x + \frac{1}{|x|}$

(b) $y = \sqrt{x} + \frac{1}{x}$

(c) $y = x - \frac{1}{x^2}$

*4. Find all intersection points of parabola $y = x^2$ and the circle with radius $\sqrt{6}$ and center at $(0, 4)$.

*5. Let A and B be points with coordinates (a, r) and (b, s) . Then let N be the point with coordinates $(b-a, s-r)$, and let O be the origin $(0, 0)$. Prove that $ON \cong AB$. (Hint: prove that $ABNO$ is a parallelogram by proving that its diagonals bisect each other.)