Pure Mathematics Year 1/AS

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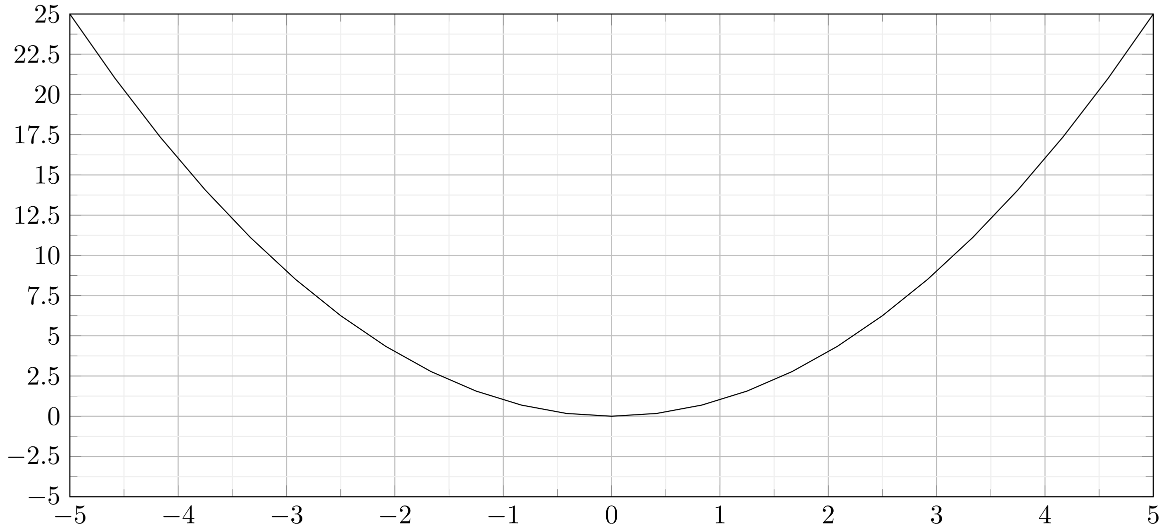
Contents

Part I

Graphs and Transformations

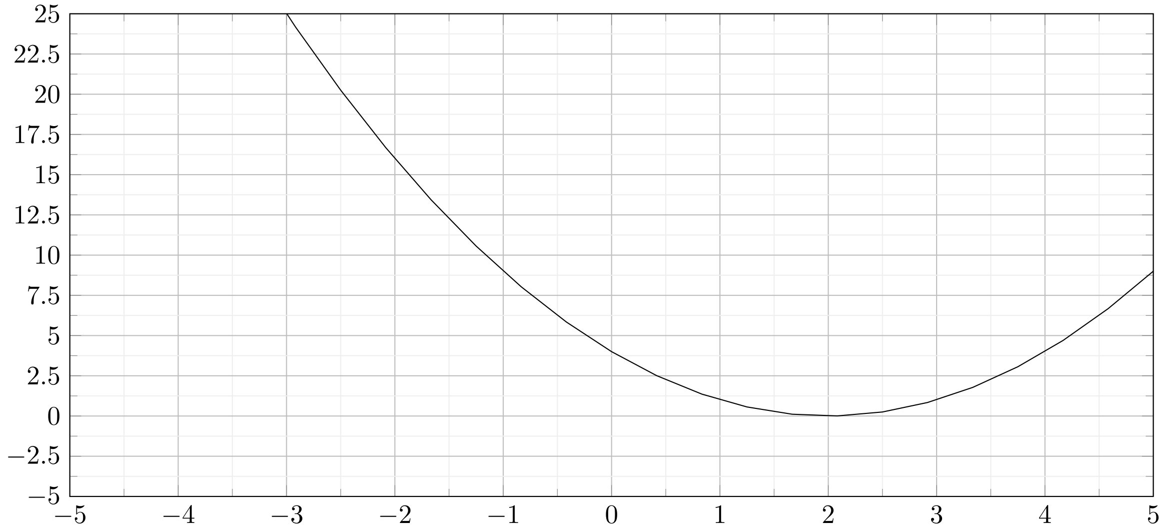
1 Transformations

The graph of $f(x)$, here as an example: $y = x^2$.

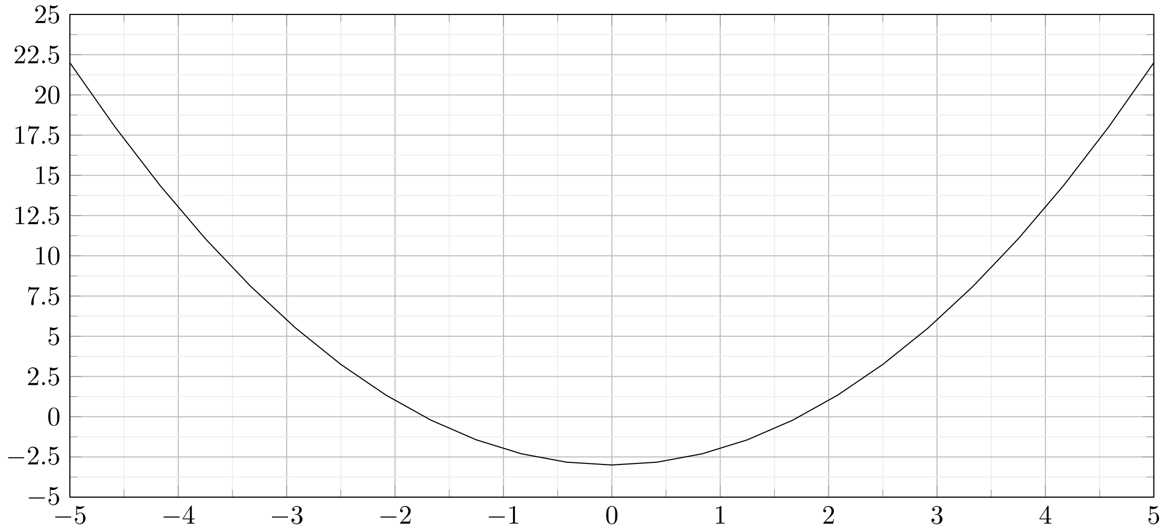


1.1 Translation

The graph of $f(x-a)$ is the graph of $f(x)$ translated right by a units. For example, if we want to move our graph 2 units right, then we can plot $y = (x-2)^2$.



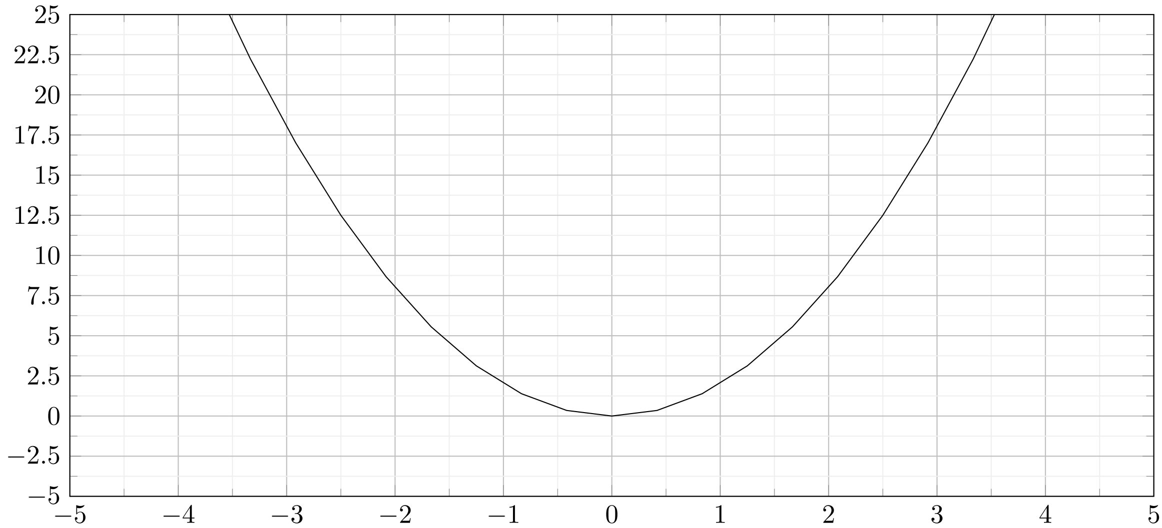
The graph of $f(x)+b$ is the graph of $f(x)$ translated upwards by b units. For example, if we want to move our graph 3 units down, then we can plot $y = x^2 - 3$.



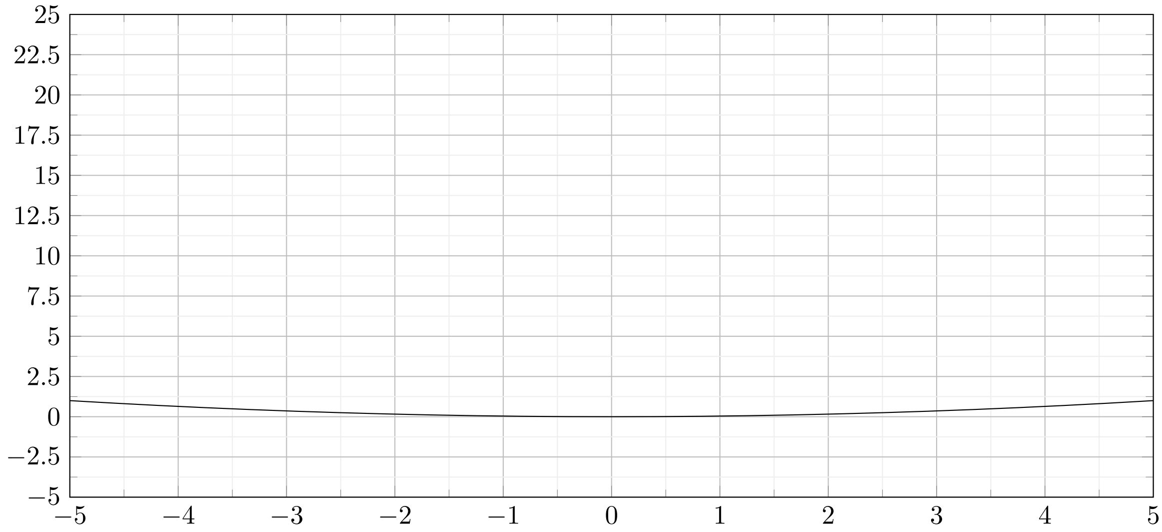
1.2 Scaling

(NB: Never say shrink - always say stretch by a factor e where $|e| < 1$)

The graph of $cf(x)$ is the graph of $f(x)$ stretched vertically by a factor of c. For example, if we want to stretch our graph by a factor of 2, then we can plot $y = 2 * x^2$.



The graph of $f(dx)$ is the graph of $f(x)$ stretched horizontally by a factor of d^{-1}. For example, if we want to stretch our graph by a factor of 5, then we can plot $y = (0.2 * x)^2$.



Example 1: Combining Transformations

$$y = cf(\frac{1}{a} * (x - b)) + d$$

This is obtained from $f(x)$ by doing the following:

1. Shift from the right b units.
2. Stretch horizontally by a factor of a.
3. Stretch vertically by a factor of c.
4. Shift upwards by d units.

Example 2: Combining Transformations

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

This is obtained from $f(x)$ by doing the following:

1. Flip horizontally.
2. Stretch horizontally by a factor of 0.5.