# simple-plot

Typst Package

*Mathematical Function Plotting*

A lightweight library for creating elegant mathematical plots
Version 0.2.6
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# Contents

1. Introduction ..... 3
  1.1. Features ..... 3
  1.2. Installation ..... 3
  1.3. Quick Start ..... 3
2. Basic Usage ..... 4
  2.1. Plotting Functions ..... 4
  2.2. Mathematical Functions Reference ..... 4
  2.3. Function Domain ..... 6
  2.4. Function Labels ..... 7
  2.5. Data Points and Scatter Plots ..... 7
3. Grid Options ..... 9
  3.1. Grid Modes ..... 9
  3.2. Minor Grid Subdivisions ..... 9
  3.3. Grid Label Break ..... 11
4. Axis Configuration ..... 12
  4.1. Axis Position ..... 12
  4.2. Axis Extension ..... 12
5. Tick Configuration ..... 13
  5.1. Default Integer Ticks ..... 13
  5.2. Custom Tick Step ..... 13
  5.3. Tick Label Step ..... 15
  5.4. Unit Label Only ..... 15
  5.5. Custom Tick Positions ..... 17
  5.6. Hide Origin Label ..... 17
6. Markers ..... 19
  6.1. Available Marker Types ..... 19
  6.2. Using Markers ..... 20
7. Convenience Functions ..... 21
  7.1. `plot-fn` - Quick Function Plot ..... 21
  7.2. `scatter` - Scatter Plot Helper ..... 21
  7.3. `line-plot` - Line Plot Helper ..... 21
  7.4. `func-plot` - Function Plot Helper ..... 21
8. Global Configuration ..... 23
  8.1. Setting Defaults ..... 23
  8.2. Resetting Defaults ..... 23
9. Styling ..... 24
  9.1. Custom Styles ..... 24
  9.2. Default Style Values ..... 24
10. Parameter Reference ..... 25
  10.1. `plot` Function ..... 25
  10.2. Function/Data Specification ..... 27
11. Complete Examples ..... 28
  11.1. Trigonometric Functions ..... 28
  11.2. Polynomial with Fine Grid ..... 29
  11.3. Minimal Style Plot ..... 30
  11.4. Data with Trend Line ..... 31

# 1. Introduction

`simple-plot` is a Typst package for creating clean, elegant mathematical plots. Built on CeTZ, it provides an intuitive interface for plotting functions, data points, and creating publication-ready graphs.

## 1.1. Features

- Plot mathematical functions with automatic sampling
- Scatter plots and line plots with customizable markers
- Clean integer-based tick system by default
- Major and minor grid with elegant styling
- White box masking for tick labels (grid-label-break)
- Automatic axis extension beyond grid
- Flexible axis positioning (origin, bottom/left, custom)
- Multiple label display options (unit-label-only, label-step)
- Function labels with flexible positioning
- Clipping for clean rendering at boundaries

## 1.2. Installation

Import the package in your Typst document:

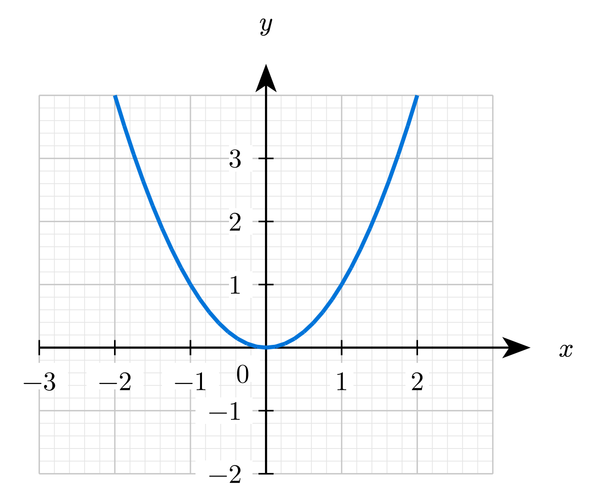
```
#import "@local/simple-plot:0.2.6": plot
```

## 1.3. Quick Start

**Code**

```
#plot(
  width: 6, height: 5,
  xmin: -3, xmax: 3, ymin: -2, ymax: 4,
  xlabel: $x$, ylabel: $y$,
  show-grid: true,
  (fn: x => x * x, stroke: blue + 1.5pt),
)
```

**Preview**



# 2. Basic Usage

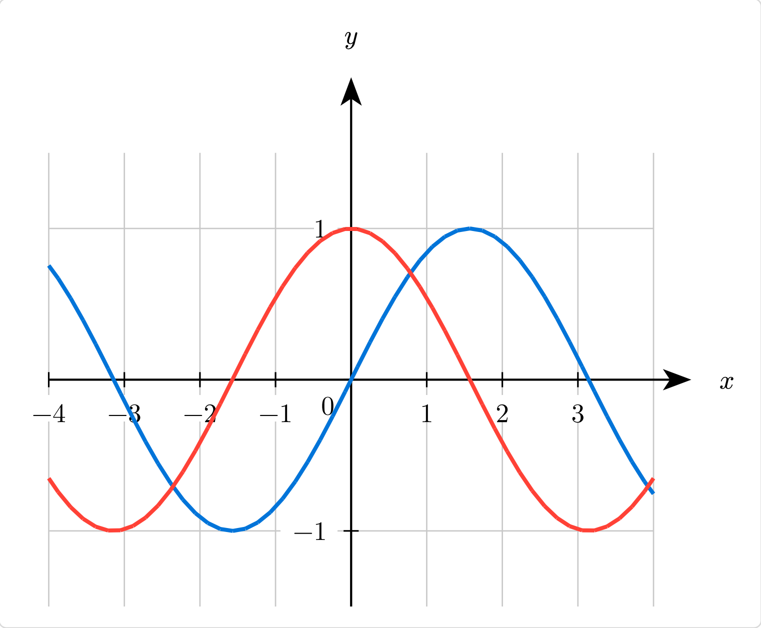
## 2.1. Plotting Functions

Plot mathematical functions by passing a dictionary with `fn`:

**Code**

```
#plot(
  width: 8, height: 6,
  xmin: -4, xmax: 4, ymin: -1.5, ymax: 1.5,
  xlabel: $x$, ylabel: $y$,
  show-grid: "major",
  (fn: x => calc.sin(x), stroke: blue + 1.5pt),
  (fn: x => calc.cos(x), stroke: red + 1.5pt),
)
```

**Preview**



## 2.2. Mathematical Functions Reference

Functions are defined using Typst's `calc` module. Here are the most common mathematical functions:

| Function | Typst syntax |
|---|---|
| Power $x^n$ | `calc.pow(x, n)` |
| Square root $\sqrt{x}$ | `calc.sqrt(x)` |
| Absolute value $\lvert x \rvert$ | `calc.abs(x)` |
| Sine $\sin(x)$ | `calc.sin(x)` |
| Cosine $\cos(x)$ | `calc.cos(x)` |
| Tangent $\tan(x)$ | `calc.tan(x)` |
| Exponential $e^x$ | `calc.exp(x)` |
| Natural log $\ln(x)$ | `calc.ln(x)` |
| Log base $b$ | `calc.log(x, base: b)` |
| Maximum | `calc.max(a, b)` |
| Minimum | `calc.min(a, b)` |

**Important:** When using constants in calculations, use decimal notation (e.g., `2.0` instead of `2`) to avoid type errors. For example:

- ✓ `x => x * x / 2.0`
- ✗ `x => x * x / 2` *(may cause errors)*

This is because Typst's type system requires consistent float arithmetic.

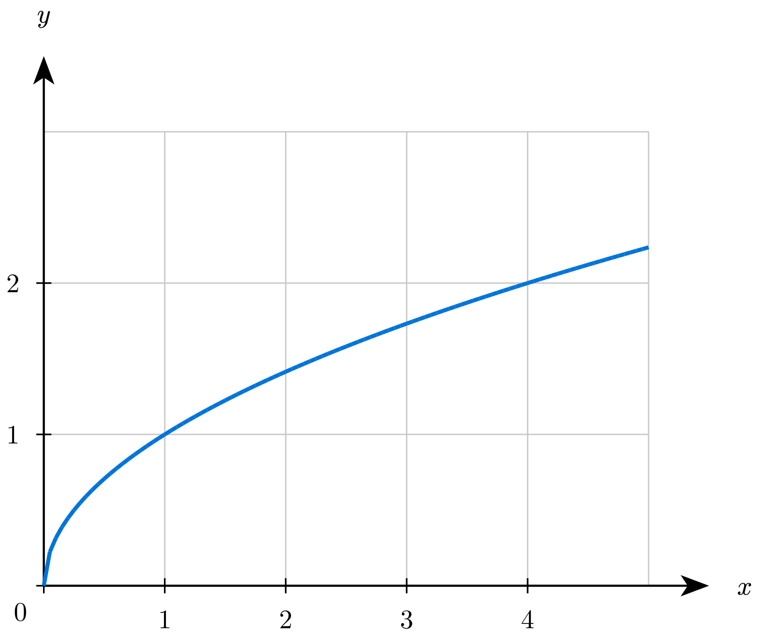
## 2.3. Function Domain

Specify a custom domain for functions:

**Code**

```
#plot(
  width: 8, height: 6,
  xmin: 0, xmax: 5, ymin: 0, ymax: 3,
  xlabel: $x$, ylabel: $y$,
  axis-x-pos: "bottom", axis-y-pos: "left",
  show-grid: "major",
  (fn: x => calc.sqrt(x), domain: (0, 5), stroke: blue + 1.5pt),
)
```

**Preview**



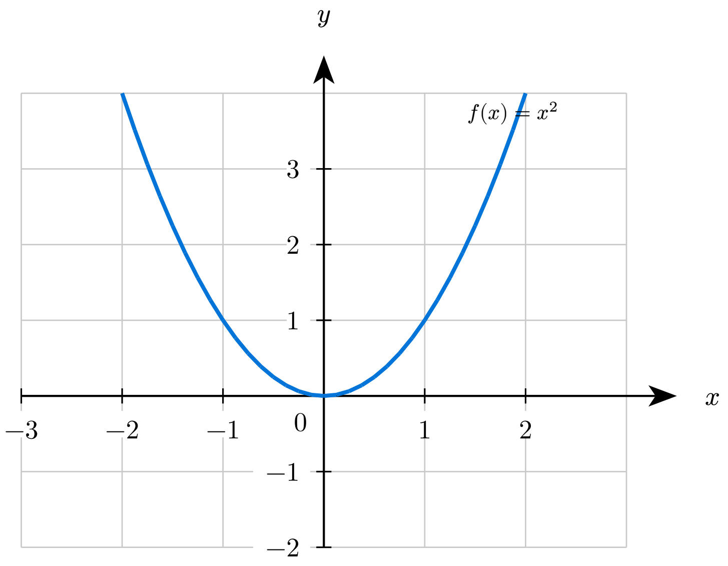
## 2.4. Function Labels

Add labels to your functions:

**Code**

```
#plot(
  width: 8, height: 6,
  xmin: -3, xmax: 3, ymin: -2, ymax: 4,
  xlabel: $x$, ylabel: $y$,
  show-grid: "major",
  (
    fn: x => x * x,
    stroke: blue + 1.5pt,
    label: $f(x) = x^2$,
    label-side: "above",
    label-pos: 0.75,
  ),
)
```

**Preview**



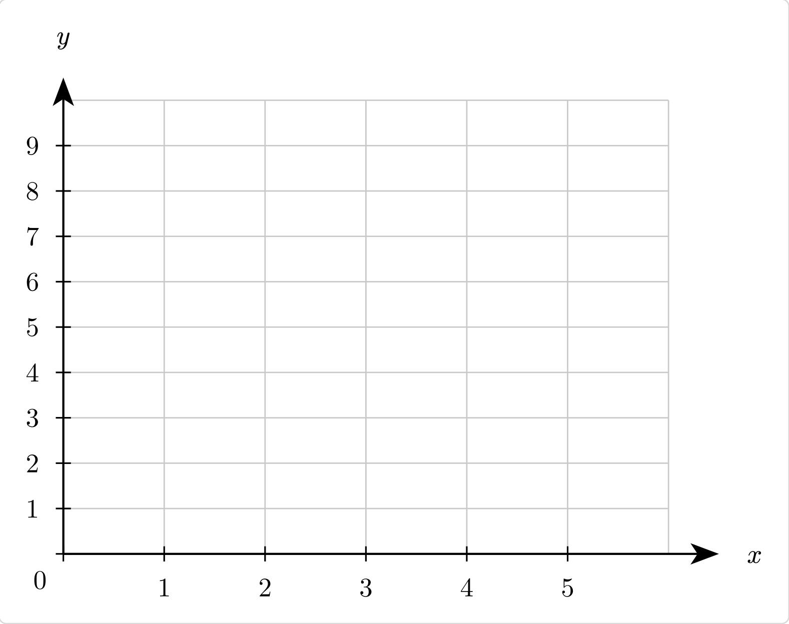
## 2.5. Data Points and Scatter Plots

Plot discrete data points:

### Code

```
#plot(
  width: 8, height: 6,
  xmin: 0, xmax: 6, ymin: 0, ymax: 10,
  xlabel: $x$, ylabel: $y$,
  axis-x-pos: "bottom", axis-y-pos: "left",
  show-grid: "major",
  (
    data: ((1, 2), (2, 4), (3, 5), (4, 7), (5, 9)),
    mark: "o",
    mark-size: 0.15,
    stroke: blue + 1pt,
  ),
)
```

### Preview



# 3. Grid Options

## 3.1. Grid Modes

Control grid display with `show-grid`:

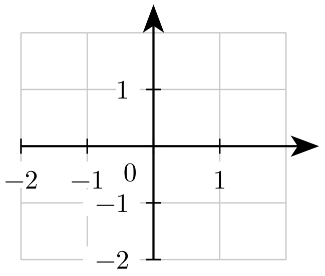
**Code**

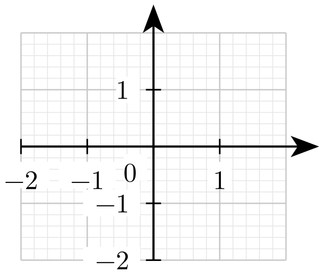
```
// Major grid only
#plot(
  width: 5, height: 4,
  xmin: -2, xmax: 2, ymin: -2, ymax: 2,
  show-grid: "major",
)

// Minor grid only
#plot(
  width: 5, height: 4,
  xmin: -2, xmax: 2, ymin: -2, ymax: 2,
  show-grid: "minor",
)

// Both grids
#plot(
  width: 5, height: 4,
  xmin: -2, xmax: 2, ymin: -2, ymax: 2,
  show-grid: "both",
)
```

**Preview**





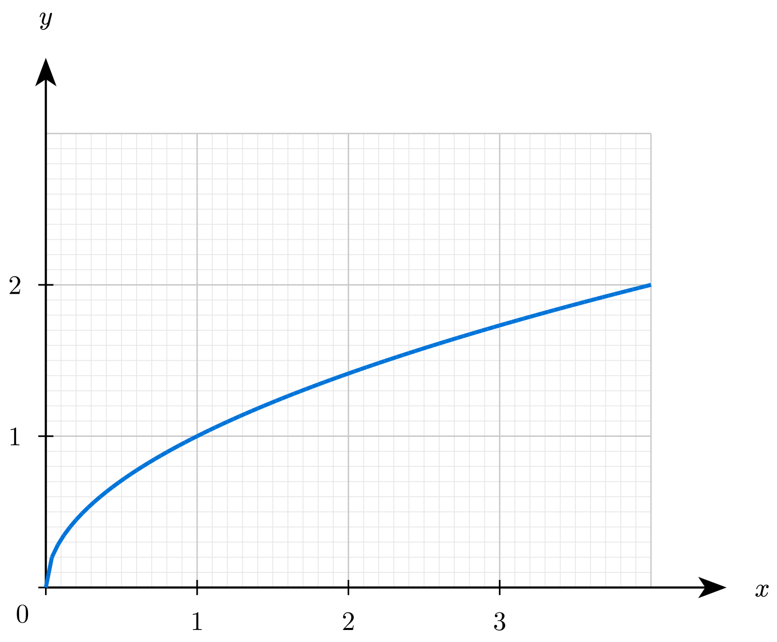
## 3.2. Minor Grid Subdivisions

Control the number of subdivisions with `minor-grid-step`:

### Code

```
#plot(
  width: 8, height: 6,
  xmin: 0, xmax: 4, ymin: 0, ymax: 3,
  xlabel: $x$, ylabel: $y$,
  axis-x-pos: "bottom", axis-y-pos: "left",
  show-grid: "both",
  minor-grid-step: 10,  // 10 subdivisions per unit
  (fn: x => calc.sqrt(x), domain: (0, 4), stroke: blue + 1.5pt),
)
```

### Preview



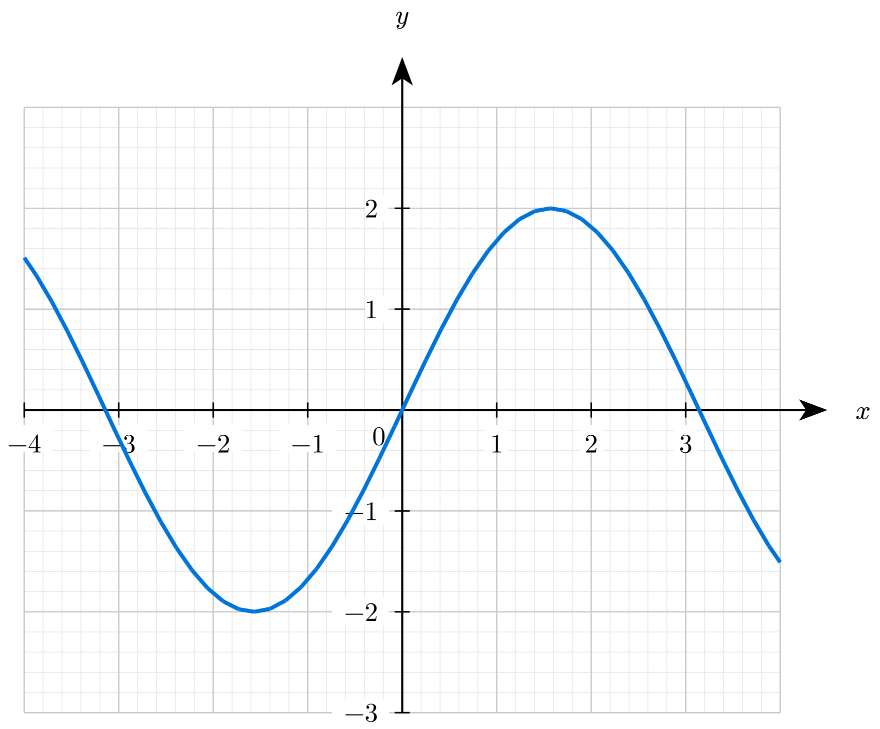
## 3.3. Grid Label Break

The `grid-label-break` option (enabled by default) draws white boxes behind tick labels, creating an elegant effect where grid lines appear to stop at the labels:

**Code**

```
#plot(
  width: 10, height: 8,
  xmin: -4, xmax: 4, ymin: -3, ymax: 3,
  xlabel: $x$, ylabel: $y$,
  show-grid: "both",
  minor-grid-step: 5,
  grid-label-break: true,  // Default
  (fn: x => calc.sin(x) * 2, stroke: blue + 1.5pt),
)
```

**Preview**



# 4. Axis Configuration

## 4.1. Axis Position

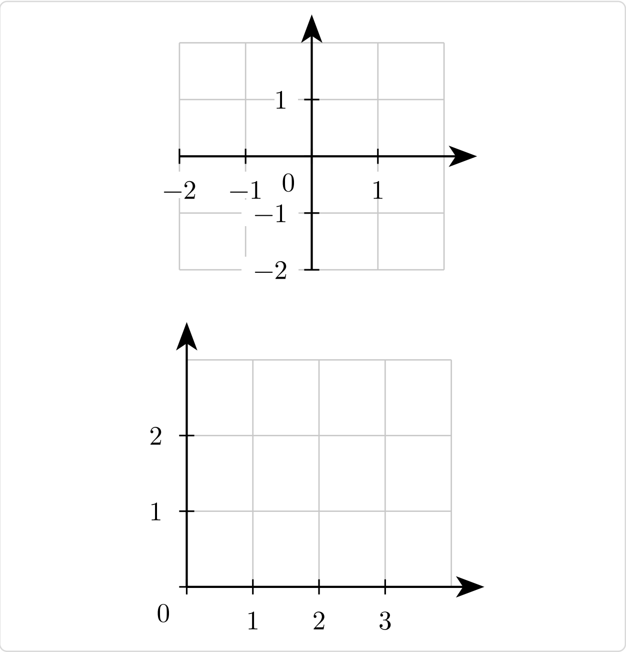
Position axes at origin (default), bottom/left, or custom values:

**Code**

```
// Through origin (default)
#plot(
  width: 5, height: 4,
  xmin: -2, xmax: 2, ymin: -2, ymax: 2,
  show-grid: "major",
)

// Bottom and left
#plot(
  width: 5, height: 4,
  xmin: 0, xmax: 4, ymin: 0, ymax: 3,
  axis-x-pos: "bottom",
  axis-y-pos: "left",
  show-grid: "major",
)
```

**Preview**



## 4.2. Axis Extension

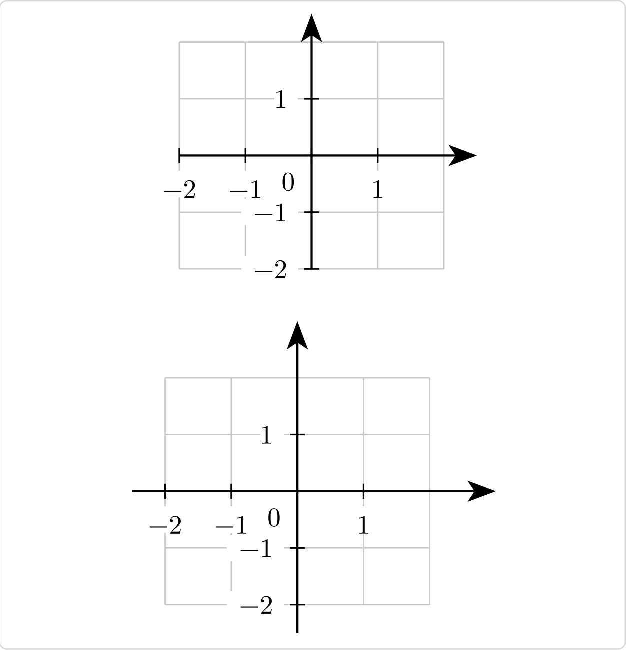
By default, axes extend 0.5 units beyond the grid on the arrow side. Customize with `axis-x-extend` and `axis-y-extend`:

**Code**

```
// Default extension (0, 0.5)
#plot(
  width: 5, height: 4,
  xmin: -2, xmax: 2, ymin: -2, ymax: 2,
  show-grid: "major",
)

// Custom extension
#plot(
  width: 5, height: 4,
  xmin: -2, xmax: 2, ymin: -2, ymax: 2,
  axis-x-extend: (0.5, 1),
  axis-y-extend: (0.5, 1),
  show-grid: "major",
)
```

**Preview**



# 5. Tick Configuration

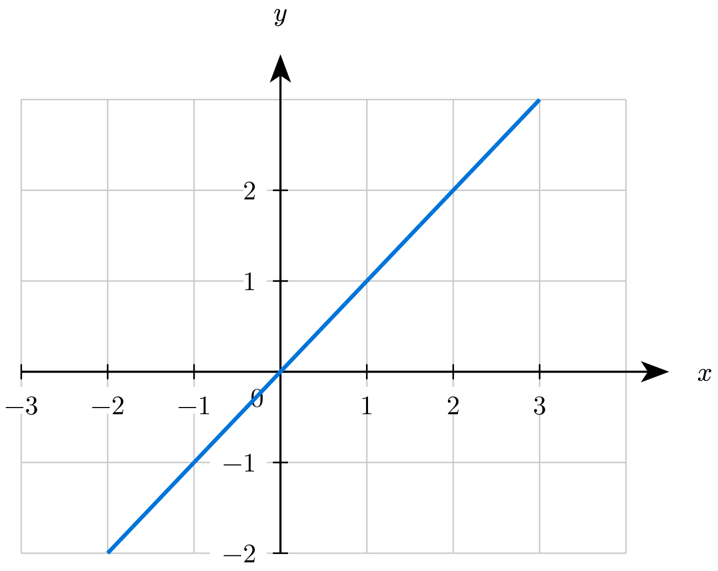
## 5.1. Default Integer Ticks

By default, ticks are placed at every integer (step $= 1$):

**Code**

```
#plot(
  width: 8, height: 6,
  xmin: -3, xmax: 4, ymin: -2, ymax: 3,
  xlabel: $x$, ylabel: $y$,
  show-grid: "major",
  (fn: x => x, stroke: blue + 1.5pt),
)
```

**Preview**



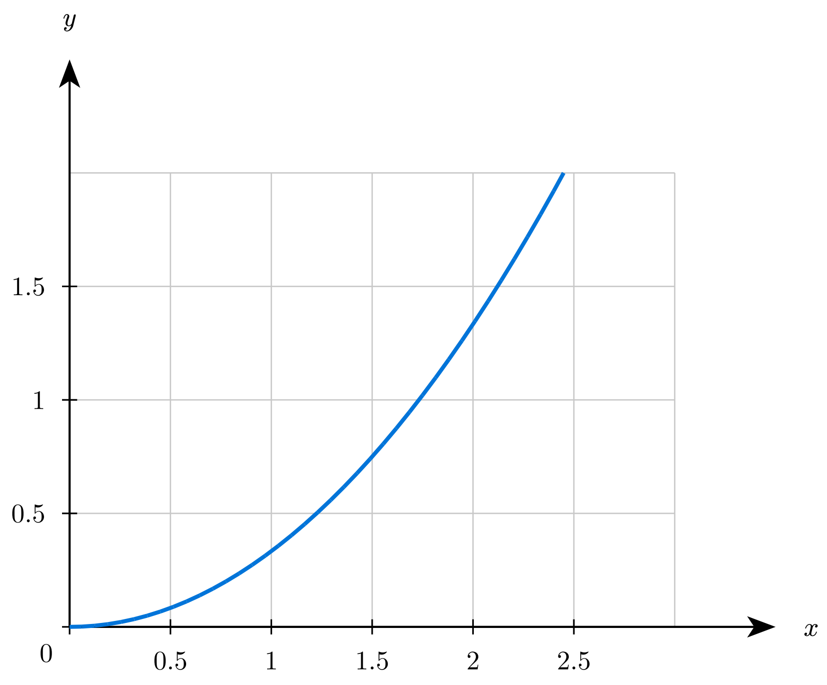
## 5.2. Custom Tick Step

Change tick spacing with `xtick-step` and `ytick-step`:

### Code

```
#plot(
  width: 8, height: 6,
  xmin: 0, xmax: 3, ymin: 0, ymax: 2,
  xlabel: $x$, ylabel: $y$,
  axis-x-pos: "bottom", axis-y-pos: "left",
  xtick-step: 0.5,
  ytick-step: 0.5,
  show-grid: "major",
  (fn: x => x * x / 3, stroke: blue + 1.5pt),
)
```

### Preview



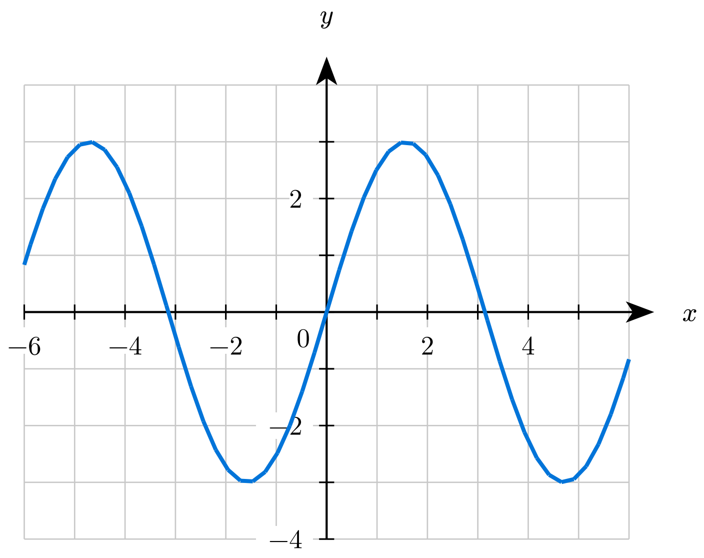
## 5.3. Tick Label Step

Show labels only at every N-th tick with `xtick-label-step` and `ytick-label-step`:

**Code**

```
#plot(
  width: 8, height: 6,
  xmin: -6, xmax: 6, ymin: -4, ymax: 4,
  xlabel: $x$, ylabel: $y$,
  xtick-label-step: 2,  // Labels at -6, -4, -2, 2, 4, 6
  ytick-label-step: 2,  // Labels at -4, -2, 2, 4
  show-grid: "major",
  (fn: x => calc.sin(x) * 3, stroke: blue + 1.5pt),
)
```

**Preview**



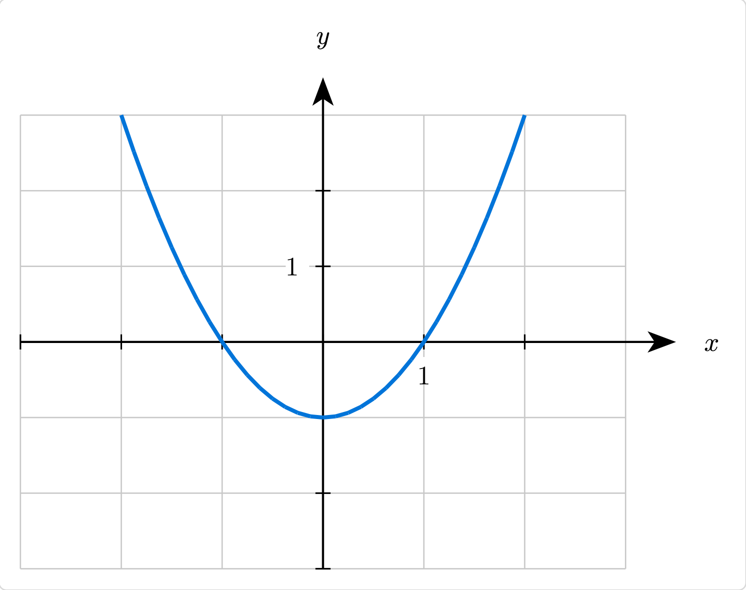
## 5.4. Unit Label Only

Show only “1” on each axis for a minimal style:

### Code

```
#plot(
  width: 8, height: 6,
  xmin: -3, xmax: 3, ymin: -3, ymax: 3,
  xlabel: $x$, ylabel: $y$,
  unit-label-only: true,
  show-origin: false,
  show-grid: "major",
  (fn: x => x * x - 1, stroke: blue + 1.5pt),
)
```

### Preview



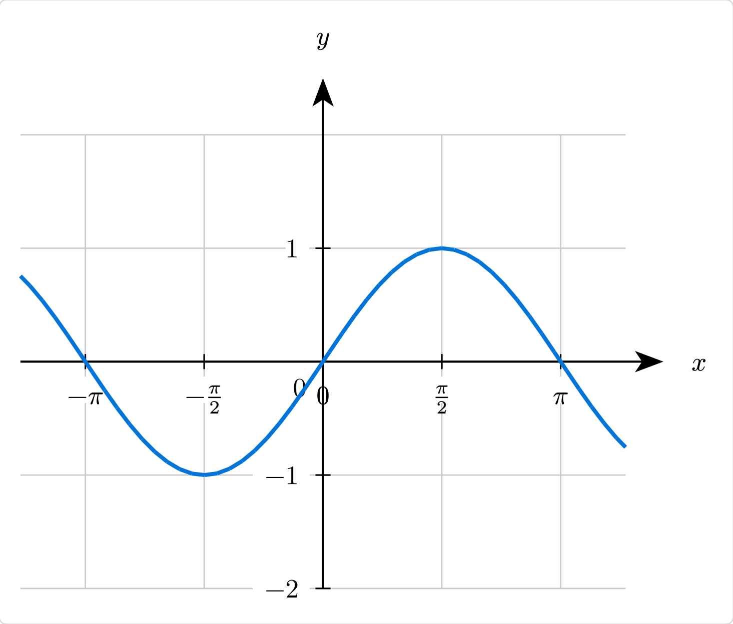
## 5.5. Custom Tick Positions

Specify exact tick positions with `xtick` and `ytick`:

**Code**

```
#plot(
  width: 8, height: 6,
  xmin: -4, xmax: 4, ymin: -2, ymax: 2,
  xlabel: $x$, ylabel: $y$,
  xtick: (-calc.pi, -calc.pi/2, 0, calc.pi/2, calc.pi),
  xtick-labels: ($-pi$, $-pi/2$, $0$, $pi/2$, $pi$),
  show-grid: "major",
  (fn: x => calc.sin(x), stroke: blue + 1.5pt),
)
```

**Preview**



## 5.6. Hide Origin Label

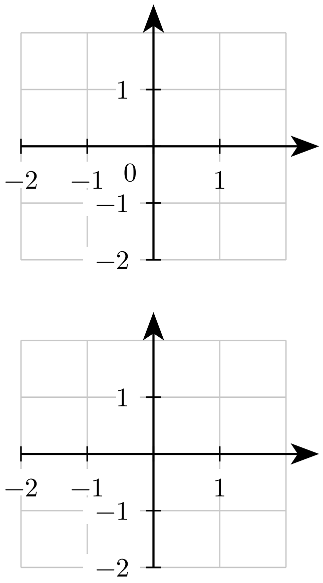
Control the “0” label at the origin:

### Code

```
// With origin (default)
#plot(
  width: 5, height: 4,
  xmin: -2, xmax: 2, ymin: -2, ymax: 2,
  show-origin: true,
  show-grid: "major",
)

// Without origin
#plot(
  width: 5, height: 4,
  xmin: -2, xmax: 2, ymin: -2, ymax: 2,
  show-origin: false,
  show-grid: "major",
)
```

### Preview



# 6. Markers

## 6.1. Available Marker Types

The following markers are available:

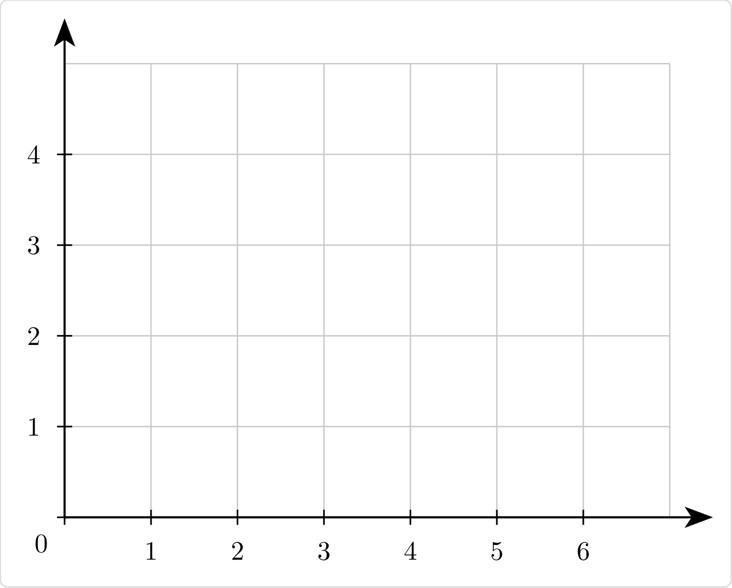
| Marker | Description |
|---|---|
| `"o"` | Circle (outline) |
| `"*"` | Circle (filled) |
| `"square"` / `"s"` | Square (outline) |
| `"square*"` | Square (filled) |
| `"triangle"` / `"^"` | Triangle up (outline) |
| `"triangle*"` | Triangle up (filled) |
| `"diamond"` / `"d"` | Diamond (outline) |
| `"diamond*"` | Diamond (filled) |
| `"star"` | Star (outline) |
| `"star*"` | Star (filled) |
| `"+"` | Plus sign |
| `"x"` | Cross |
| `"\|"` | Vertical bar |
| `"-"` | Horizontal bar |

## 6.2. Using Markers

### Code

```
#plot(
  width: 8, height: 6,
  xmin: 0, xmax: 7, ymin: 0, ymax: 5,
  axis-x-pos: "bottom", axis-y-pos: "left",
  show-grid: "major",
  (data: ((1, 1), (2, 2), (3, 2.5)), mark: "o", stroke: blue),
  (data: ((1, 2), (2, 3), (3, 3.5)), mark: "square*", stroke: red),
  (data: ((1, 3), (2, 4), (3, 4.2)), mark: "triangle", stroke: green),
)
```

### Preview



# 7. Convenience Functions

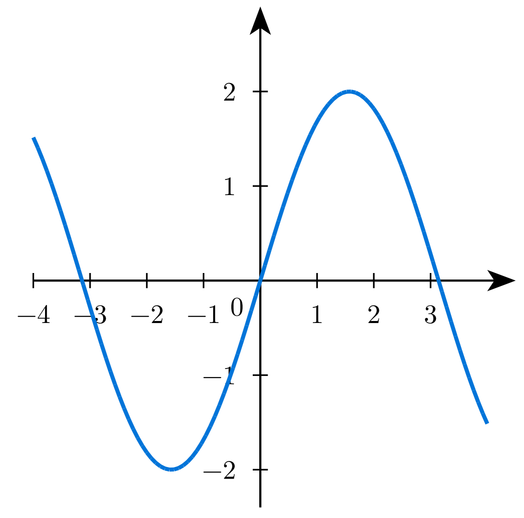
## 7.1. `plot-fn` - Quick Function Plot

Plot a single function with automatic y-scaling:

**Code**

```
#plot-fn(
  x => calc.sin(x) * 2.0,
  domain: (-4, 4),
  stroke: blue + 1.5pt,
)
```

**Preview**



## 7.2. `scatter` - Scatter Plot Helper

Create scatter plot specifications:

```
#let my-data = scatter(
  ((1, 2), (2, 4), (3, 5)),
  mark: "o",
  stroke: blue,
)
#plot(xmin: 0, xmax: 4, ymin: 0, ymax: 6, my-data)
```

## 7.3. `line-plot` - Line Plot Helper

Create connected line plots:

```
#let my-line = line-plot(
  ((1, 2), (2, 4), (3, 5)),
  stroke: blue + 1pt,
  mark: "o",
)
#plot(xmin: 0, xmax: 4, ymin: 0, ymax: 6, my-line)
```

## 7.4. `func-plot` - Function Plot Helper

Create function plot specifications:

```
#let my-func = func-plot(
  x => calc.sin(x),
  stroke: blue + 1.5pt,
  label: $sin(x)$,
)
#plot(xmin: -4, xmax: 4, ymin: -1.5, ymax: 1.5, my-func)
```

# 8. Global Configuration

## 8.1. Setting Defaults

Use `set-plot-defaults` to configure defaults for all subsequent plots:

```
#set-plot-defaults(
  width: 8,
  height: 6,
  show-grid: "both",
  minor-grid-step: 5,
)

// All plots will now use these defaults
#plot(xmin: -3, xmax: 3, ymin: -2, ymax: 2, ...)
```

## 8.2. Resetting Defaults

Reset to original defaults:

```
#reset-plot-defaults()
```

# 9. Styling

## 9.1. Custom Styles

Override default styles with the `style` parameter:

```
#plot(
  xmin: -3, xmax: 3, ymin: -2, ymax: 2,
  style: (
    axis: (stroke: black + 1pt, arrow: "stealth"),
    grid: (
      major: (stroke: luma(180) + 0.6pt),
      minor: (stroke: luma(220) + 0.3pt),
    ),
    ticks: (
      length: 0.12,
      stroke: black + 0.6pt,
      label-size: 0.7em,
    ),
  ),
  ...
)
```

## 9.2. Default Style Values

| Property | Default | Description |
|---|---|---|
| `axis.stroke` | `black + 0.8pt` | Axis line style |
| `axis.arrow` | `"stealth"` | Arrow head style |
| `grid.major.stroke` | `luma(200) + 0.5pt` | Major grid line style |
| `grid.minor.stroke` | `luma(230) + 0.3pt` | Minor grid line style |
| `ticks.length` | `0.1` | Tick mark length (cm) |
| `ticks.stroke` | `black + 0.6pt` | Tick mark style |
| `ticks.label-size` | `0.65em` | Tick label font size |
| `ticks.label-offset` | `0.15` | Distance from tick to label |
| `plot.stroke` | `blue + 1.2pt` | Default function stroke |
| `plot.samples` | `100` | Default sample count |
| `marker.size` | `0.12` | Default marker size |
| `labels.size` | `0.8em` | Axis label font size |

# 10. Parameter Reference

## 10.1. `plot` Function

**Dimensions and Bounds:**

| Parameter | Type | Default | Description |
|---|---|---|---|
| `width` | float | 6 | Plot width in cm |
| `height` | float | 6 | Plot height in cm |
| `scale` | float | 1 | Scale factor for entire plot |
| `xmin` | float | auto | Minimum x value |
| `xmax` | float | auto | Maximum x value |
| `ymin` | float | auto | Minimum y value |
| `ymax` | float | auto | Maximum y value |

**Axis Configuration:**

| Parameter | Type | Default | Description |
|---|---|---|---|
| `xlabel` | content | none | X-axis label |
| `ylabel` | content | none | Y-axis label |
| `xlabel-pos` | string/array | "end" | "end", "center", or (x, y) |
| `ylabel-pos` | string/array | "end" | "end", "center", or (x, y) |
| `xlabel-anchor` | string | "west" | Anchor for x label |
| `ylabel-anchor` | string | "south" | Anchor for y label |
| `xlabel-offset` | array | (0.3, 0) | X label offset (cm) |
| `ylabel-offset` | array | (0, 0.3) | Y label offset (cm) |
| `axis-x-pos` | string/float | 0 | "bottom", "center", or y-value |
| `axis-y-pos` | string/float | 0 | "left", "center", or x-value |
| `axis-x-extend` | float/array | (0, 0.5) | X-axis extension (left, right) |
| `axis-y-extend` | float/array | (0, 0.5) | Y-axis extension (bottom, top) |

**Tick Configuration:**

| Parameter | Type | Default | Description |
|---|---|---|---|
| `xtick` | array/none | auto | Custom x tick positions |
| `ytick` | array/none | auto | Custom y tick positions |
| `xtick-step` | float | 1 | X tick spacing |
| `ytick-step` | float | 1 | Y tick spacing |
| `xtick-labels` | array/none | auto | Custom x tick labels |
| `ytick-labels` | array/none | auto | Custom y tick labels |
| `xtick-label-step` | int | 1 | Show x label every N ticks |
| `ytick-label-step` | int | 1 | Show y label every N ticks |

| | | | |
|---|---|---|---|
| `show-origin` | bool | true | Show “0” at origin |
| `unit-label-only` | bool | false | Show only “1” on axes |
| `tick-label-size` | length | 0.65em | Tick label font size |
| `axis-label-size` | length | 0.8em | Axis label font size |

**Grid Configuration:**

| Parameter | Type | Default | Description |
|---|---|---|---|
| `show-grid` | bool/string | false | true, false, "major", "minor", "both" |
| `minor-grid-step` | int | 5 | Subdivisions per major tick |
| `grid-label-break` | bool | true | White boxes behind labels |

**Styling:**

| Parameter | Type | Default | Description |
|---|---|---|---|
| `style` | dictionary | none | Style overrides |

## 10.2. Function/Data Specification

Each plot item is a dictionary with these fields:

| Field | Type | Description |
|---|---|---|
| `fn` | function | Function to plot: `x => y` |
| `data` | array | Data points: `((x1, y1), (x2, y2), ...)` |
| `domain` | array | Function domain: `(xmin, xmax)` |
| `samples` | int | Number of samples for function |
| `stroke` | stroke | Line style |
| `mark` | string | Marker type |
| `mark-size` | float | Marker size in cm |
| `mark-fill` | color | Marker fill color |
| `label` | content | Label text |
| `label-pos` | string | "above", "below", "left", "right" |
| `label-at` | float/string | x-position or "start"/"end"/"center" |
| `label-anchor` | string | Text anchor point |

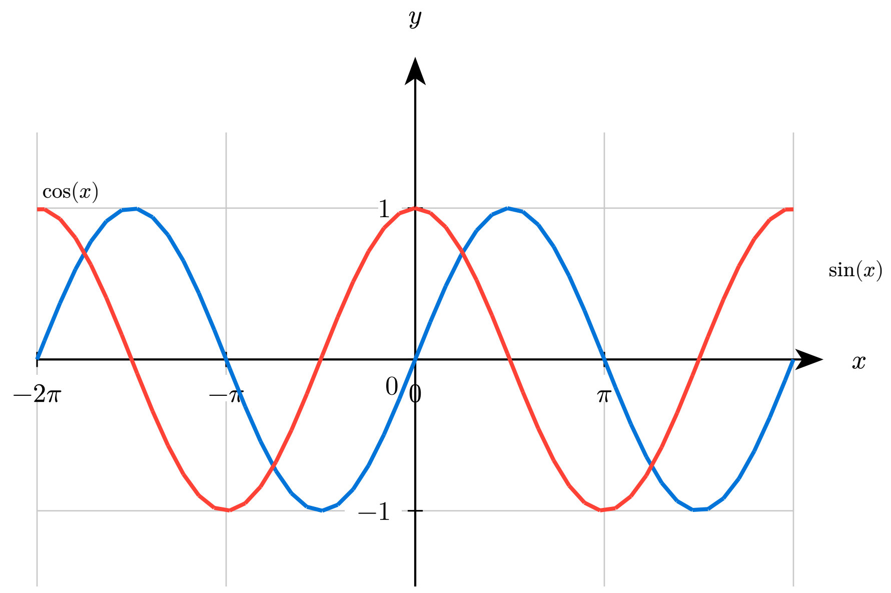
# 11. Complete Examples

## 11.1. Trigonometric Functions

### Code

```
#plot(
  width: 10, height: 6,
  xmin: -2 * calc.pi, xmax: 2 * calc.pi,
  ymin: -1.5, ymax: 1.5,
  xlabel: $x$, ylabel: $y$,
  xtick: (-2*calc.pi, -calc.pi, 0, calc.pi, 2*calc.pi),
  xtick-labels: ($-2pi$, $-pi$, $0$, $pi$, $2pi$),
  show-grid: "major",
  (fn: x => calc.sin(x), stroke: blue + 1.5pt, label: $sin(x)$, label-pos: 1),
  (fn: x => calc.cos(x), stroke: red + 1.5pt, label: $cos(x)$, label-pos: 0),
)
```

### Preview

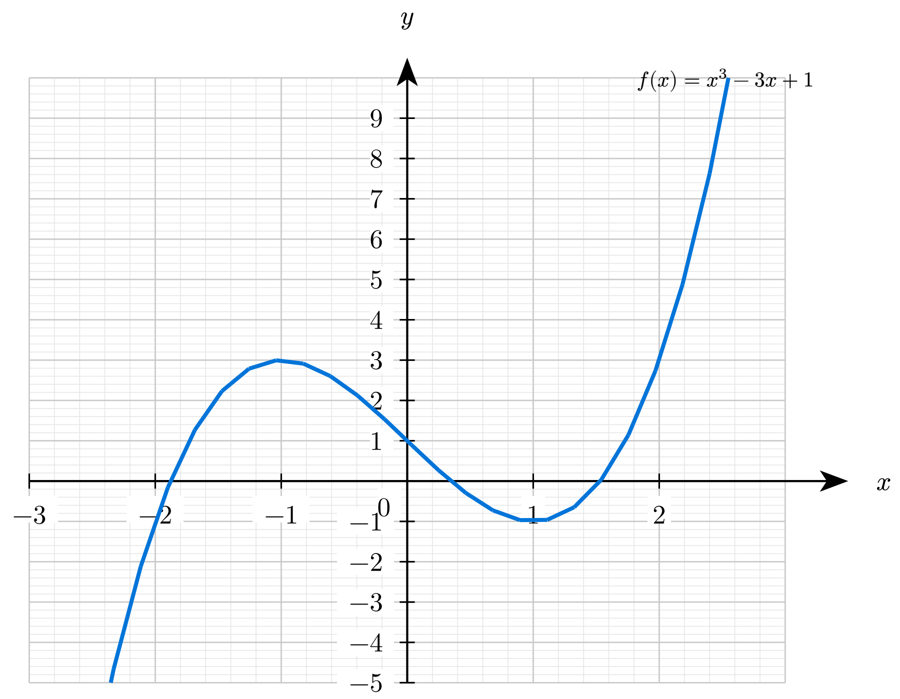


## 11.2. Polynomial with Fine Grid

### Code

```
#plot(
  width: 10, height: 8,
  xmin: -3, xmax: 3, ymin: -5, ymax: 10,
  xlabel: $x$, ylabel: $y$,
  show-grid: "both",
  minor-grid-step: 5,
  (
    fn: x => x * x * x - 3 * x + 1,
    stroke: blue + 1.5pt,
    label: $f(x) = x^3 - 3x + 1$,
    label-side: "above",
    label-pos: 0.85,
  ),
)
```

### Preview

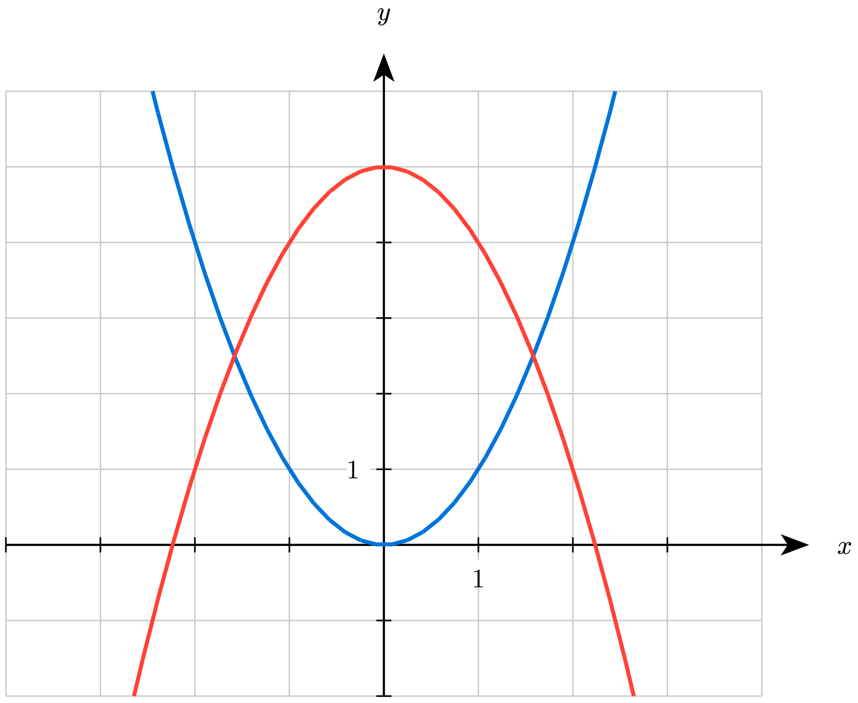


## 11.3. Minimal Style Plot

### Code

```
#plot(
  width: 10, height: 8,
  xmin: -4, xmax: 4, ymin: -2, ymax: 6,
  xlabel: $x$, ylabel: $y$,
  show-grid: "major",
  unit-label-only: true,
  show-origin: false,
  (fn: x => x * x, stroke: blue + 1.5pt),
  (fn: x => -x * x + 5, stroke: red + 1.5pt),
)
```

### Preview

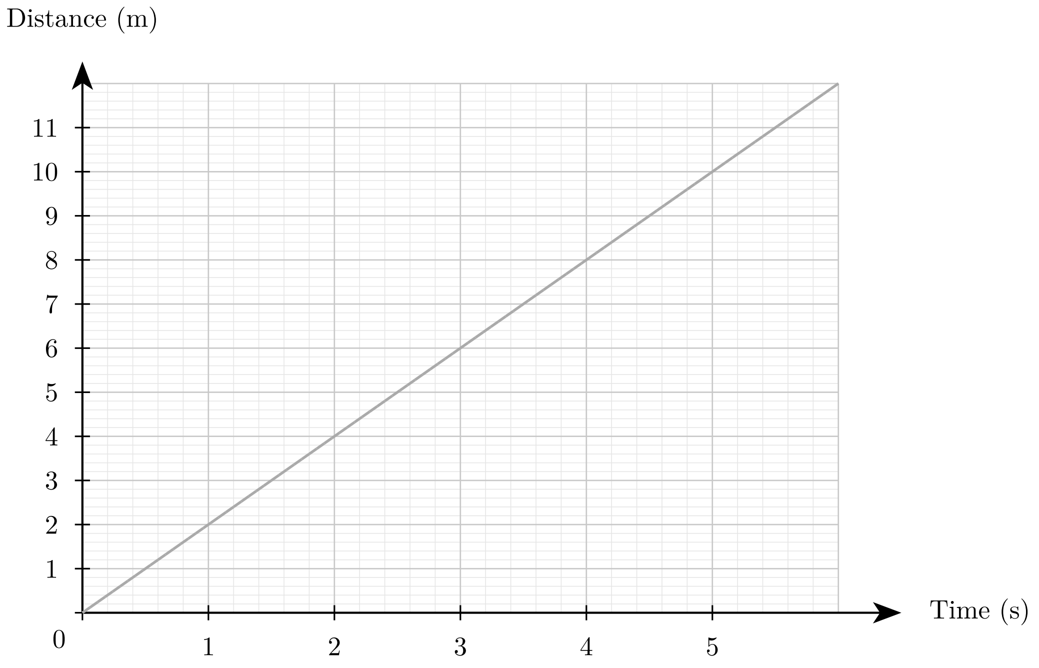


## 11.4. Data with Trend Line

**Code**

```
#plot(
  width: 10, height: 7,
  xmin: 0, xmax: 6, ymin: 0, ymax: 12,
  xlabel: "Time (s)", ylabel: "Distance (m)",
  axis-x-pos: "bottom", axis-y-pos: "left",
  show-grid: "both",
  minor-grid-step: 5,
  (fn: x => 2 * x, stroke: gray + 1pt, domain: (0, 6)),  // Trend line
  (
    data: ((0.5, 1.2), (1, 2.3), (2, 3.8), (3, 6.2), (4, 7.9), (5, 10.1)),
    mark: "o",
    mark-size: 0.12,
    stroke: none,
  ),
)
```

**Preview**


Distance (m)
Time (s)