

# Riesketcher

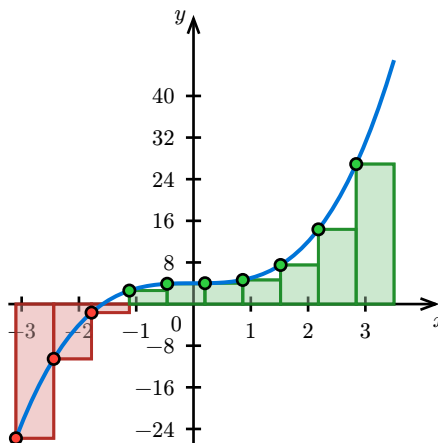
A package to draw Riemann sums (left, right, midpoint, and trapezoidal) and their plots for functions using CeTZ; supports tagged and untagged partitions.

```
#import "@preview/riesketcher:0.4.0": riesketcher, trapezoidal
```

## Examples

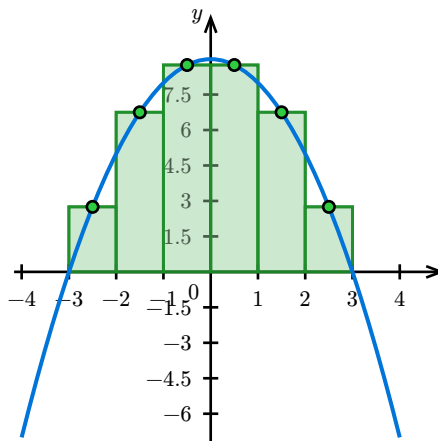
### Left-Hand Riemann sum

```
riesketcher(  
  x => calc.pow(x, 3) + 4,  
  method: "left",  
  start: -3.1,  
  end: 3.5,  
  n: 10,  
  plot-x-tick-step: 1,  
)
```



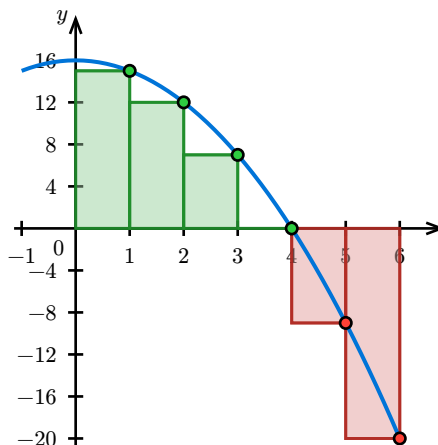
### Midpoint Riemann sum

```
riesketcher(  
  x => -calc.pow(x, 2) + 9,  
  method: "mid",  
  domain: (-4, 4),  
  start: -3,  
  end: 3,  
  n: 6,  
  plot-x-tick-step: 1,  
)
```



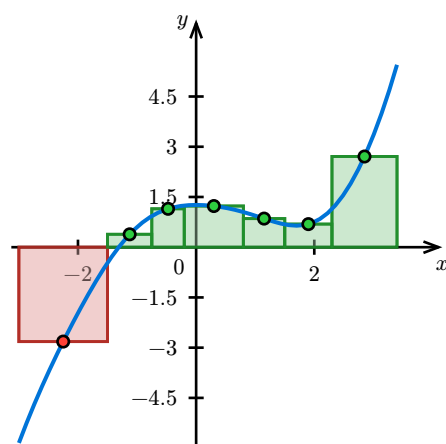
### Right-method Riemann sum

```
riesketcher(  
  x => 16 - x * x,  
  method: "right",  
  end: 6,  
  n: 6,  
  domain: (-1, auto),  
  plot-x-tick-step: 1,  
)
```



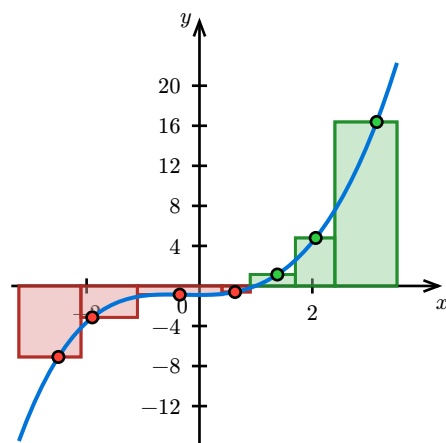
## Custom untagged partition (midpoint method)

```
riesketcher(  
  x => 0.17 * calc.pow(x, 3)  
    + 1.5 * calc.sin(calc.cos(x)),  
  method: "mid",  
  partition: (-3, -1.5, -0.75, -0.2, 0.8, 1.5,  
    2.3, 3.4),  
  plot-x-tick-step: 2,  
)
```



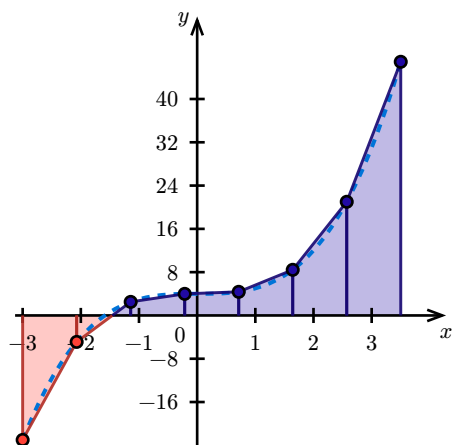
## Tagged partition

```
riesketcher(  
  x => 0.5 * calc.pow(x, 3)  
    - 0.9 * calc.cos(x),  
  partition: (-3.2, -2.1, -1.1, 0.4, 0.9, 1.7,  
    2.4, 3.5),  
  tags: (-2.5, -1.9, -0.35, 0.63, 1.38, 2.06, 3.14),  
  plot-x-tick-step: 2,  
)
```



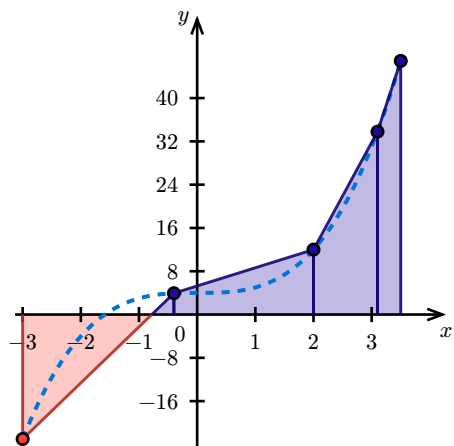
## Trapezoidal Rule (uniform grid)

```
trapezoidal(  
  x => calc.pow(x, 3) + 4,  
  start: -3,  
  end: 3.5,  
  n: 7,  
  plot-x-tick-step: 1,  
  positive-color: rgb("#210aa4")  
)
```



## Trapezoidal Rule (non-uniform grid)

```
trapezoidal(  
  x => calc.pow(x, 3) + 4,  
  partition: (-3, -0.4, 2, 3.1, 3.5),  
  plot-x-tick-step: 1,  
  positive-color: rgb("#210aa4")  
)
```



## Method parameters

### riesketcher

- riesketcher()

### riesketcher

Draw a Riemann sum of a function, and optionally plot the function.

#### Parameters

```
riesketcher(  
    fn: function ,  
    start: number ,  
    end: number ,  
    domain: array ,  
    n: number ,  
    partition: array none ,  
    tags: array none ,  
    method: string ,  
    transparency: number ,  
    dot-radius: number ,  
    plot: boolean ,  
    plot-grid: boolean ,  
    plot-x-tick-step: number ,  
    plot-y-tick-step: number ,  
    positive-color: color ,  
    negative-color: color ,  
    plot-line-color: color ,  
    size: tuple  
)
```

**fn**    function

The function to draw a Riemann sum of.

**start**    number

The starting point for the bars. Used only if partition is not a valid array; otherwise, the first value of partition is used.

Default: 0

**end**    number

The ending point for the bars. Used only if partition is not a valid array; otherwise, the last value of partition is used.

Default: 10

**domain**    array

Tuple of the domain of fn. If a tuple value is auto, that value is set to start/end.

Default: (auto, auto)

**n**    number

Number of bars. Used only if `partition` is not a valid array; otherwise, the number of bars is determined by the length of `partition`.

Default: 10

**partition**    array or none

(optional) Array of partition points. If valid, it overrides `start`, `end`, and `n`; otherwise, equal partitions are generated from `start`, `end`, and `n`.

Default: none

**tags**    array or none

(optional) Array of sample points for bar heights. If valid, it overrides `method`; otherwise, sample points are determined by `method`.

Default: none

**method**    string

Determines where the sample points for bar heights are taken (`left`, `mid/midpoint`, or `right`). Used only if `tags` is not a valid array; otherwise, bar heights are taken from `tags`.

Default: "left"

**transparency**    number

Transparency fill of bars.

Default: 40%

**dot-radius**    number

Radius of dots.

Default: 0.15

**plot**    boolean

Whether to add plot of the function.

Default: true

**plot-grid**    boolean

Show grid on plot.

Default: false

**plot-x-tick-step** number

X tick step of plot.

Default: `auto`

**plot-y-tick-step** number

Y tick step of plot.

Default: `auto`

**positive-color** color

Color of positive bars.

Default: `color.green`

**negative-color** color

Color of negative bars.

Default: `color.red`

**plot-line-color** color

Color of plotted line.

Default: `color.blue`

**size** tuple

The width and height of the plot area, given as a tuple (`width`, `height`). Controls the overall size of the rendered Riemann sum and function plot.

Default: `(5, 5)`

## trapezoidal

- trapezoidal()

### trapezoidal

Illustrate the chained trapezoidal rule of a function, and optionally plot the function.

#### Parameters

```
trapezoidal(  
    fn: function ,  
    start: number ,  
    end: number ,  
    domain: array ,  
    n: number ,  
    partition: array none ,  
    transparency: number ,  
    dot-radius: number ,  
    plot: boolean ,  
    plot-grid: boolean ,  
    plot-x-tick-step: number ,  
    plot-y-tick-step: number ,  
    positive-color: color ,  
    negative-color: color ,  
    plot-line-color: color ,  
    size: tuple  
)
```

**fn**    function

The function to illustrate the chained trapezoidal rule of.

**start**    number

The starting point for the trapezoids. Used only if partition is not a valid array; otherwise, the first value of partition is used.

Default: 0

**end**    number

The ending point for the trapezoids. Used only if partition is not a valid array; otherwise, the last value of partition is used.

Default: 10

**domain**    array

Tuple of the domain of fn. If a tuple value is auto, that value is set to start/end.

Default: (auto, auto)

**n**    number

Number of trapezoids. Used only if `partition` is not a valid array; otherwise, the number of trapezoids is determined by the length of `partition`.

Default: `10`

**partition**    array or none

(optional) Array of partition points. If valid, it overrides `start`, `end`, and `n`; otherwise, equal partitions are generated from `start`, `end`, and `n`.

Default: `none`

**transparency**    number

Transparency fill of trapezoids.

Default: `40%`

**dot-radius**    number

Radius of dots.

Default: `0.15`

**plot**    boolean

Whether to add plot of the function.

Default: `true`

**plot-grid**    boolean

Show grid on plot.

Default: `false`

**plot-x-tick-step**    number

X tick step of plot.

Default: `auto`

**plot-y-tick-step**    number

Y tick step of plot.

Default: `auto`



**positive-color** `color`

Color of positive trapezoids.

Default: `color.green`

**negative-color** `color`

Color of negative trapezoids.

Default: `color.red`

**plot-line-color** `color`

Color of plotted line.

Default: `color.blue`

**size** `tuple`

The width and height of the plot area, given as a tuple (`width`, `height`). Controls the overall size of the rendered Riemann sum and function plot.

Default: `(5, 5)`