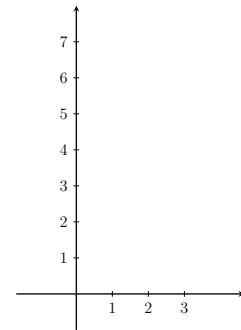


Objectives:

- Estimate areas under curves.
- Estimate the distance traveled by an object using velocity.

Example 1 How can we compute the area between the x -axis and the line $2x + 1$ between $x = 1$ and

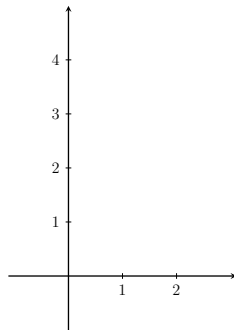
$x = 3$?



Example 2 How can we compute the area between the x -axis and the curve x^2 between $x = 0$ and $x = 2$?

We can estimate using shapes we understand such as _____.

Triangle:



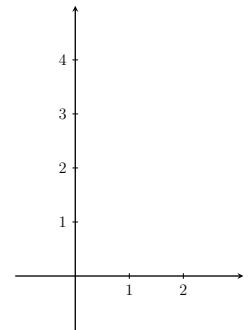
Right-Riemann sum

$n = 4$ rectangles

widths: $\Delta x =$

Endpoints:

Heights:



Right-hand sum:

Left-Riemann sum

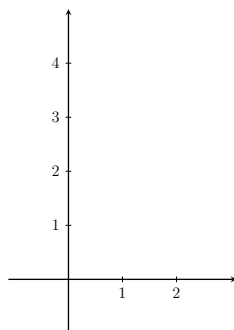
$n = 4$ rectangles

widths: $\Delta x =$

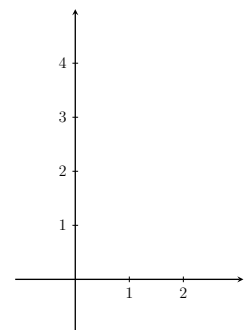
Endpoints:

Heights:

Left-hand sum:



How can we make a more accurate estimate?



To make any of these estimates more accurate, _____.

Note: We don't have to use the left or right endpoints of an interval to determine the height of each rectangle. We could come up with different endpoints by using:

Example 3 Estimate the area between the x -axis and the curve $10 - 2x$ between $x = 0$ and $x = 3$.

Let's use $n = 3$ rectangles.

Right-hand estimate:

Left-hand estimate:

Trapezoidal estimate:

Exact value:

Example 4 Velocity and distance