> # Import package for RiemannSum

> # The : surpresses the output of a command

> $with(Student[Calculus1])$:

>

> # Variables

> # := assigns 5 to the variable a

> $a := 5$

$$a := 5 \tag{1}$$

> # Functions

> # -> means "map to"

> # in essence, the left-hand side of the arrow indicates the variable of the function

> # while the right-hand side is the actual function expression

> $f := x \rightarrow a \cdot x^2 + b$

$$f := x \mapsto a\, x^2 + b \tag{2}$$

> # Notice that while Maple knows what a is, it treats b as an unknown variable

> # This allows us to more general computations with Maple since we don't have to specify numbers for everything

> $f(1)$

$$5 + b \tag{3}$$

> $f(\mathrm{sqrt}(b))$

$$6\, b \tag{4}$$

> $f(0)$

$$b \tag{5}$$

> # Make sure to include the · for multiplication

> # Otherwise, Maple will interpret ax^2 as a single variable (or unknown)

> $g := x \rightarrow ax^2 + b$

$$g := x \mapsto ax^2 + b \tag{6}$$

> $g(0)$

$$ax^2 + b \tag{7}$$

>

> # Next, we'll introduce the int command which computes the antiderivative of a given function

> # This is also a good time to introduce Maple's documentation.

> # When you need to use a command that you don't know the syntax for, you can use the search bar at the top of the screen (or Alt + S on Windows) to look up the documentation for that command.

> # To demonstrate this, let's find the antiderivative of f

> $int(f(x), x)$

$$\frac{5}{3}\, x^3 + b\, x \tag{8}$$

> # Note that this sets $c = 0$

> # We can also use the int command to compute definite integrals (ie: finding the area under a curve)

> # The 0..1 indicates that 0 and 1 are the two endpoints of the integral

> $int(f(x), x = 0..1)$

$$\frac{5}{3} + b \quad (9)$$

> # The int command has a variety of other features and options for computing integral, but the two demonstrated above are the most important for MATH 101

>

> # We continue with the RiemannSum command that, as the name suggests, computes RiemannSums of functions

> # But first, let's give b a value so that we can plot f

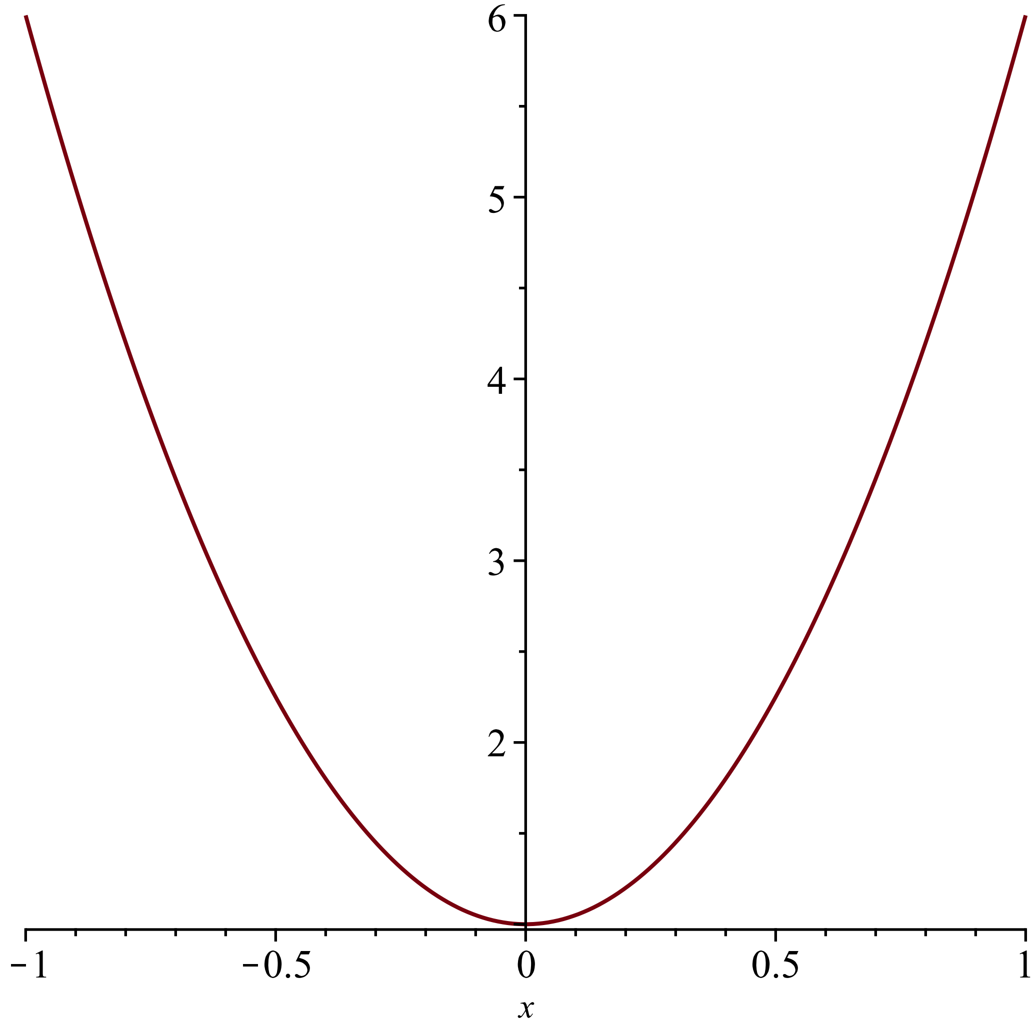
> $b := 1$

$$b := 1 \quad (10)$$

> $f(x)$

$$5x^2 + 1 \quad (11)$$

> $plot(f(x), x = -1 ..1)$



> # Now, let's look at RiemannSum

> # For the most basic version, we just need to specify the function, variable, and interval

> # This leaves all the options that we have for Riemann sums up to Maple (ie: it will just go with default values - see the documentation)

> $RiemannSum(f(x), x = 0 ..1)$

(12)

$$\frac{213}{80} \tag{12}$$

> # For example, the command above uses the midpoint method. If we want to use a different method, we need to tell Maple exactly what we want.

> $RiemannSum(f(x), x = 0..1, method = left)$

$$\frac{97}{40} \tag{13}$$

> # These values are quite close, but obviously not exactly equal

> $evalf\left(\frac{213}{80}\right)$

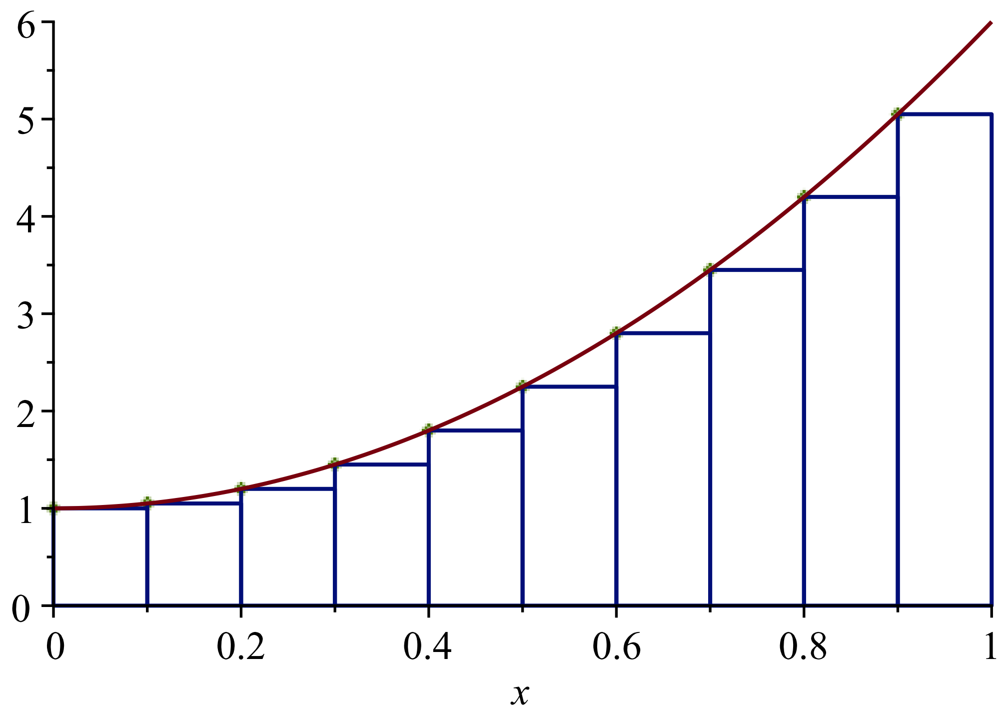
$$2.662500000 \tag{14}$$

> $evalf\left(\frac{97}{40}\right)$

$$2.425000000 \tag{15}$$

> # We can also look at what the command does visually

> $RiemannSum(f(x), x = 0..1, method = left, output = plot)$

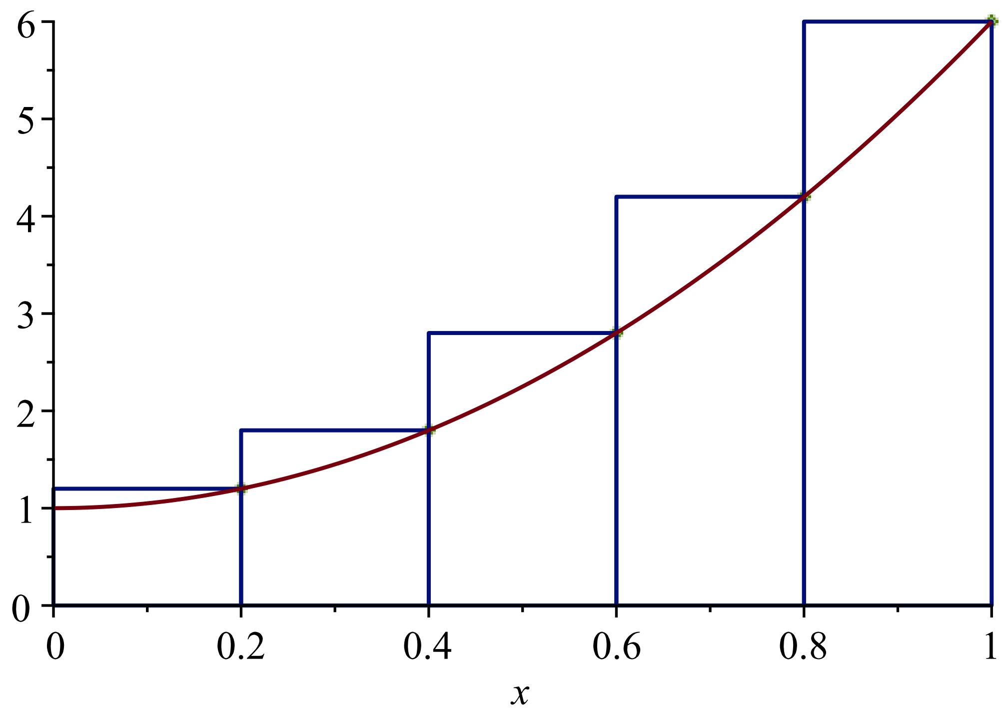


A left Riemann sum approximation of $\int_0^1 f(x)\,dx$, where $f(x) = 5x^2 + 1$ and the partition is uniform. The approximate value of the integral is 2.425000000. Number of subintervals used: 10.

> # Notice that the caption specifies that 10 partitions are used for the Riemann sum (which we can also see in the plot)

> # To use a different number of partitions, we (again) need to tell Maple how many we want

> $RiemannSum(f(x), x = 0..1, method = right, output = plot, partition = 5)$



A right Riemann sum approximation of $\int_0^1 f(x)\,dx$, where $f(x) = 5x^2 + 1$ and the partition is uniform. The approximate value of the integral is 3.200000000. Number of subintervals used: 5.

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> # Once done with the worksheet, we can export it as a pdf by going to File > Export As, and specifying pdf for the file type

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