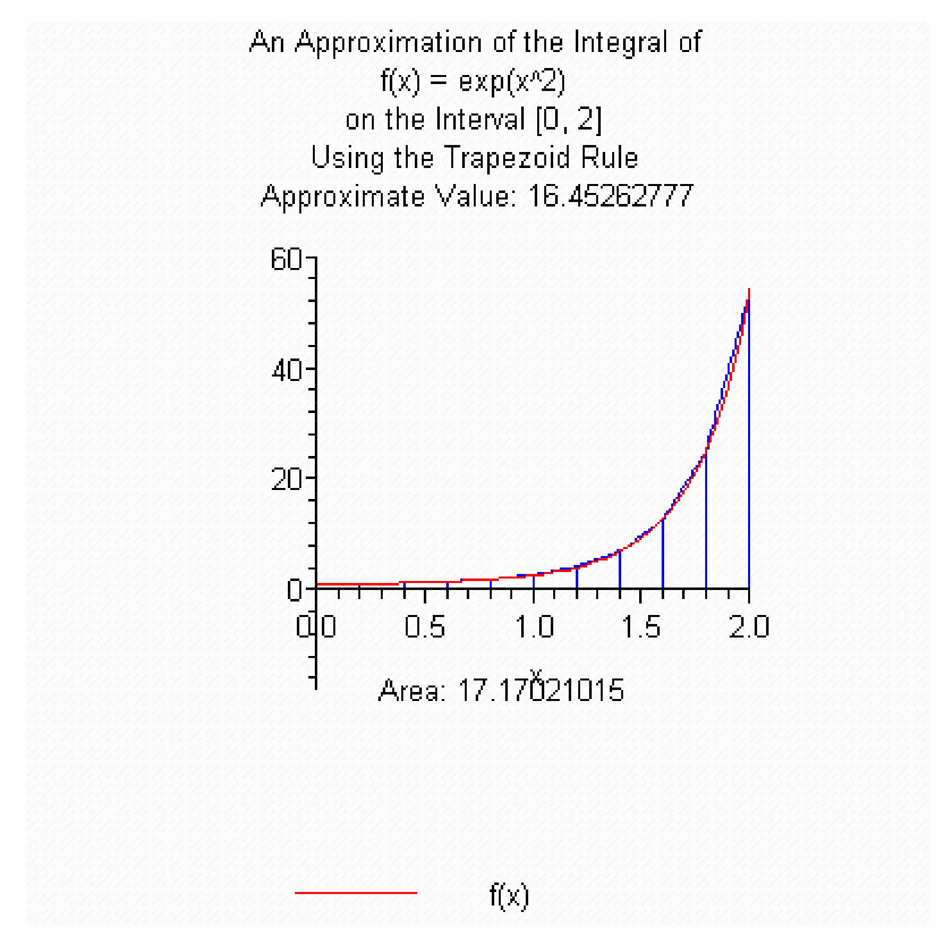
```
> with(Student[Calculus1]):
```

To search for an approximation method, help->search->enter "integral approximation". Then look at the Student1 folder->Calculus1 folder->Approximate Int. This location provides general information about Maple numerical integration. Under methods are listed various numerical approximation methods. Also in the Calculus1 folder-> Riemann Sums are listed examples of various approximations such as the right Riemann sum, etc. In the Calculus1 folder-> Trapezoid are examples using trapezoids. These examples can be cut and pasted into your Maple worksheet. Unless partition is specified, the default number of subdivisions is 10.

```
> Int(exp(x^2),x=0..2);
```

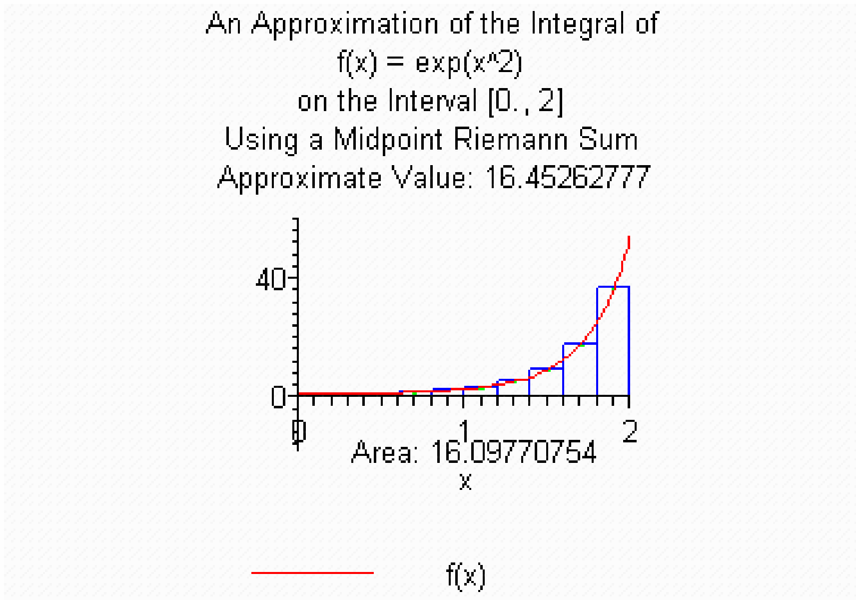
$$\int_0^2 e^{(x^2)}\,dx$$

```
> ApproximateInt(exp(x^2), x=0..2,view=[0..2,0..60],method
= trapezoid,output=plot);
```

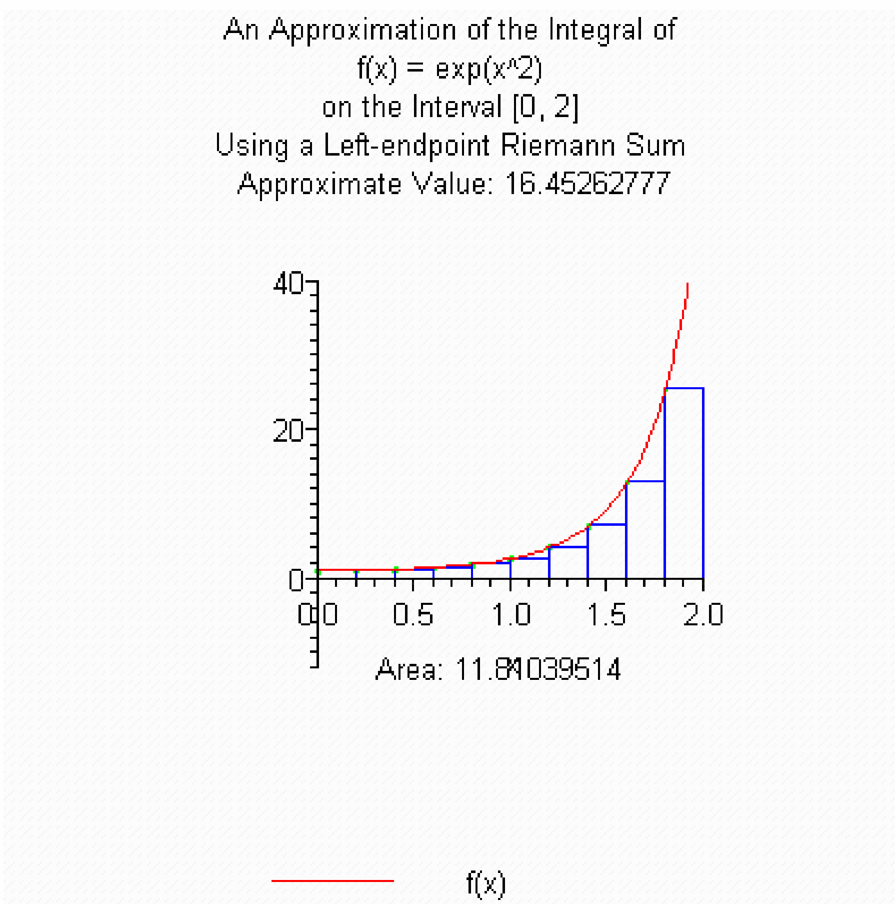


Note that actual area is stated at the top of the plot (after "Approximate Value:") and the approximate value appears immediately below the plot.

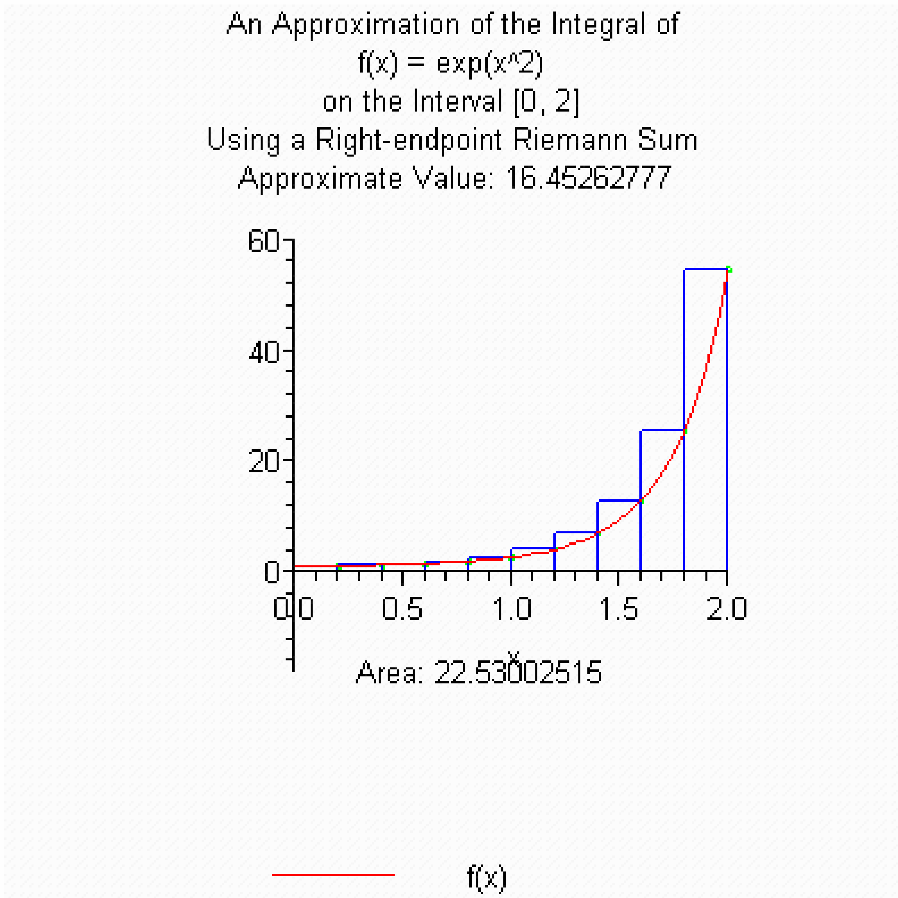
```
>
> RiemannSum(exp(x^2), x=0.0..2,view=[0..2,0..60], method =
midpoint,output=plot);
```



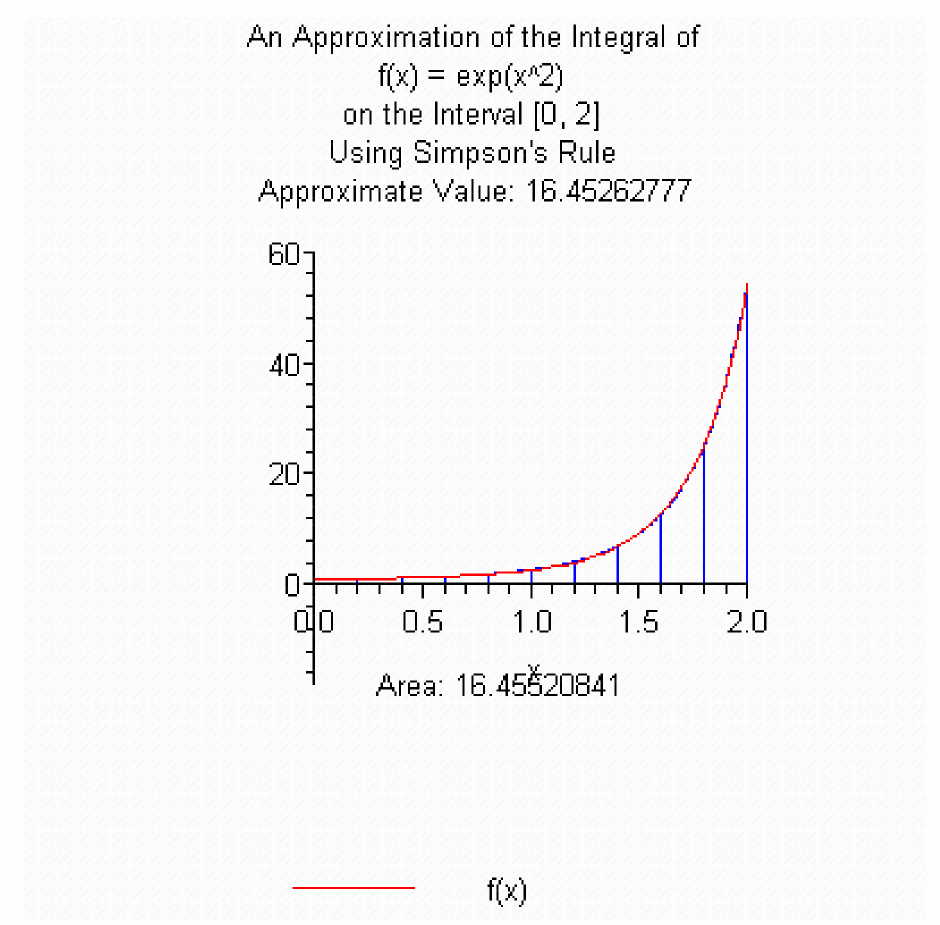
> RiemannSum(exp(x^2), x=0..2,view=[0..2,0..40], method = left, output = plot);



```
> RiemannSum(exp(x^2), x=0..2,view=[0..2,0..60],method =
right, output = plot);
```




```
> ApproximateInt(exp(x^2), x=0..2, view=[0..2,0..60],method
= simpson, output = plot,partition=10);
```




```
>
```

An interesting point is that Maple uses the same number of partitions (10) to compute Simpson's approximation as that used in the trapezoidal rule and midpoint rule. The reason is that appararently Maple's version of Simpson's approximation with 10 partitions actually assumes 20 partitions, 10 for the trapezoids and 10 more for the midpoints of each trapezoid. An alternate way to find an approximation for subdivisions with Simpson's rule is to used a weighted average of the midpoint rule result and that for the trapezoidal rule, each with 10 subdivisions.

```
> s:=(2/3)*16.09770754+(1/3)*17.17021015;
```

$$s := 16.45520841$$

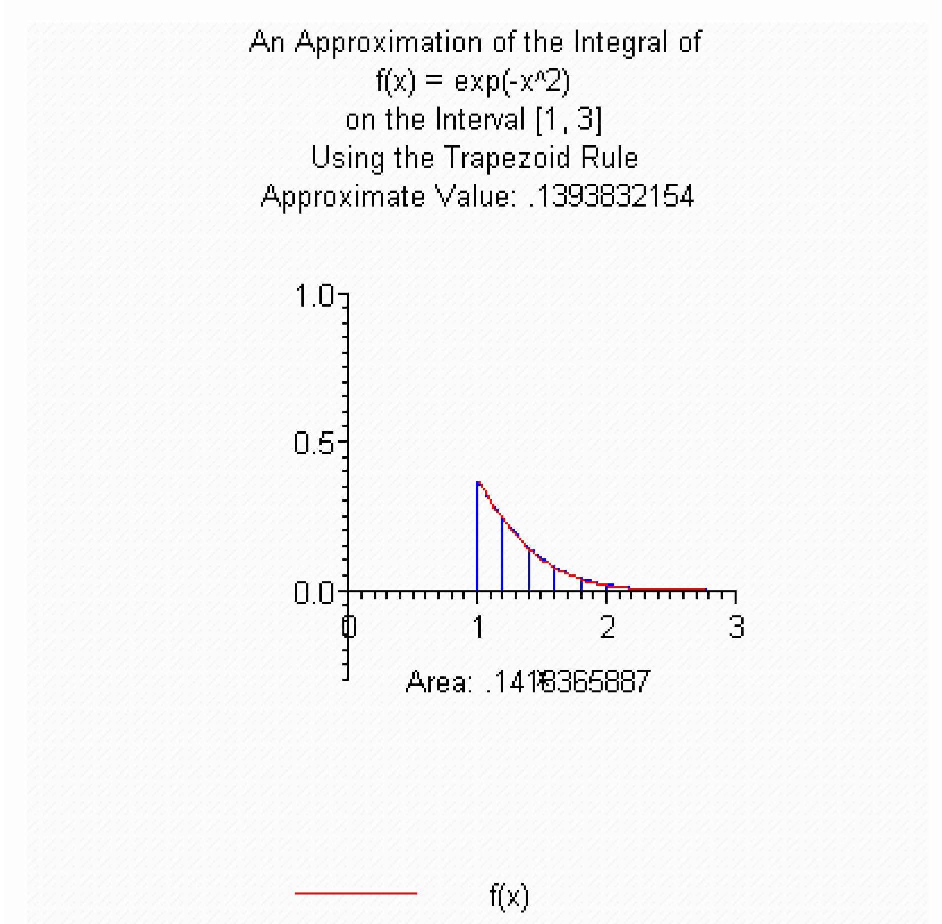
```
>
```

Note that the results for Simpson's rule are the same regardless which option is used.

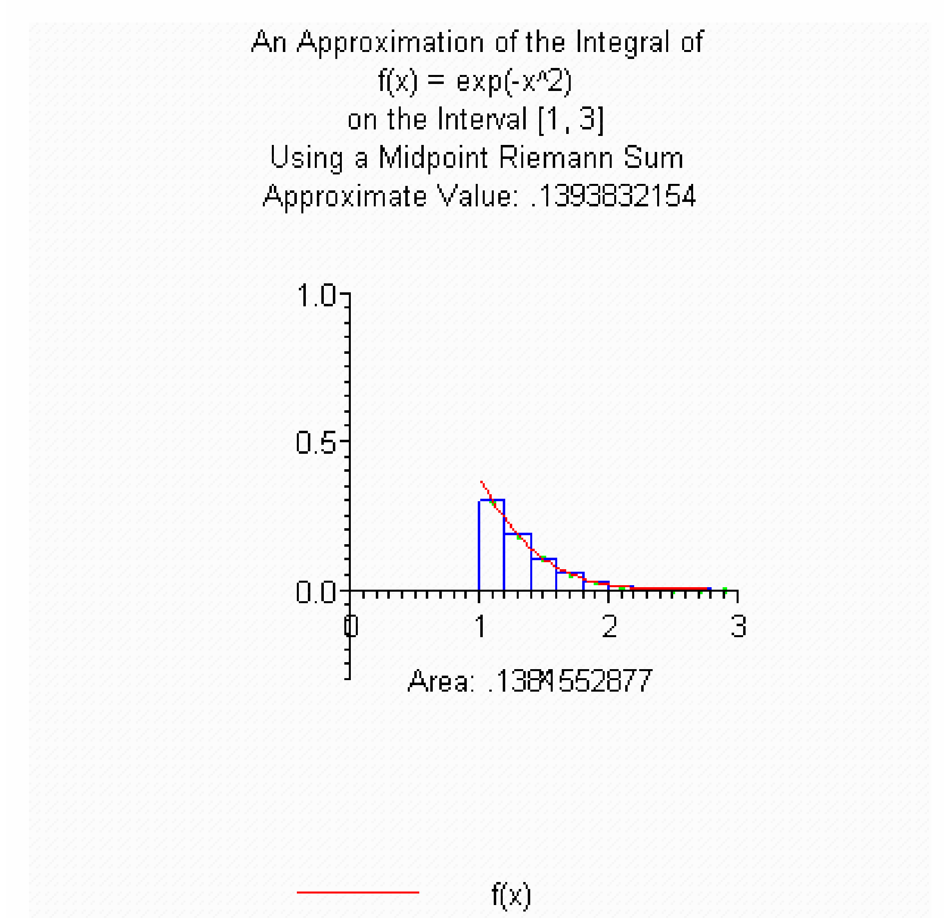
```
> Int(exp(-x^2),x=1..3);
```

$$\int_{1}^{3} e^{(-x^2)}\, dx$$

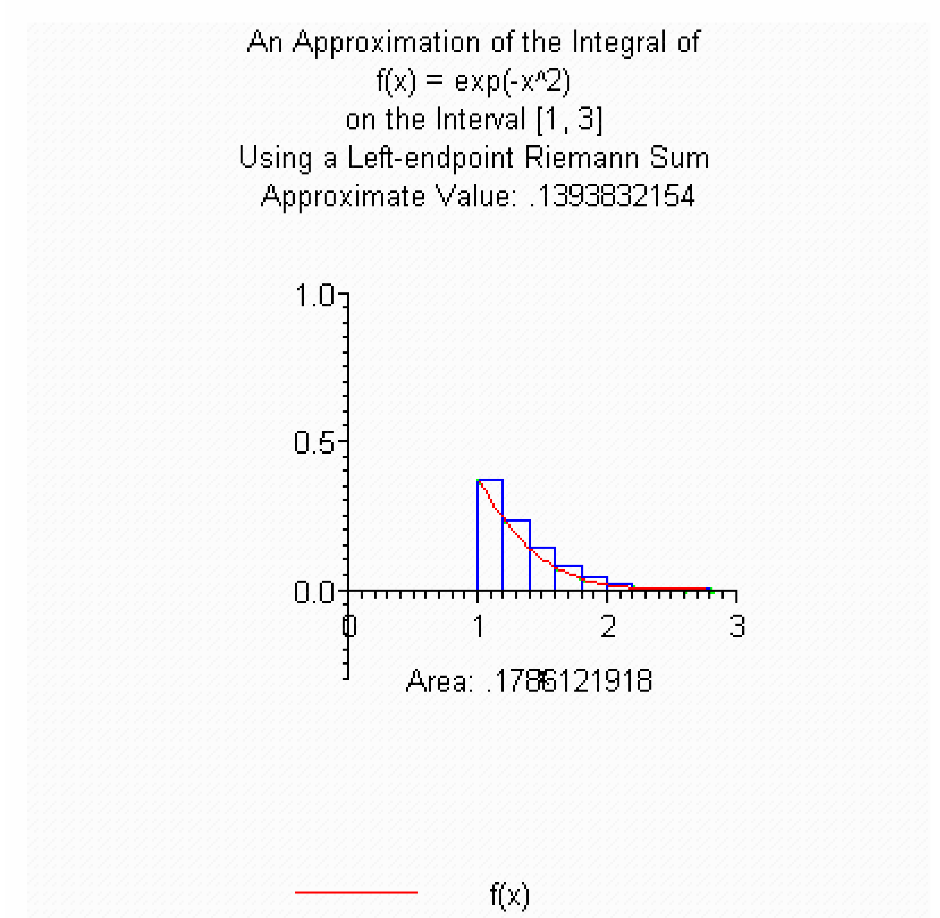
```
> ApproximateInt(exp(-x^2), x=1..3,view=[0..3,0..1],method
= trapezoid,output=plot);
```



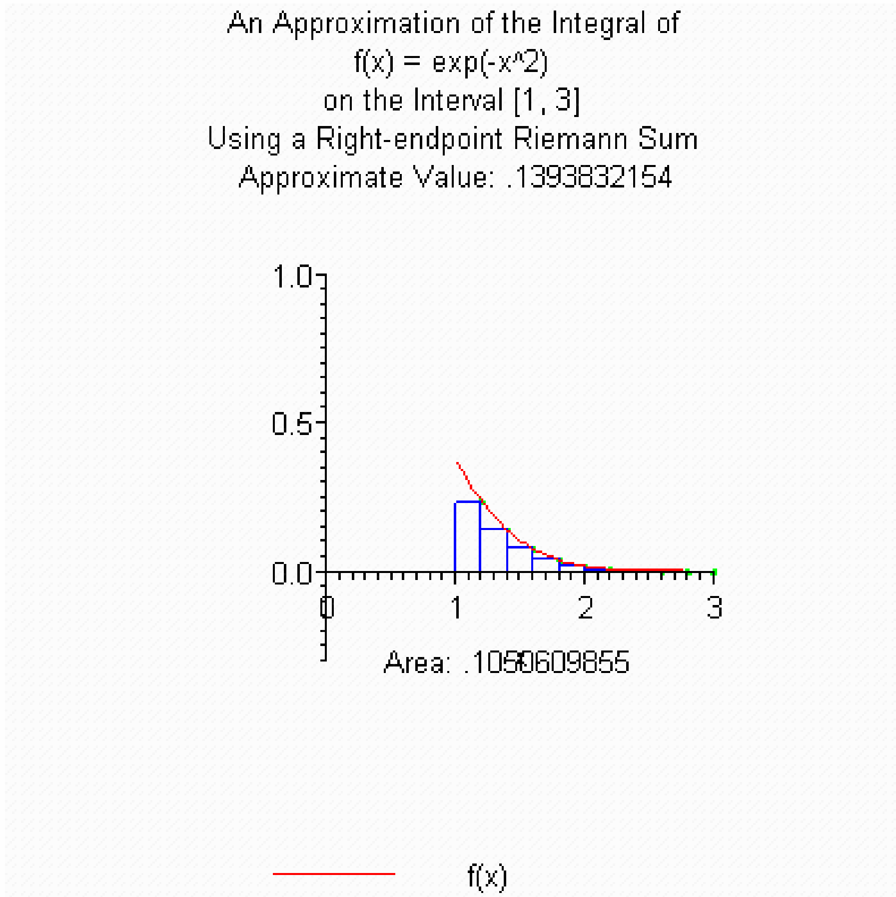

```
> RiemannSum(exp(-x^2), x=1..3,view=[0..3,0..1], method =
midpoint,output=plot);
```



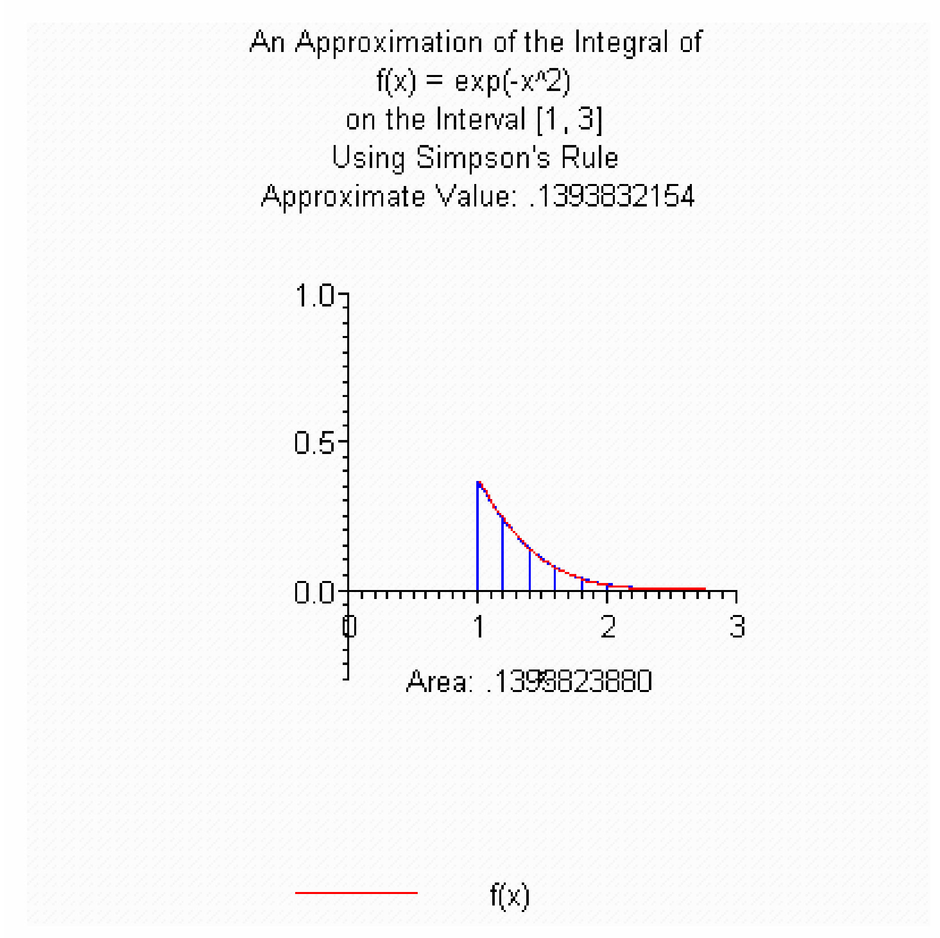

```
> RiemannSum(exp(-x^2), x=1..3,view=[0..3,0..1], method =
left, output = plot);
```




```
> RiemannSum(exp(-x^2), x=1..3,view=[0..3,0..1], method =
right, output = plot);
```




```
> ApproximateInt(exp(-x^2), x=1..3, view=[0..3,0..1],method
= simpson, output = plot,partition=10);
```



>

Note that Simpson's rule is accurate to 5 decimal places. Not bad!