int or Int - Definite and Indefinite Integration

Calling Sequences

int(expr, x)
Int(expr, x)
int(expr, x=a..b, ...)
Int(expr, x=a..b, ...)

Parameters

`expr` - an algebraic expression, the integrand
`x` - a name
`a, b` - interval on which integral is taken
`...` - options

Description

- The function **int** computes an indefinite or definite integral of the expression **expr** with respect to the variable **x**. The name **integrate** is a synonym for **int**.
- Indefinite integration is performed if the second argument **x** is a name. Note that no constant of integration appears in the result. Definite integration is performed if the second argument is of the form **x=a..b** where **a** and **b** are the endpoints of the interval of integration.
- If Maple cannot find a closed form expression for the integral, the function call itself is returned.
- The capitalized function name **Int** is the inert version of the **int** function, which simply returns unevaluated. The prettyprinter understands **Int** to be equivalent to **int** for printing purposes but formats the integral sign in black to visually distinguish the inert case. In this form, **expr** can actually be a procedure which can be integrated numerically.

Examples

```
> int( sin(x), x );
```

$$-\cos(x)$$

```
> int( sin(x), x=0..Pi );
```

$$2$$

```
> int( x/(x^3-1), x );
```

$$\frac{1}{3}\ln(x-1)-\frac{1}{6}\ln(x^2+x+1)+\frac{1}{3}\sqrt{3}\arctan\left(\frac{1}{3}(2x+1)\sqrt{3}\right)$$

```
> int(sin(x),x=0..pi);
```

$$-\cos(\pi)+1$$

```
> Int((cos(x))^2,x);
```

$$\int \cos(x)^2\,dx$$

```
> int((cos(x))^2,x);
```

$$\frac{1}{2}\cos(x)\sin(x)+\frac{1}{2}x$$

Note that for the previous integral when done analytically, we may get what appears to be a different result, but through trigonometric identities it can be shown to be identical to the result above.

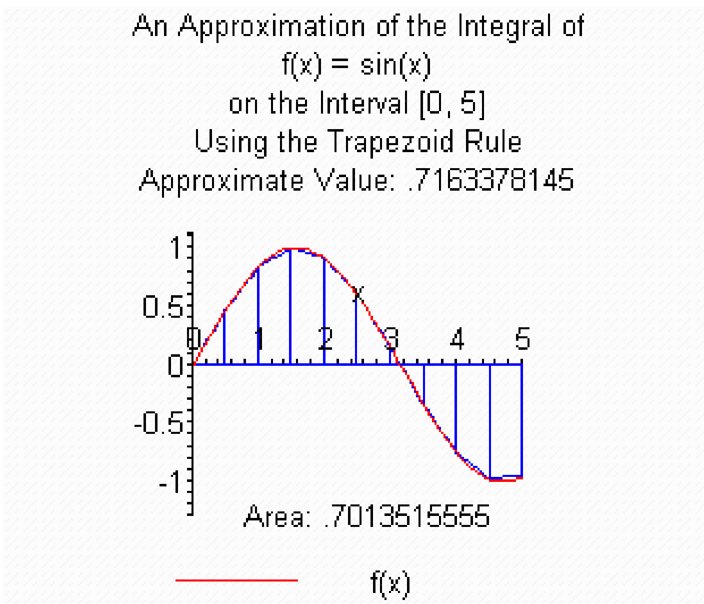
```
> Int(cos(x^2),x);
```

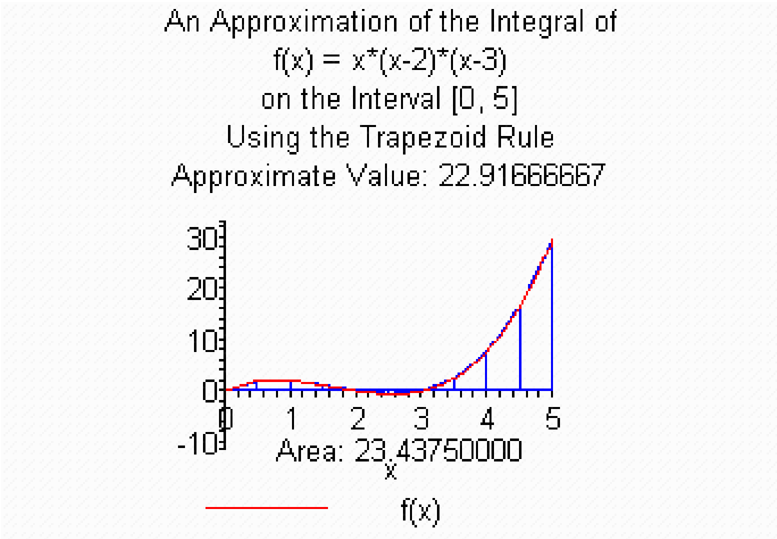
$$\int \cos(x^2)\, dx$$

\>

The following material indicates how to perform numerical integration.

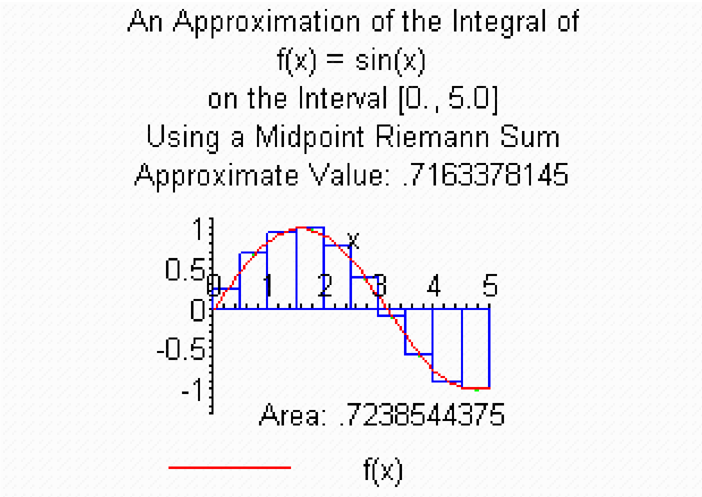
```
> with(Student[Calculus1]):
>
ApproximateInt(sin(x), x=0..5, method =
trapezoid,output=plot);
ApproximateInt(x*(x - 2)*(x - 3), x=0..5, method =
trapezoid, output = plot);
```



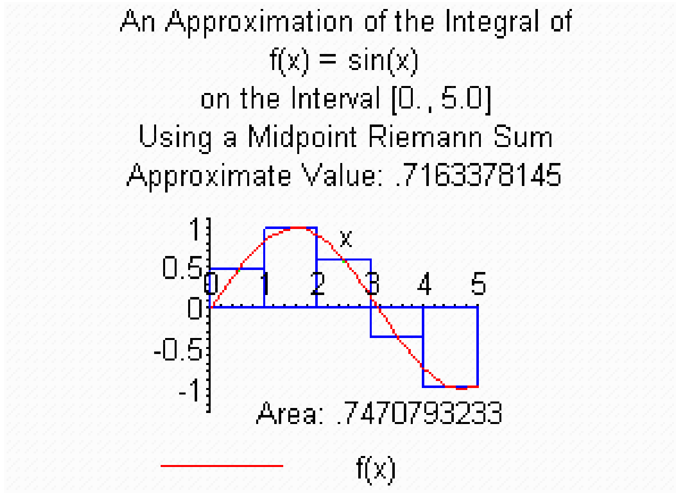


Note that actual area is stated at the top of the plot (after "Approximate Value:") and the approximate value appears immediately below the plot.

```
>  RiemannSum(sin(x), x=0.0..5.0, method =
midpoint,output=plot);
```




```
> RiemannSum(sin(x), x=0.0..5.0, method =
midpoint,output=plot,partition=5);
```




```
>
```

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.

The following material addresses center of mass computations using integration results.

For a function f(x) the goal is to find the center of mass over a specified domain.
My is the moment about the y-axis, Mx is the moment about the x-axis, and m is the total mass.
f(x)=sin(x) and (xbar,ybar) represents the center of mass.

```
> m:=int(sin(x),x=0..Pi);
```

$$m := 2$$

```
> My:=int(x*sin(x),x=0..Pi);
```

$$My := \pi$$

```
> Mx:=int((1/2)*(sin(x))^2,x=0..Pi);
```

$$Mx := \frac{\pi}{4}$$

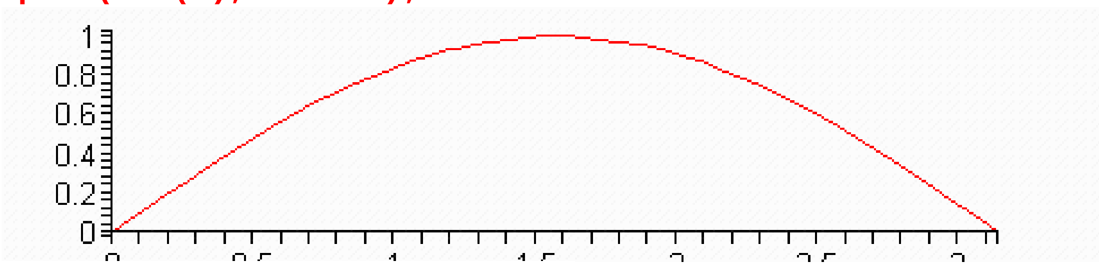
```
> xbar:=My/m;
```

$$xbar := \frac{\pi}{2}$$

```
> ybar:=Mx/m;
```

$$ybar := \frac{\pi}{8}$$

```
> plot(sin(x),x=0..Pi);
```



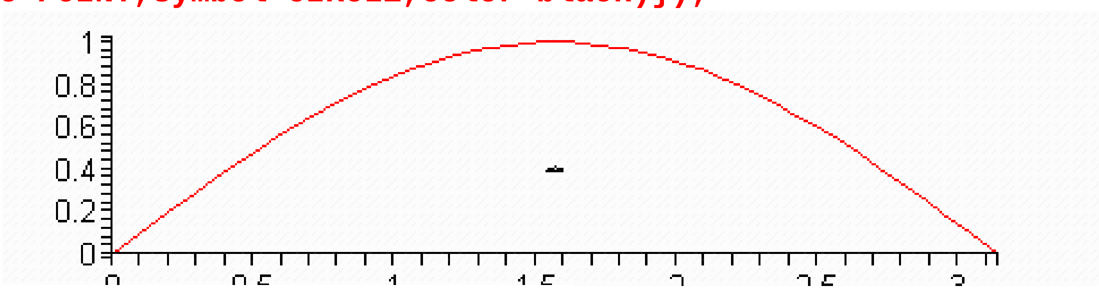
The center of mass is at the following point A.

```
> A:=point([xbar,ybar]);
```

$$A := point\left(\left[\frac{\pi}{2}, \frac{\pi}{8}\right]\right)$$

The following graph indicates the center of mass at the circle.

```
>
plots[display]({plot(sin(x),x=0..Pi),plot([[xbar,ybar]],sty
le=POINT,symbol=CIRCLE,color=black)});
```



The following graph labels the center of mass.

```
>
p:=plot(sin(x),x=0..Pi):q:=plot([[xbar,ybar]],style=POINT,s
ymbol=CIRCLE,color=black):
> delta:=.1:
t1:=textplot([xbar,ybar+delta,"(xbar,ybar)"],align=ABOVE):
> display({p,q,t1});
```