

# Integral

`integral(f,x)` returns the integral of  $f$  with respect to  $x$ .

```
integral(x^2,x)
```

$$\frac{1}{3}x^3$$

Extend the argument list for multiple integrals.

```
f = x y
integral(f,x,y)
```

$$\frac{1}{4}x^2y^2$$

`defint(f,x,a,b)` computes the definite integral of  $f$  with respect to  $x$  evaluated from  $a$  to  $b$ . The argument list can be extended for multiple integrals. The following example computes the integral of  $f = x^2$  over the domain of a semicircle. For each  $x$  along the abscissa,  $y$  ranges from 0 to  $\sqrt{1-x^2}$ .

```
defint(x^2, y, 0, sqrt(1 - x^2), x, -1, 1)
```

$$\frac{1}{8}\pi$$

Alternatively, `eval` can be used to compute a definite integral step by step.

```
I = integral(x^2,y)
I = eval(I,y,sqrt(1 - x^2)) - eval(I,y,0)
I = integral(I,x)
eval(I,x,1) - eval(I,x,-1)
```

$$\frac{1}{8}\pi$$

Here is a useful trick. Integrals involving sine and cosine can often be solved using exponentials. For example, the definite integral

$$\int_0^{2\pi} (\sin^4 t - 2 \cos^3(t/2) \sin t) dt$$

can be solved as follows.

```
f = sin(t)^4 - 2 cos(t/2)^3 sin(t)
f = expform(f)
defint(f, t, 0, 2 pi)
```

$$\frac{3}{4}\pi - \frac{16}{5}$$