

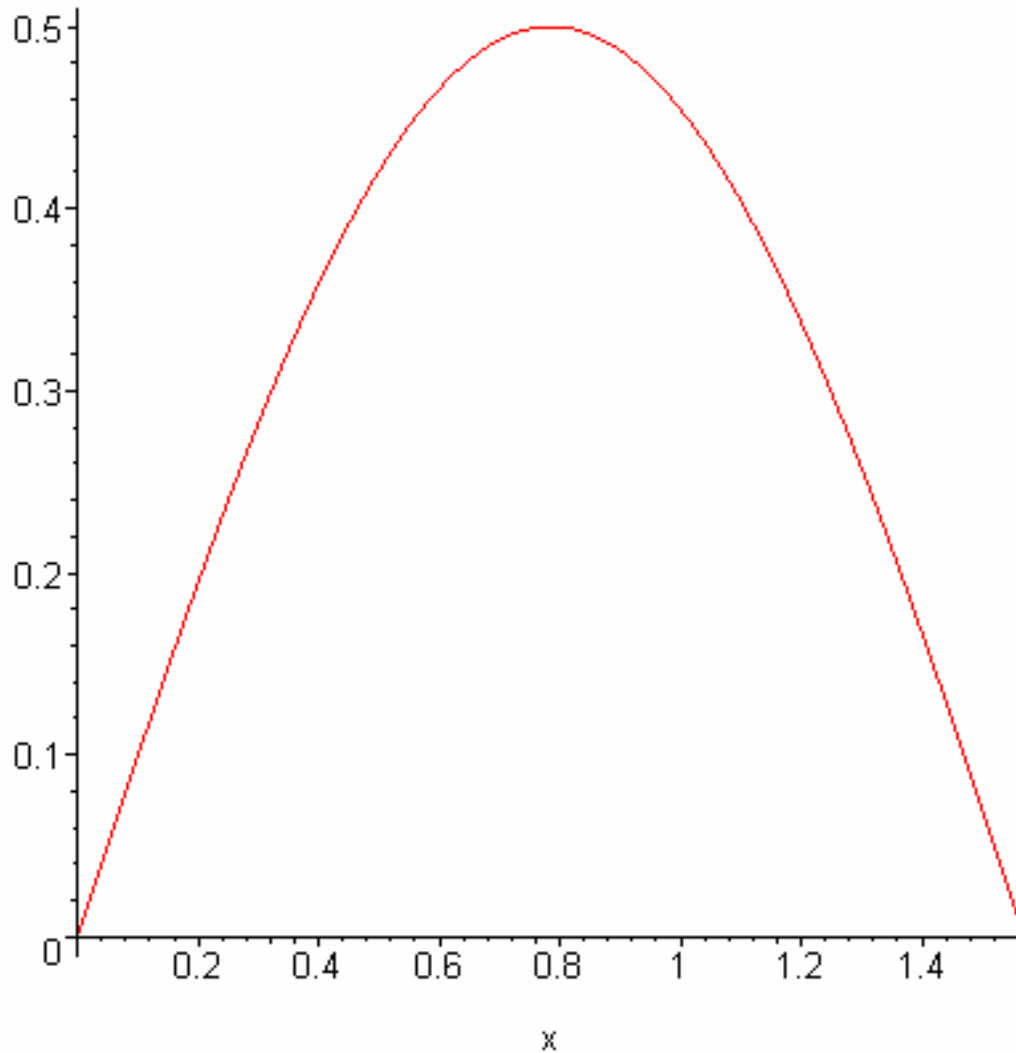
MAPLE demo 09 July 2007

On integration and finding volumes, surface areas and lengths using MAPLE

Some integration examples. #18, p. 436

```
> y:=x->sin(x)*cos(x);  
y := x → sin(x) cos(x)
```

```
> plot(y(x), x=0..Pi/2);
```



```
> V:=int(Pi*y(x)^2, x=0..Pi/2);
```

$$V := \frac{\pi^2}{16}$$

```
> evalf(%);
```

0.6168502752

```
> Int(Pi*y(x)^2, x=0..Pi/2);
```

$$\int_0^{\frac{\pi}{2}} \pi \sin(x)^2 \cos(x)^2 dx$$

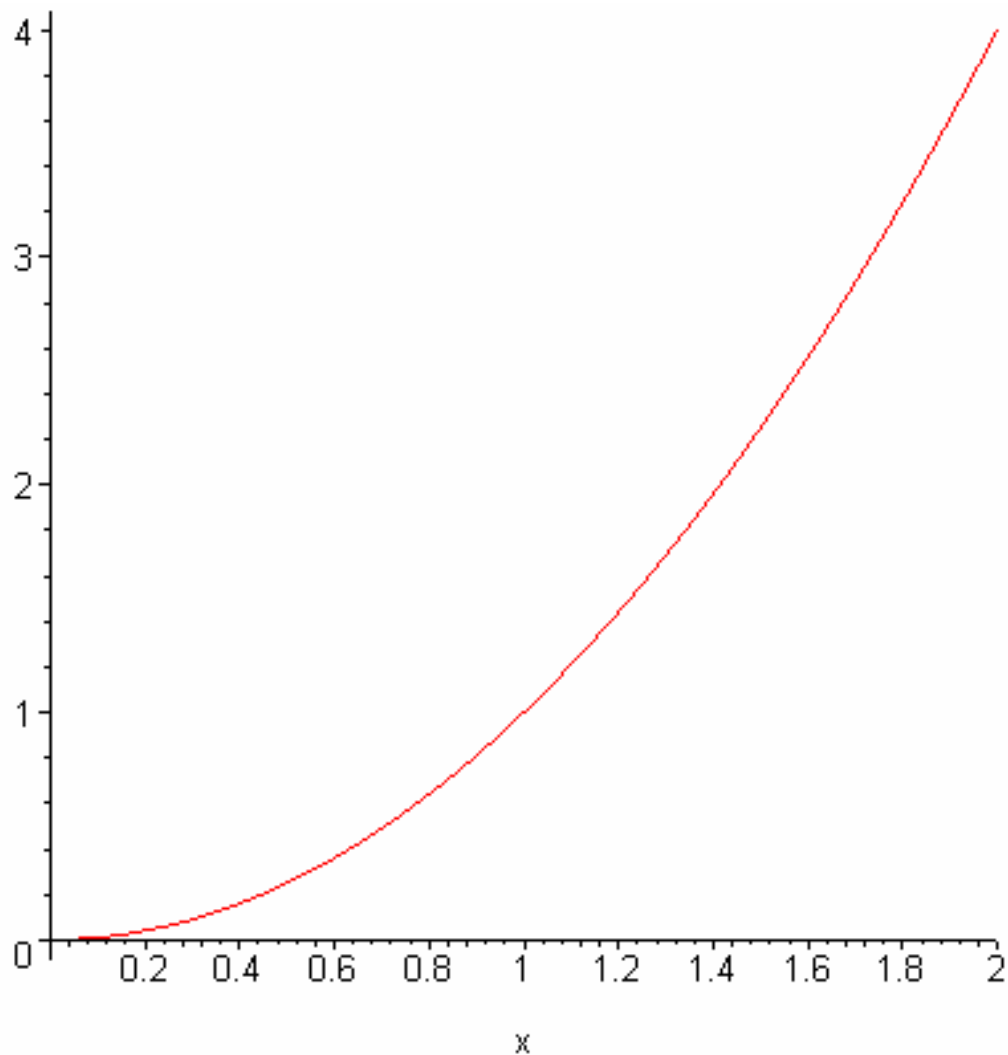
Int gives the "inert" form of the integral, i.e. it does not work it out. int works out the integral exactly if possible. Use evalf to get the floating point version of the answer.

e.g. #2, p. 474

```
> y:=x->x^2;
```

```
y := x → x2
```

```
> plot(y(x), x=0..2);
```



Find arclength of the curve.

```
> D(y);
```

```
x → 2x
```

> `int(sqrt(1+D(y)(x)^2),x=0..2);`

$$\sqrt{17} - \frac{1}{4} \ln(-4 + \sqrt{17})$$

> `evalf(%);`
4.646783762

Now do it as an integral with respect to y.

> `x:=y->y^(1/2);`

$$x := y \rightarrow \sqrt{y}$$

> `int(sqrt(D(x)(y)^2+1),y=0..4);`

$$\sqrt{17} + \frac{1}{8} \ln(33 + 8\sqrt{17})$$

> `evalf(%);`
>
4.646783763

Same answer.

Now find surface area of revolution about x-axis.

First do it as an integral with respect to x.

> `int(2*Pi*x^2*sqrt(1+D(y)(x)^2),x=0..2);`

$$-\sqrt{\pi} \left(\frac{\sqrt{\pi}}{128} - \frac{1}{64} \left(\frac{1}{2} - 6 \ln(2) \right) \right) \sqrt{\pi} - \frac{33 \sqrt{\pi} \sqrt{17}}{8} + \frac{1}{32} \sqrt{\pi} \ln \left(\frac{1}{2} + \frac{\sqrt{17}}{8} \right)$$

> `evalf(%);`
53.22596526

Now as an integral with respect to y.

> `int(2*Pi*y*sqrt(D(x)(y)^2+1),y=0..4);`

$$\frac{33 \pi \sqrt{17}}{8} - \frac{1}{64} \pi \ln(33 + 8\sqrt{17})$$

> `evalf(%);`
53.22596527

Answers are the same except in the last decimal place. I do not know why the numbers are not the same.