>
MAPLE demo on Simpsons rule

```
> f:=t->t^3+t;
```

$$f := t \to t^3 + t$$

```
> A:=int(f(x),x=0..1);
```

$$A := \frac{3}{4}$$

```
> with(student);
```

[D, *Diff*, *Doubleint*, *Int*, *Limit*, *Lineint*, *Product*, *Sum*, *Tripleint*, *changevar*, *completesquare*, *distance*, *equate*, *integrand*, *intercept*, *intparts*, *leftbox*, *leftsum*, *makeproc*, *middlebox*, *middlesum*, *midpoint*, *powsubs*, *rightbox*, *rightsum*, *showtangent*, *simpson*, *slope*, *summand*, *trapezoid*]

```
> A1:=simpson(f(x),x=0..1,4);
```

$$A1 := \frac{1}{6} + \frac{1}{3}\left(\sum_{i=1}^{2}\left(\left(\frac{i}{2} - \frac{1}{4}\right)^3 + \frac{i}{2} - \frac{1}{4}\right)\right) + \frac{1}{6}\left(\sum_{i=1}^{1}\left(\frac{1}{8}i^3 + \frac{1}{2}i\right)\right)$$

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

$$0.7500000000$$

Simpsons evaluates this one exactly since error estimate is zero.

Lets try different example.

```
> g:=x->exp(-x^2);
```

$$g := x \to e^{(-x^2)}$$

```
> A:=int(g(x),x=0..2);
```

$$A := \frac{1}{2}\operatorname{erf}(2)\sqrt{\pi}$$

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

$$0.8820813910$$

```
> A1:=simpson(g(x),x=0..2,4);
```

$$A1 := \frac{1}{6} + \frac{1}{6}e^{(-4)} + \frac{2}{3}\left(\sum_{i=1}^{2} e^{(-(i-1/2)^2)}\right) + \frac{1}{3}\left(\sum_{i=1}^{1} e^{(-i^2)}\right)$$

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

$$0.8818124254$$

```
> E1:=evalf(abs(A1-A));
```

$$E1 := 0.0002689656$$

```
> A2:=evalf(simpson(g(x),x=0..2,8));
```

$$A2 := 0.8820655104$$

```
> E2:=evalf(abs(A2-A));
```

$$E2 := 0.0000158806$$

```
> E1/E2;
```

$$16.93674043$$

Comparison with trapezoid rule.

```
> B1:=evalf(trapezoid(g(x),x=0..2,4));
```

$$B1 := 0.8806186342$$

```
> ET1:=evalf(abs(B1-A));
```

$$ET1 := 0.0014627568$$

```
> B2:=evalf(trapezoid(g(x),x=0..2,8));
```

$$B2 := 0.8817037914$$

```
> ET2:=evalf(abs(B2-A));
```

$$ET2 := 0.0003775996$$

Trapezoid worse than Simpson for same n and also decreases less rapidly.

Demo of partial fraction expansions.

```
> help(parfrac);
> f:=x->(3*x^2+x+4)/(x*(x^2+1));
```

$$f := x \rightarrow \frac{3\,x^2 + x + 4}{x\,(x^2 + 1)}$$

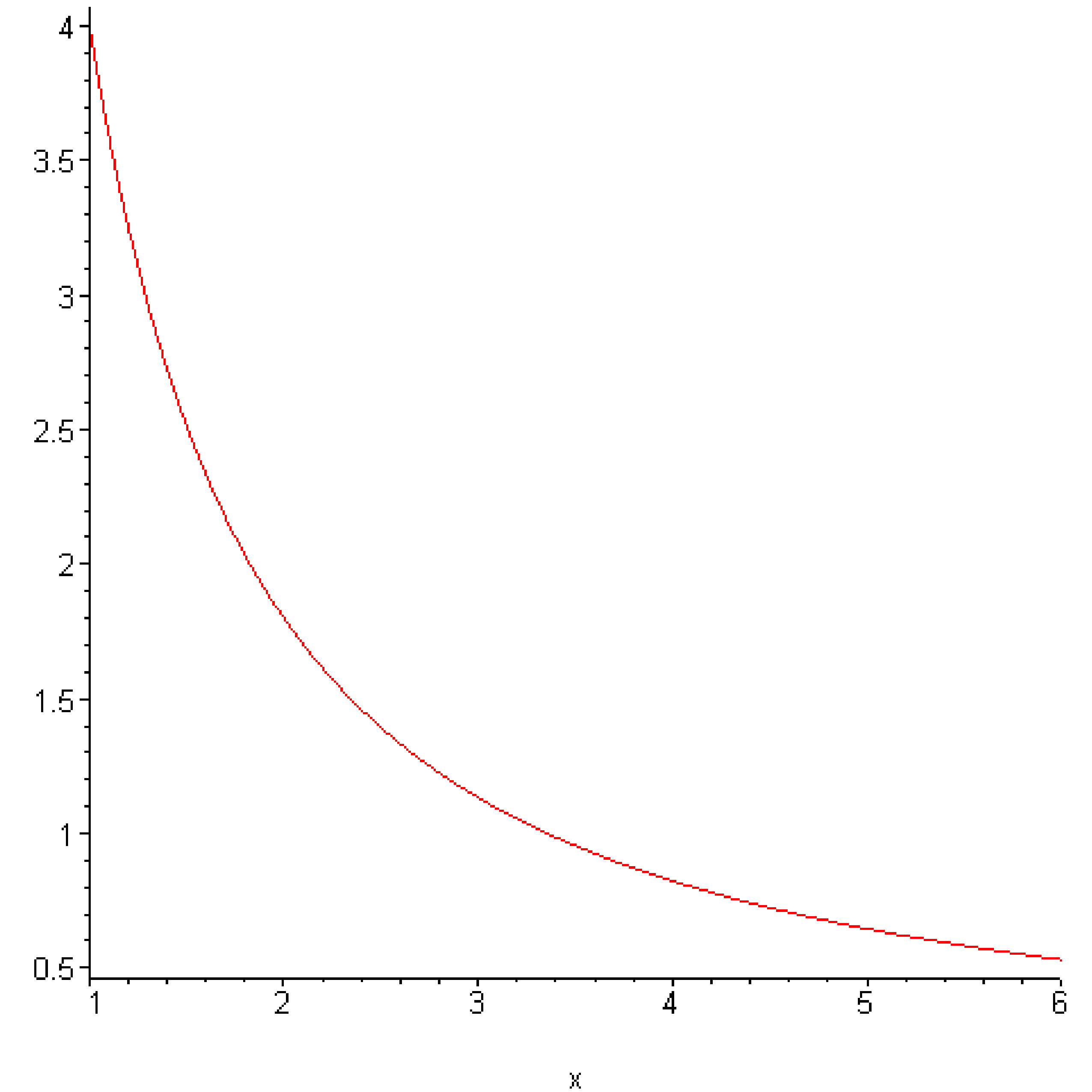
```
> f(2);
```

$$\frac{9}{5}$$

```
> f(3);
```

$$\frac{17}{15}$$

```
> plot(f(x),x=1..6);
```




```
> convert(f(x),parfrac,x);
```

$$\frac{4}{x} + \frac{-x+1}{x^2+1}$$

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

$$-\frac{1}{2}\ln(x^2+1) + \arctan(x) + 4\ln(x)$$

```
>
```