

Appendix D

Some Maple Commands

In this appendix we will indicate the syntax for Maple commands corresponding to some of the ideas discussed in the notes.

Detailed descriptions and examples of any of these commands can be found by entering Maple or Xmaple and typing `help(command-name);`, e.g. `help(sum);` or `help(limit);`. If this produces a syntax error, try putting the command name in back-quotes (`'`), e.g. `help('@');`.

π	<code>Pi;</code>
∞	<code>infinity;</code>
x^y	<code>x^y;</code>
$\sum_{j=a}^b f(j)$	<code>sum(f(j),j=a..b);</code>
$\int f(x)dx$	<code>int(f(x),x);</code>
$\int_a^b f(x)dx$	<code>int(f(x),x=a..b);</code>
$f'(x)$	<code>diff(f(x),x);</code>
$f^{(n)}(x)$	<code>diff(f(x),x\\$n);</code>
f'	<code>D(f);</code>
$f^{(n)}$	<code>(D@@n)(f)</code>

$$\begin{aligned} \lim_{x \rightarrow a} f(x) & \quad \text{limit}(f(x), x=a); \\ \lim_{x \rightarrow a^+} f(x) & \quad \text{limit}(f(x), x=a, \text{right}); \\ \lim_{x \rightarrow a^-} f(x) & \quad \text{limit}(f(x), x=a, \text{left}); \\ f \circ g & \quad f@g; \end{aligned}$$

Some useful Maple commands are

`%` A name for the last line calculated by Maple.
`simplify(expression);` simplify *expression*.
`factor(expression);` factor *expression*.
`evalf(expression);` express *expression* as a number in decimal notation.
 (Here *expression* should represent a number.)
`quit;` Exit from Maple.

EXAMPLES

> `sum(j^2, j=1..n);`

$$\frac{1}{3}(n+1)^3 - \frac{1}{2}(n+1)^2 + \frac{1}{6}n + \frac{1}{6}$$

> `simplify(%);`

$$\frac{1}{3}n^3 + \frac{1}{2}n^2 + \frac{1}{6}n$$

> `factor(%);`

$$\frac{1}{6}n(n+1)(2n+1)$$

> `limit((n^2 + 2*n + 3)/(4*n^2 + 5*n - 1), n=infinity);`

$$\frac{1}{4}$$

> `4*int(1/(1+x^2), x=0..1);`

$$\pi$$

> `evalf(%);`

$$3.141592654$$

> `D(f@g);`

$$D(f)@g D(g)$$

```
> limit( exp(1/x),x=0,left);
```

$$0$$

```
> limit( exp(1/x),x=0);
```

undefined

To solve the system of equations $x^2 + y^2 = 25$, $x + y = 1$ for the unknowns x and y .

```
> solve({x^2 + y^2 = 25, x+y=1},{x,y});
```

$$\{y = -3, x = 4\}, \{y = 4, x = -3\}$$

To introduce a simple name for a complicated expression.

```
> f1 := 3*x^4 + 5*x^2 + 3;
```

$$f1 := 3x^4 + 5x^2 + 3$$

```
> diff(f1,x);
```

$$12x^3 + 10x$$

```
> diff(f1,x$2);
```

$$36x^2 + 10$$

To introduce a simple name for a function.

```
> g1 := (x -> (x+1)/(x-1));
```

$$g1 := x \rightarrow \frac{1+x}{x-1}$$

```
> g1(2);
```

$$3$$

```
> (g1@g1)(t);
```

$$\frac{1 + \frac{1+t}{-1+t}}{\frac{1+t}{-1+t} - 1}$$

```
> simplify(%);
```

$$t$$

In Xmaple you can draw graphs of functions by using the `plot` command. If f is a function, and a , b , c , d are numbers with $a < b$ and $c < d$, then the command

`plot(f(x),x=a..b,c..d)`
 will cause the part of the graph of f in the box $B(a,b;c,d)$ to be drawn. The command
`> plot(x^3/(1-x^2), x=-4..4, -4..4);`
 makes the plot in figure a.

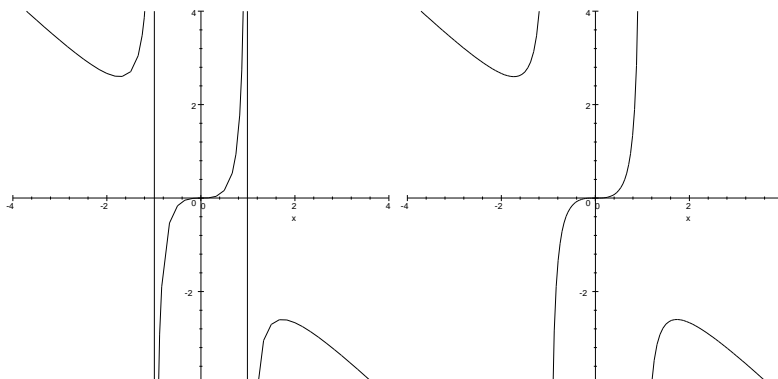


Figure a.

Figure b.

The two vertical lines appearing in the plot are not part of the graph, but are due to the fact that the points ± 1 are not in the the domain of the function being plotted. We can get a better plot of the graph by adding the statement `discont=true` to the plot command, to warn Maple that the function being plotted is discontinuous. (Actually, according to our definitions, this function is not discontinuous, because it is continuous at every point of its domain.)

The command

`> plot(x^3/(1-x^2), x=-4..4, -4..4, discont=true);`
 makes the plot in figure b.