Maple - Seminar 1

EXAMPLE 1: Find all real solutions to the equation $x^x = \left(\frac{3}{4}\right)^{\left(\frac{3}{4}\right)}$.

```
> restart;
> eq:=x^x=(3/4)^(3/4);
```

$$eq := x^x = \frac{3^{(3/4)}\,4^{(1/4)}}{4}$$

Symbolical solution.

```
> solve(eq,x);
```

$$\frac{3}{4}\,\frac{-2\ln(2)+\ln(3)}{\mathrm{LambertW}\left(-\frac{3}{2}\ln(2)+\frac{3}{4}\ln(3)\right)}$$

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

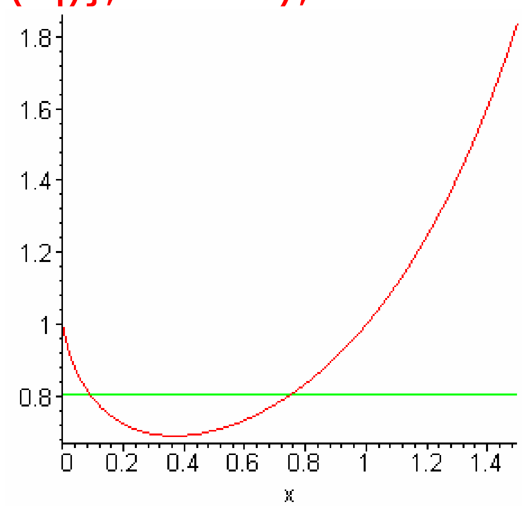
$$0.7499999995$$

Numerical solution. We use the plot command to assess the number of all real solutions.

```
> fsolve(eq,x);
```

$$0.7500000000$$

```
> plot({lhs(eq),rhs(eq)},x=0..1.5);
```




```
> fsolve(eq,x=0..0.2); fsolve(eq,x=0.2..1);
```

$$0.08932454111$$

$$0.7500000000$$

EXAMPLE 2: Display the graphic representation of the function $g(x) = x^{\left(\frac{1}{3}\right)}$ and of its first derivative in the same drawing.

```
> restart;
> g:=x->surd(x,3);
```

$$g := x \to \mathrm{surd}(x, 3)$$

```
> convert(g(x),power);
```

$$x^{(1/3)}$$

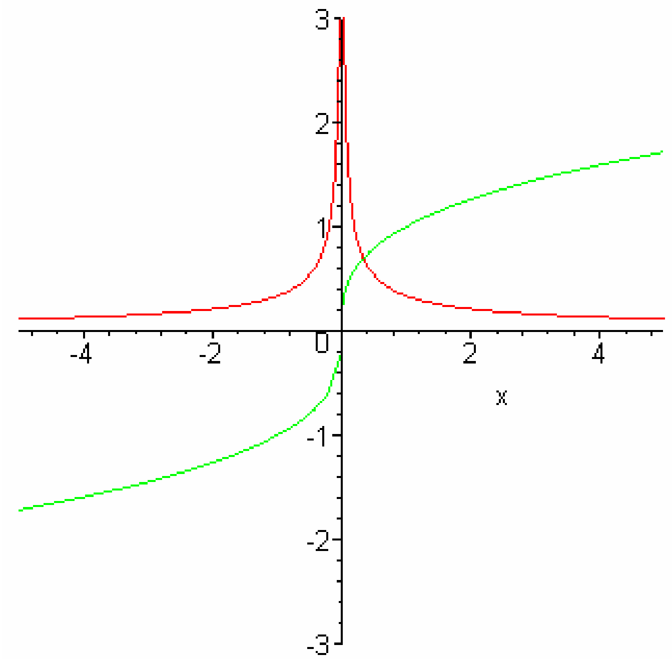
```
> D(g);
```

$$x \to \frac{1}{3}\,\frac{\mathrm{surd}(x, 3)}{x}$$

```
> convert(D(g)(x),power);
```

$$\frac{1}{3\,x^{(2/3)}}$$

```
> plot({g(x),D(g)(x)},x,view=[-5..5,-3..3]);
```




```
> limit(D(g)(x),x=0);
```

$$\infty$$

EXAMPLE 3: Solve the equation $x[x]-5x+7=0$ in real unknown x where $[x]$ denote the greatest integer less than or equal to a number x, the so called floor function of x.

```
> restart;
> eq:=x*floor(x)-5*x+7=0;
```

$$eq := x\,\mathrm{floor}(x) - 5\,x + 7 = 0$$

Symbolical solution.

```
> solve(eq,x);
```

$$\mathrm{RootOf}(\mathrm{floor}(\_Z)\,\_Z - 5\,\_Z + 7)$$

```
> allvalues(%);
```

$$\mathrm{RootOf}(\mathrm{floor}(\_Z)\,\_Z - 5\,\_Z + 7,\ 1.750000000)$$

Numerical solution.

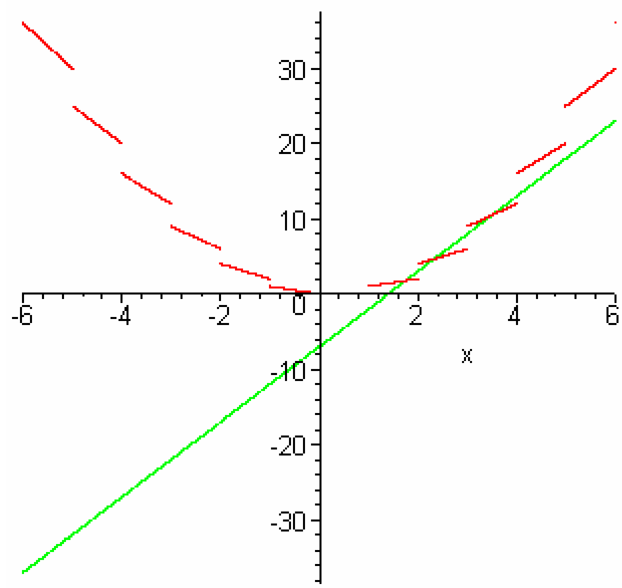
```
> fsolve(eq,x);
```

$$1.750000000$$

```
> eq1:=x*floor(x)=5*x-7;
```

$$eq1 := x\,\mathrm{floor}(x) = 5\,x - 7$$

```
> plot({lhs(eq1),rhs(eq1)},x=-
6..6,style=point,symbol=point,numpoints=10000);
```




```
> fsolve(eq,x=0..2); fsolve(eq,x=2..3); fsolve(eq,x=3..4);
```

$$1.750000000$$

$$2.333333333$$

$$3.500000000$$

EXAMPLE 4: Solve the inequality $a^2 - 1 \leq 0$ ($a^2 - 1 < 0$) in the real unknown *a*.

```
> restart;
> InS1:=solve(a^2-1<=0,a);
```

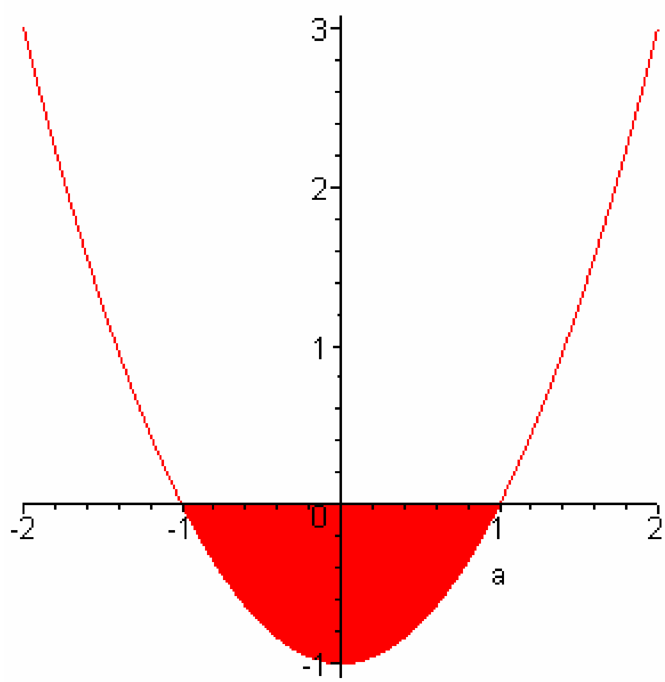
$$InS1 := \mathrm{RealRange}(-1, 1)$$

```
> InS2:=solve(a^2-1<0,a);
```

$$InS2 := \mathrm{RealRange}(\mathrm{Open}(-1), \mathrm{Open}(1))$$

```
> about(InS1);
RealRange(-1,1):
  a real range, in mathematical notation: [-1,1]
> about(InS2);
RealRange(Open(-1),Open(1)):
  a real range, in mathematical notation: (-1,1)
```

```
> InS1plot:=plot(a^2-1,a=-1..1,filled=true):
> Function:=plot(a^2-1,a=-2..2):
> plots[display]({InS1plot,Function});
```



EXAMPLE 5: Solve the system of linear inequalities $1 < x + y$, $x - 2\,y < 2$ in real unknowns *x*, *y*.

```
> restart;
> in1:=x+y>1; in2:=x-2*y<2;
```

$$in1 := 1 < x + y$$

$$in2 := x - 2\,y < 2$$

```
> solve({in1,in2},{x,y});
```

$$\{\frac{-1}{3} < y, 1 < x + y, x - 2\,y < 2\}$$

```
> with(SolveTools[Inequality]);
```

[*LinearMultivariateSystem* , *LinearUnivariate* , *LinearUnivariateSystem*]

```
> LinearMultivariateSystem({in1,in2},[x,y]);
```

$$\{\left[\{\frac{4}{3} < x\}, \{-1 + \frac{x}{2} < y\}\right], \left[\{x \le \frac{4}{3}\}, \{1 - x < y\}\right]\}$$

```
> with(plots):
Warning, the name changecoords has been redefined
```

```
> inequal({in1,in2},x=-3..3,y=-
3..3,optionsexcluded=(color=pink));
```