

Differentiation in Maple

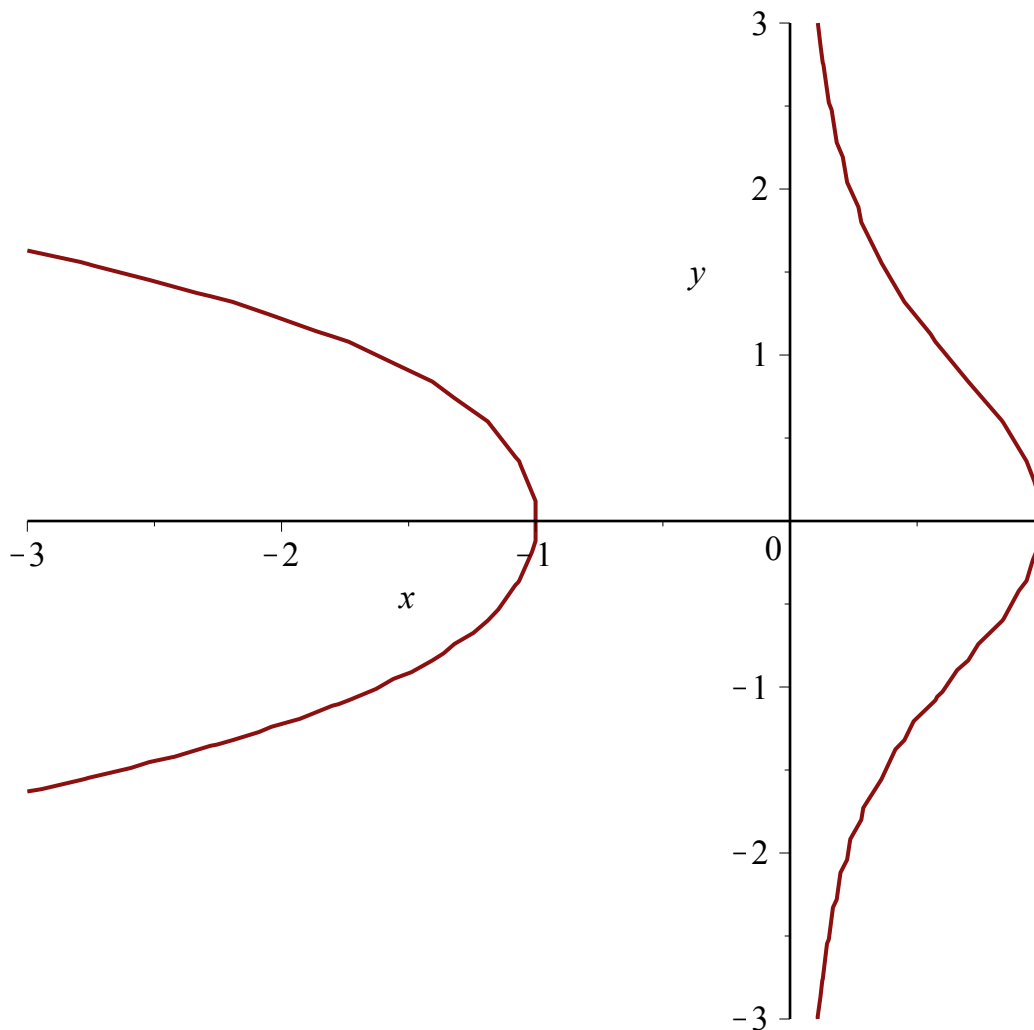
To plot a curve $y(x)$ given by an implicit relation $F(x,y)=0$, first load a useful package called **plots**:

```
with(plots);
```

```
[animate, animate3d, animatecurve, arrow, changecoords, complexplot, complexplot3d, (1)  
conformal, conformal3d, contourplot, contourplot3d, coordplot, coordplot3d, densityplot,  
display, dualaxisplot, fieldplot, fieldplot3d, gradplot, gradplot3d, implicitplot, implicitplot3d,  
inequal, interactive, interactiveparams, intersectplot, listcontplot, listcontplot3d,  
listdensityplot, listplot, listplot3d, loglogplot, logplot, matrixplot, multiple, odeplot, pareto,  
plotcompare, pointplot, pointplot3d, polarplot, polygonplot, polygonplot3d,  
polyhedra_supported, polyhedraplot, rootlocus, semilogplot, setcolors, setoptions,  
setoptions3d, spacecurve, sparsematrixplot, surfdata, textplot, textplot3d, tubeplot]
```

Now plot the curve $y(x)$ given by $x^2 + xy^2 = 1$ on the specified range of x and y using the command **implicitplot**:

```
implicitplot(x2 + x·y2 = 1, x=-3..3, y=-3..3);
```



The command **implicitdiff** (of y , with respect to x)

calculates the implicit derivative of the curve $y(x)$ with respect to x :

$implicitdiff(x^2 + x \cdot y^2 = 1, y, x);$

$$-\frac{1}{2} \frac{2x + y^2}{xy} \quad (2)$$

Reversing the order of 'x' and 'y',

implicitdiff instead calculates the implicit derivative of the curve $x(y)$ with respect to y :

$implicitdiff(x^2 + x \cdot y^2 = 1, x, y);$

$$-\frac{2xy}{2x + y^2} \quad (3)$$

Testing the result

by comparing with direct differentiation with respect to x , and then solving for $y'(x)$:

$test := diff(x^2 + x \cdot y(x)^2 = 1, x); solve(test, diff(y(x), x));$

$$2x + y(x)^2 + 2xy(x) \left(\frac{d}{dx} y(x) \right) = 0$$

$$-\frac{1}{2} \frac{2x + y(x)^2}{xy(x)} \tag{4}$$