Mathematica Labs | iLearnMath.net | Denis Shubleka

Subject: Calculus

Topic: Implicit Differentiation

- Goal: Use *Mathematica* to implicitly differentiate equations.

Task 1

Suppose we are given an equation such as $x^3 + y^3 = 6\,xy$ (Folium of Descartes), and want to find or verify $\frac{dy}{dx}$. We first move all terms to the left side: $x^3 + y^3 - 6\,xy = 0$, and then differentiate after by writing y[x] instead of y, to indicate that y depends on x.

```
lefthand = D[x^3 + (y[x])^3 - 6 x * y[x], x]
```

Next, we solve for the unknown derivative:

```
Solve[lefthand == 0, y'[x]]
```

Now, suppose we are working with parametric curves, where both x and y depend on a third variable t (also known as the parameter). If we wanted to find $\frac{dx}{dt}$ and $\frac{dy}{dt}$, begin with:

```
lefthandside = D[(x[t])^3 + (y[t])^3 - 6 x[t] * y[t], t]
```

, and then solve for $\frac{dx}{dt}$:

```
Solve[lefthandside == 0, x'[t]]
```

, and finally, $\frac{dx}{dt}$:

```
Solve[lefthandside == 0, y'[t]]
```

Related Exercises/Notes:
