Mathematica Labs | Denis Shubleka

**Subject: Calculus**

**Topic: The Derivative**

Goal: Compute the derivative as a function and as a number

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Task 1

Below we define a function f(x) and ask *Mathematica* to compute its derivative:

```
f[x_] := Log[x] + Tan[x];
f'[x]
```

Now we evaluate the derivative at x = $\pi$ by executing the following:

```
f'[π]
```

To verify that the derivative is in fact the slope of the tangent line at x = $\pi$, we plot the original function and the equation of the tangent line in the same plot.

```
Plot[{f[x], f[π] + f'[π] * (x - π)}, {x, 1, 5}]
```

We can also plot the derivative f'(x)(in green) and the original function f(x) (blue) in the same window, to verify the connection between the two:

```
Plot[{f[x], f'[x]}, {x, 0, 2 * Pi}, PlotStyle → {Blue, Green}]
```

As always, feel free to experiment with a function of your own.

Here are two additional ways Mathematica can be used to evaluate derivatives:

```
D[Tan[x], x]
```

takes the first derivative of tan(x) with respect to x.

And, from the Basic Math Assistant palette, in the Advanced tab, find the '$\partial$' operation as use it as follows:

```
∂x Log[x] + Tan[x]
```

Finally, we conclude this task by asking Mathematica to remind us about the Quotient Rule:

```
D[h[x] / g[x], x]
```

And then simplify the output using:

```
Simplify[%]
```

Try the following: product rule for two or three functions. Note that if using pre–defined functions such as f(x), you may need to clear its definition first, using the command:

```
Clear[f, g, h, x]
```

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Related Exercises/Notes:

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