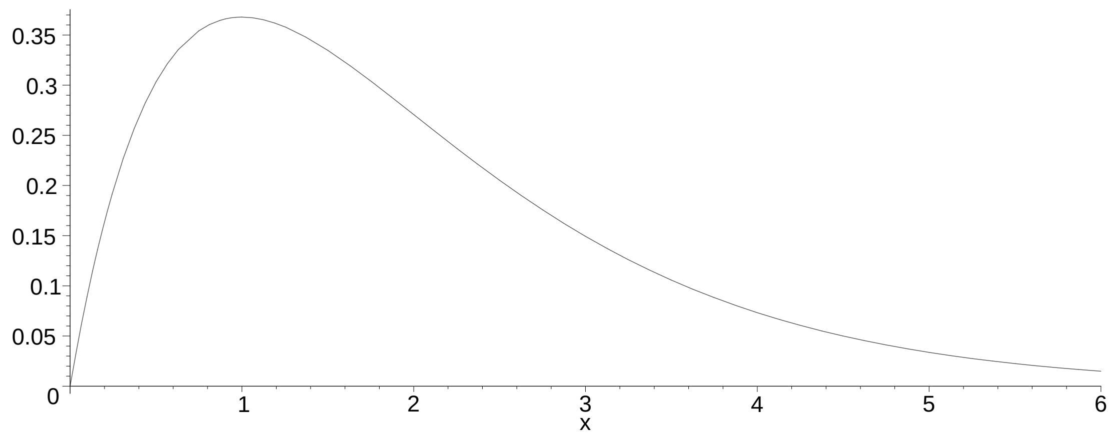
Minima, Maxima, and Inflection Points of Functions

Let's first define a function. Note how Maple wants the exponential function input.

```
> f := x->x*exp(-x);
```

$$f := x \rightarrow x\,\mathbf{e}^{(-x)}$$

```
> plot(f(x), x=0..6);
```



First, we seek the maximum value of f(x), and x value at which this occurs.

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

$$\mathbf{e}^{(-x)} - x\,\mathbf{e}^{(-x)}$$

```
> solve( diff(f(x),x) = 0);
```

$$1$$

So, the maximum value occurs at x=1. This is certainly what it appears from the graph.   The maximum value itself is f(1):

```
> f(1);
```

$$\mathbf{e}^{(-1)}$$

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

$$0.3678794412$$

Now let's find the inflection point. This is the point at which concavity changes -- i.e. when the second derivative is zero.

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

$$-2\,\mathbf{e}^{(-x)} + x\,\mathbf{e}^{(-x)}$$

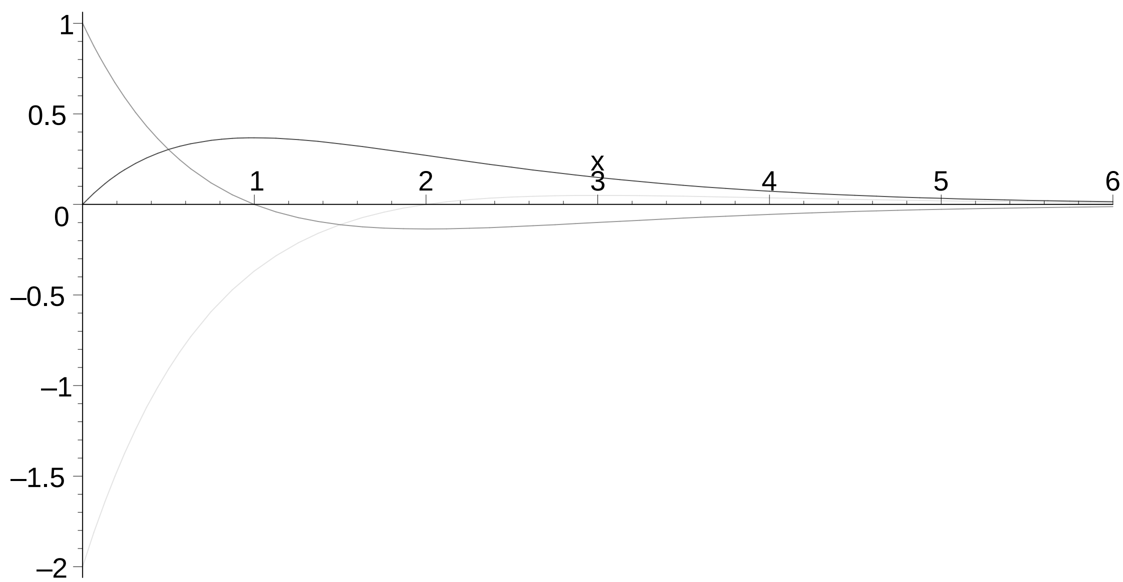
```
> solve( diff( diff( f(x), x), x) = 0 , x);
```

$$2$$

The inflection point occurs at x=2.

Let’s plot the function and its first and second derivatives:

```
> plot( { f(x), diff(f(x),x), diff( diff(f(x),x),x)}, x=0..6);
```



As expected, the first derivatve is zero at the function’s maximum, while the second derivative is zero at the inflection point.

```
>
```