

One more example with loops:  
The Collatz Conjecture.

Start with a positive integer  $n$ .

If  $n = 1$ , Stop.

Else, if  $n$  is even, divide  $n$  by 2.

Else ( $n$  is odd), multiply  $n$  by 3 and add 1.

E.g. if  $n = 6$ ,

$$6 \rightarrow 3 \rightarrow 10 \rightarrow 5 \rightarrow 16 \rightarrow 8 \rightarrow 4 \rightarrow 2 \rightarrow 1$$

$\begin{matrix} \parallel \\ 2^4 \end{matrix}$

✓

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New topic: Functions.

Similar to the ones from calc / pre-calc:

$$f: \mathbb{R} \rightarrow \mathbb{R}$$

e.g.  $f(x) = x^2 + 1$

$$f(x) = \cos(x)$$

$$f(x) = e^{\cos(x)}$$

In C/C++, there is something similar.

Math class	C/C++
$f: \mathbb{R} \rightarrow \mathbb{R}$ $f(x) = x^2 + 1$ (or $f: x \mapsto x^2 + 1$ )	<code>double f(double);</code> <code>double f(double x)</code> <code>{</code> <code>    return x*x + 1;</code> <code>}</code>

Differences vs math class:

- functions might have side effects
- functions might rely on global state

Just because  $f(3)$  returned 7 once  
doesn't mean it will the next time!

```
int c = 0;
int f(int x)
{
    c = c + 22;
    return x * c;
}
```