

Introducing Loops*

► Documentation

Instructions: For each of the following small programs, pretend you are *Maple* and write down the output of the program and answer the question at the end.

Very Important: Notice that each loop, from "*for k from 1 to n*" to "*end do*", is enclosed in a single bracket. This is because Maple considers these two lines to be the beginning and end of a single command (with the actual instructions for the loop in the middle). If Maple comes across "*for k from 1 to n*" by itself, it will not understand the command and will give you an error message. (If you ever need to type in a loop yourself, you can use SHIFT-ENTER to move from one line to the next without going to the next execution group.)

Loop Exercise 1

```
> a[0] := 0
> for k from 1 to 7
  do
    a[k] := a[k - 1] + 1
  end do
```

Question: What is $a[7]$?

Loop Exercise 2

```
> x[0] := 1
> for k from 1 to 4
  do
    x[k] := 2 · x[k - 1]
  end do
```

Question: What is the program doing?

*This worksheet was created by Carol Schumacher.

Loop Exercise 3

```
> deltat := .1; n := 5; t[0] := 2; y[0] := 3
> for k from 1 to n
do
  t[k] := t[k - 1] + deltat;
  y[k] := y[k - 1] + 2 * t[k]
end do;
```

Question: What is $t[3]$? What is $y[5]$?

Euler's Method Exercise

This is the place where the derivative is defined.

```
> slope := (t, y) → -t * y
```

This is where we enter the stepsize $deltat$ and the initial values for t and y .

```
> deltat := 0.25; t[0] := 0 ; y[0] := 3
```

And now, finally, here is the loop.

```
> for k from 1 to 4
do
  t[k] := t[k - 1] + deltat;
  y[k] := y[k - 1] + slope(t[k - 1], y[k - 1]) * deltat
end do
```

Question: How many points on the graph do you now have? What are they?