```
> restart
```

This relates to https://scholarworks.umt.edu/cgi/viewcontent.cgi?article=1475&context=tme
Adri Treffers, de rekenprofessor zoals @aobtweets hem ooit profileerde, over Sweller.

Reading from

"Cognitive psychologist Sweller is the founder of Cognitive Load Theory.
Sweller doesn't like the usual approach to problem solving in mathematics instruction, ..."

(to like or not like, this is science)

to Treffers description of Sweller's example:

"The problems required students to transform a given number into a goal number where the only two moves allowed were multiplying by 3 or subtracting 29. Each problem had only one solution and that solution required an alternation of multiplying by 3 and subtracting 29 a specific number of times. (Sweller, 2016, p. 2)."

But using the operations x maps to 3x (up) and x maps to x-29 (down) there are many ways to go from a start S to a target T.

Here's a non-alternating one. Do mod 29 calculations on the side. From 15 to 121, for example.

```
> T:=121
```

$$T := 121 \quad (1)$$

```
> t:=T mod 29
```

$$t := 5 \quad (2)$$

```
> S[0]:=15
```

$$S_0 := 15 \quad (3)$$

```
> s[0]:=S[0] mod 29
```

$$s_0 := 15 \quad (4)$$

After 27 ups it's OK mod 29:

```
> for n from 1 to 27 do S[n]:=3*S[n-1];s[n]:=S[n] mod 29 od
```

$$S_1 := 45$$

$$s_1 := 16$$

$$S_2 := 135$$

$$s_2 := 19$$

$$S_3 := 405$$

$$s_3 := 28$$

$$S_4 := 1215$$

$$s_4 := 26$$

$$S_5 := 3645$$

$$s_5 := 20$$

$$S_6 := 10935$$

$$s_6 := 2$$

$$S_7 := 32805$$

$$s_7 := 6$$

$$S_8 := 98415$$

$$s_8 := 18$$

$$S_9 := 295245$$

$$s_9 := 25$$

$$S_{10} := 885735$$

$$s_{10} := 17$$

$$S_{11} := 2657205$$

$$s_{11} := 22$$

$$S_{12} := 7971615$$

$$s_{12} := 8$$

$$S_{13} := 23914845$$

$$s_{13} := 24$$

$$S_{14} := 71744535$$

$$s_{14} := 14$$

$$S_{15} := 215233605$$

$$s_{15} := 13$$

$$S_{16} := 645700815$$

$$s_{16} := 10$$

$$S_{17} := 1937102445$$

$$s_{17} := 1$$

$$S_{18} := 5811307335$$

$$s_{18} := 3$$

$$S_{19} := 17433922005$$

$$s_{19} := 9$$

$$S_{20} := 52301766015$$

$$s_{20} := 27$$

$$S_{21} := 156905298045$$

$$s_{21} := 23$$

$$S_{22} := 470715894135$$

$$s_{22} := 11$$

$$S_{23} := 1412147682405$$

$$s_{23} := 4$$

$$S_{24} := 4236443047215$$

$$s_{24} := 12$$

$$S_{25} := 12709329141645$$

$$s_{25} := 7$$

$$S_{26} := 38127987424935$$

$$s_{26} := 21$$

$$S_{27} := 114383962274805$$

$$s_{27} := 5 \tag{5}$$

```
> n,s[n-1]=t
```

$$28, 5 = 5 \tag{6}$$

```
> ifactor(S[n-1]-T)
```

$$(2)^2\ (29)\ (131)^2\ (271)\ (212029) \tag{7}$$

```
> Q:=(S[n-1]-T)/29
```

$$Q := 3944274561196 \tag{8}$$

So after 27 ups do 3944274561196 downs.

Probably not the quickest way.

Alternative method: alternate from the start.

```
> n:=0:S[n]:=15;'T'=T
```

$$S_0 := 15$$

$$T = 121 \tag{9}$$

```
> s[0]:=S[0] mod 29
```

$$s_0 := 15 \tag{10}$$

```
> for n from 1 to 27 do S[n]:=3*S[n-1]-29;s[n]:=S[n] mod 29 od
```

$$S_1 := 16$$

$$s_1 := 16$$

$$S_2 := 19$$

$$s_2 := 19$$

$$S_3 := 28$$

$$s_3 := 28$$
$$S_4 := 55$$
$$s_4 := 26$$
$$S_5 := 136$$
$$s_5 := 20$$
$$S_6 := 379$$
$$s_6 := 2$$
$$S_7 := 1108$$
$$s_7 := 6$$
$$S_8 := 3295$$
$$s_8 := 18$$
$$S_9 := 9856$$
$$s_9 := 25$$
$$S_{10} := 29539$$
$$s_{10} := 17$$
$$S_{11} := 88588$$
$$s_{11} := 22$$
$$S_{12} := 265735$$
$$s_{12} := 8$$
$$S_{13} := 797176$$
$$s_{13} := 24$$
$$S_{14} := 2391499$$
$$s_{14} := 14$$
$$S_{15} := 7174468$$
$$s_{15} := 13$$
$$S_{16} := 21523375$$
$$s_{16} := 10$$
$$S_{17} := 64570096$$
$$s_{17} := 1$$
$$S_{18} := 193710259$$
$$s_{18} := 3$$

$$S_{19} := 581130748$$
$$s_{19} := 9$$
$$S_{20} := 1743392215$$
$$s_{20} := 27$$
$$S_{21} := 5230176616$$
$$s_{21} := 23$$
$$S_{22} := 15690529819$$
$$s_{22} := 11$$
$$S_{23} := 47071589428$$
$$s_{23} := 4$$
$$S_{24} := 141214768255$$
$$s_{24} := 12$$
$$S_{25} := 423644304736$$
$$s_{25} := 7$$
$$S_{26} := 1270932914179$$
$$s_{26} := 21$$
$$S_{27} := 3812798742508$$
$$s_{27} := 5 \quad \textbf{(11)}$$

```
> q:=(S[n-1]-T)/29
```

$$q := 131475818703 \quad \textbf{(12)}$$

That's only a little better.

```
> 3944274561196-131475818703
```

$$3812798742493 \quad \textbf{(13)}$$

Much better: vary the number of downs in every step.
But then you have to be smart, to avoid possibly 27 ups again.

Alas, neither Sweller nor Treffers shows any interest in the problem.

Treffers, the problem solver, is too engaged with debunking his version of Sweller's views:

"The fact that Sweller wants to keep discovery learning away from education is shown once again by the following quote"

We've seen it before from his Freudenthal group.

NB 29 is prime, 69 is not.