The Norty Noughts

Compare these two sums:

```
  7 0 0 2              7 0 0 2
- 0 0 0 1      and   - 0 0 0 3
  7 0 0 1              6 9 9 9
```

They only differ by 2 but what a difference!

The left hand sum is EASY all the way.

The right hand sum is identical

EXCEPT

it has a HARD neighbour on the end (2-3 goes below zero).

Let's drill down into that right hand sum

to see what makes it tick.

0 - 0 = 0 is easy.
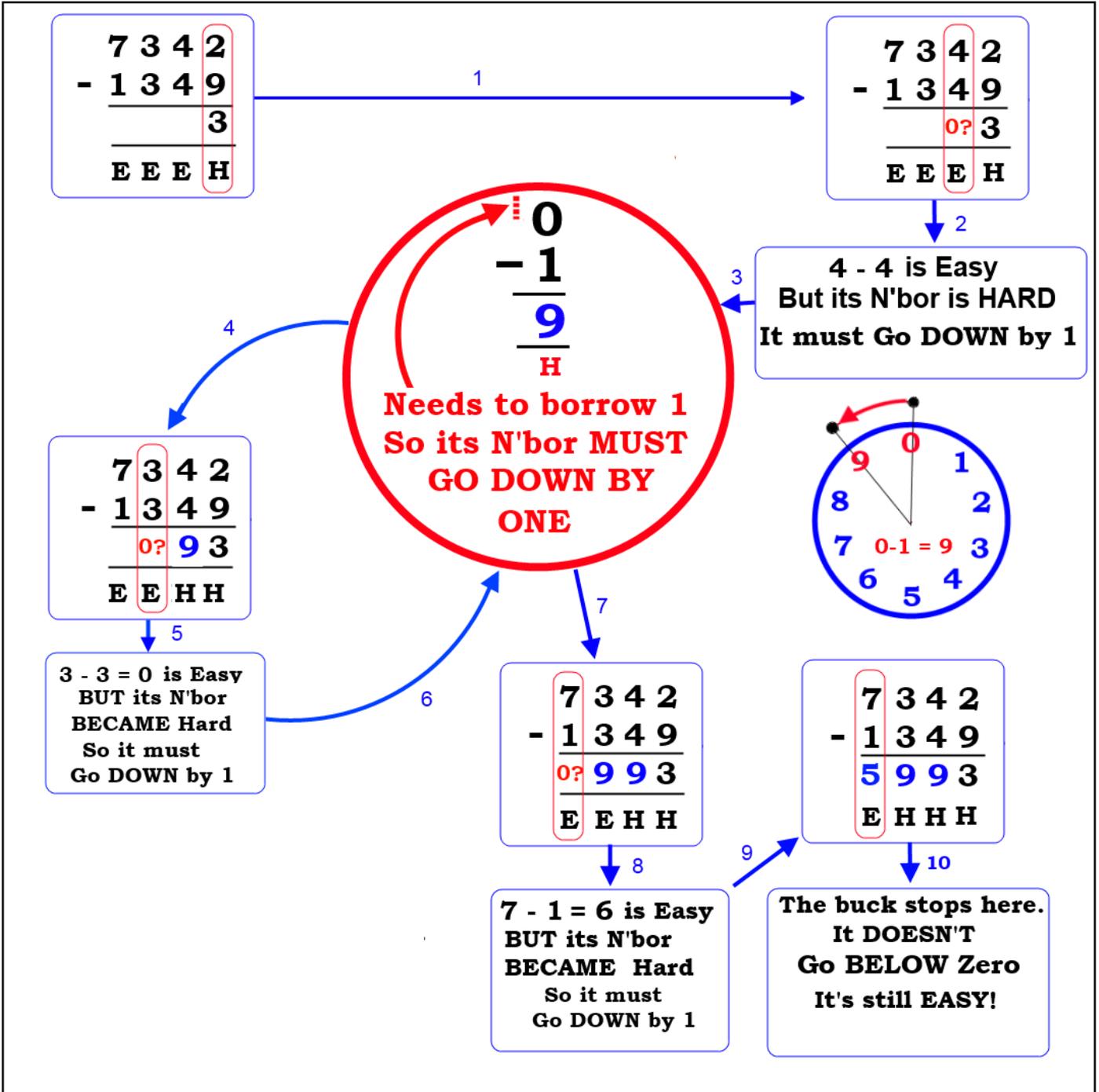
But if it's neighbour is hard

It has to go down by 1.

Now what happens when 0 goes down by 1?

It goes below zero

and so it becomes HARD

(it will need to borrow from its neighbour)

```
  7 3 4 2
- 1 3 4 9
─────────
        3
─────────
  E E E H
```

1 →

```
  7 3 4 2
- 1 3 4 9
─────────
     0? 3
─────────
  E E E H
```

↓ 2

4 - 4 is Easy
But its N'bor is HARD
It must Go DOWN by 1

3 ←

```
  0
- 1
───
  9
───
  H
```

Needs to borrow 1
So its N'bor MUST
GO DOWN BY
ONE

Clock: 9 8 7 6 5 4 3 2 1 0 — 0-1 = 9

4 ↓

```
  7 3 4 2
- 1 3 4 9
─────────
  0? 9 3
─────────
  E E H H
```

↓ 5

3 - 3 = 0 is Easy
BUT its N'bor
BECAME Hard
So it must
Go DOWN by 1

6 →

7 ↓

```
  7 3 4 2
- 1 3 4 9
─────────
  0? 9 9 3
─────────
  E E H H
```

↓ 8

7 - 1 = 6 is Easy
BUT its N'bor
BECAME Hard
So it must
Go DOWN by 1

9 →

```
  7 3 4 2
- 1 3 4 9
─────────
  5 9 9 3
─────────
  E H H H
```

↓ 10

The buck stops here.
It DOESN'T
Go BELOW Zero
It's still EASY!

Crashing Waves and Sandwiches at the Beach

```
  3 8 5 7 6 9 0 3 4 5 2
- 1 2 5 7 6 9 0 3 4 9 1
  2 5 9 9 9 9 9 9 6 1
```

In the above sum first see 3 - 1 = 2 is Easy and 8 - 2 (its neighbour) is Easy.

So put down the 2.

8 - 2 is 6 but look ahead to its neighbour.

Then spot the row of numbers subtracting to 0.

Follow along till you reach the end.

Note it ends in 5 - 9 which is Hard.

That's the signal the 0's become 9's!

Like a wave charge back and change all the 0's to 9's.

This wave comes in and crashes finally against the retaining wall (the 8 - 2).

It breaks the retaining wall.

The 8 - 2 is no longer 6, it becomes 5.

That's because the 1's have been borrowed all the way along.

But that's where the buck stops! It's not a tsunami!

It doesn't continue on and effect anything left of the retaining wall!

The 3 - 1 = 2 is left alone.

You can see it like a sandwich.

The red (5 - 9) is the troublemaker.

It is the far side of the bread.

The blue bits subtracting to 0 exactly are the filling and all those 0's becomes 9's

And the other side of the bread is the red (8 - 2) which goes down to 5.

If the far end bit of bread (the 5 - 9) had instead been (4 - 2) which is EASY

The filling would have stayed all 0's

And the other side of the bread (the 8 - 2) would have stayed a 6

Then continue on...

Finally handle the troublemaker, the 5 - 9, in 10-circle.

5 - 9 = 5 + 1 = 6.

Put it down just as it is because its neighbour (the 2 - 1) is Easy.

Finally the 2 - 1 is just 1.