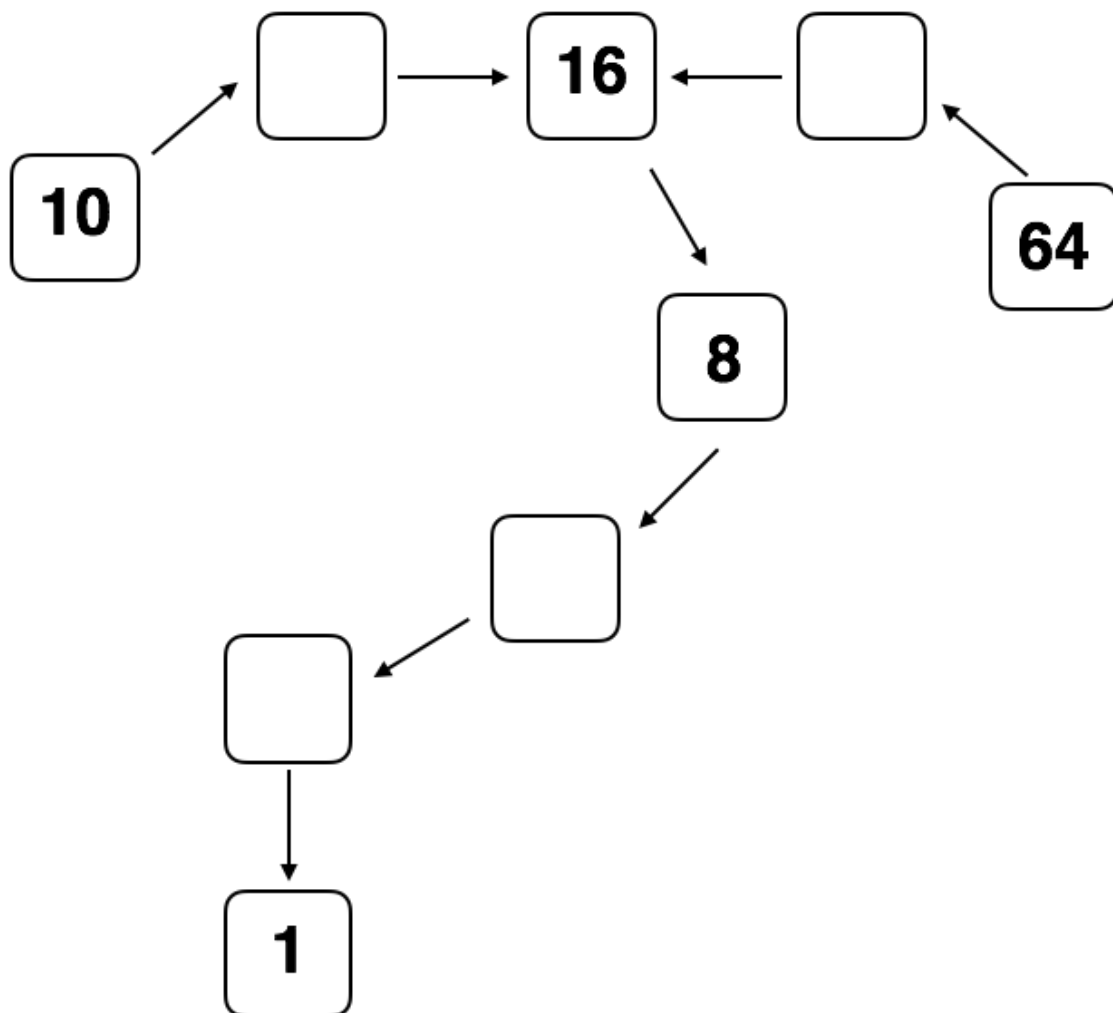# DRAW A COLLATZ SUPER MAP

Below we have combined the map for 10 with the map for 64 and made what we are calling a 'super map'.
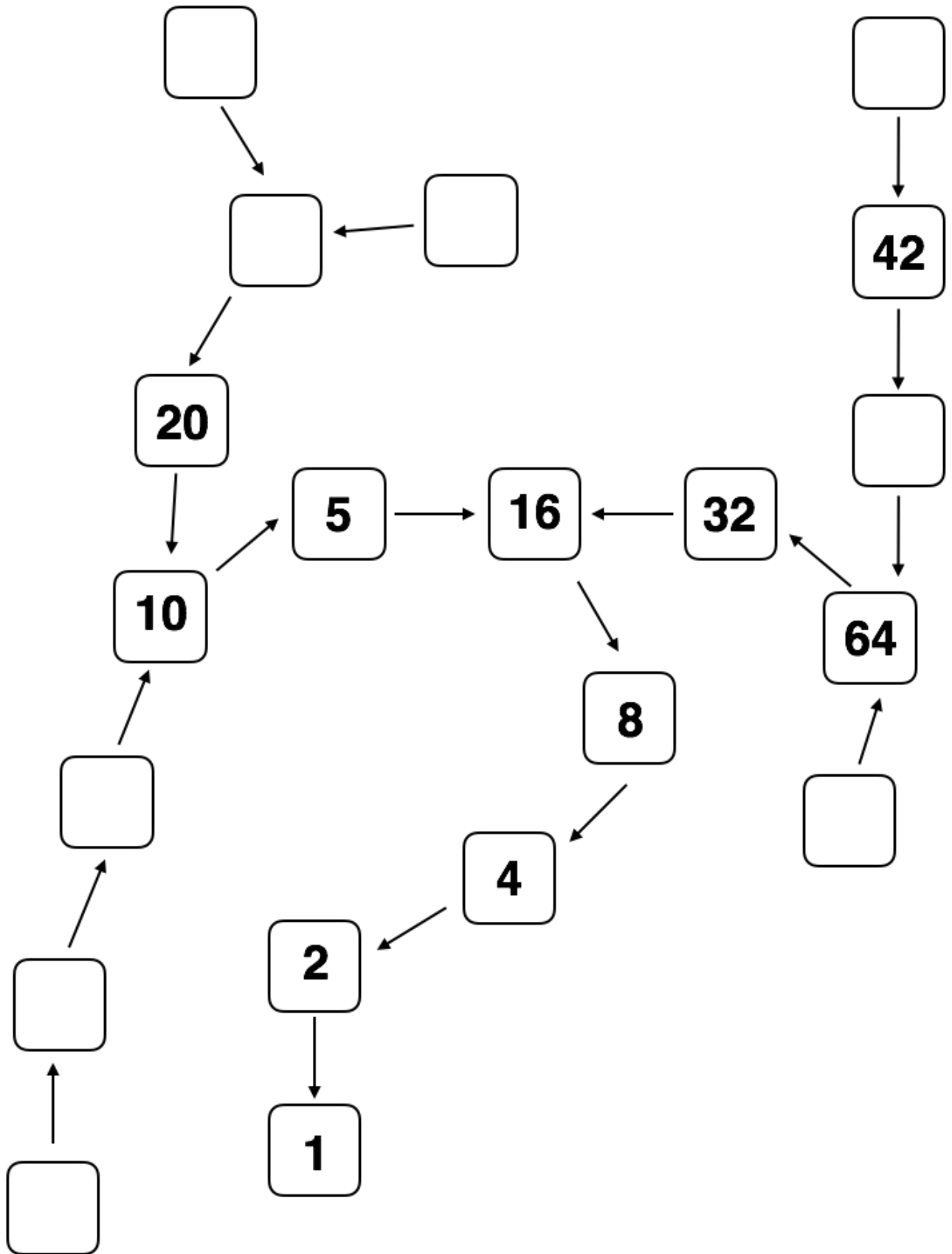
10 and 64 both share the path to one from 16 onwards.

Can you fill in the gaps?

We could expand our super map by working backwards to show the possible routes into 10 and 64.

Do this on the page below by filling in the gaps.

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```
[ ]
  ↓
[ ]  ←  [ ]

  ↓
[20]
  ↓
[10]  →  [5]  →  [16]  ←  [32]
  ↑                  ↓
[ ]               [8]
  ↑                  ↓
[ ]               [4]
  ↑                  ↓
[ ]      [2]  ←
           ↓
          [1]
```

```
[ ]
  ↓
[42]
  ↓
[ ]
  ↓
[64]  →  [32]
  ↑
[ ]
```

TEACHER NOTES

Students do the activities on the **Draw a Collatz Super Map** worksheet.

Q. **The second map activity could be used to discuss inverses and solving equations.**

Students may recognise that to 'work backwards' they are doing the inverse of the Collatz algorithm steps. They could write down these inverse operations that they are doing next to the arrows.

Alternatively, students could be asked to write and solve the equation that is relevant to each 'step backwards'.
Eg $3n + 1 = 10$ (to work out the number leading into 10).

Q. **What sort of numbers have two routes leading into them?**

All numbers can be made by even number being halved. The other route into a number is for an odd integer to have been multiplied by 3 and had 1 added to it. The resulting number would have the property of being even and one more than a multiple of 3.

In other words, a number (y) can only have two routes leading into it if it gives an odd integer solution to $3n + 1 = y$

Students/Classes/Schools make their own super map

Students could now be challenged to make their own super map, going further than we have done in the activity. Whenever there is an opportunity to draw more branches, they should do so! They may need large paper.

In the 'Great Collatz Collab' schools are sending in a map from one number to contribute to a giant super map. However, separate to this, if you have any **particularly interesting representations of super maps** (using any medium!), do email them to info@think-maths.co.uk by Wednesday 28 September 2022 and we may feature any we really like on our website or in Matt's follow up video!

See the videos and other online resources linked to on the webpage for various artisitic visualisations of Collatz 'super maps' that may inspire your students.

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