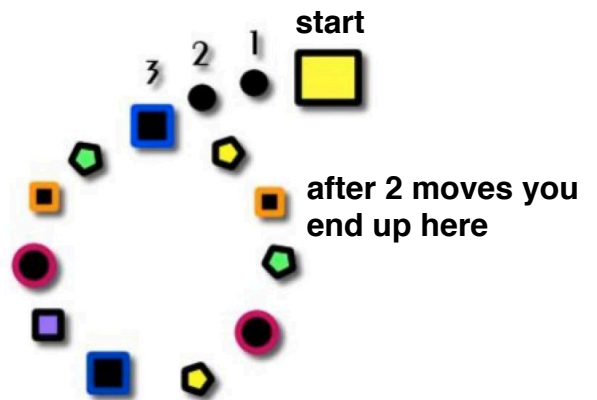


The Magic Wheel

This trick became well known after David Copperfield used it as an interactive trick on a TV special in 1992. That version had 12 objects in the circle (see picture below left). An interactive version with 11 objects in the circle is popular on the internet today. (see picture below right).

Both versions use the same mathematical concepts.

1. When you start at the top of the tail and move 3 or more positions to the left (counter clockwise) you end up at some position on the main circle. If the tail end (start 1, and 2) is removed and you then move backwards to the right (clockwise) that **same number** of positions you end up at the 3 o'clock position no matter how many positions you moved left and then right.

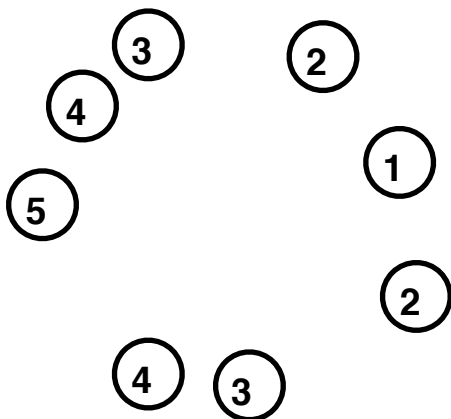


2. You remove some of the positions from the circle so there are an even number of positions left on the circle. If you start at position 1 and move a number of positions equal to one half of the total positions in either direction you will end up at the same position.

Example 1

8 positions move 4

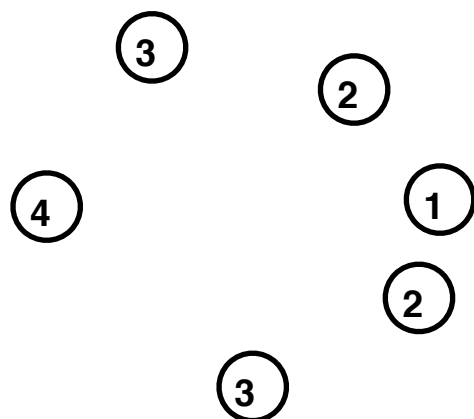
If you start at 1 and move 4 to the right or 4 to the left you end up at 5



Example 2

6 positions move 3

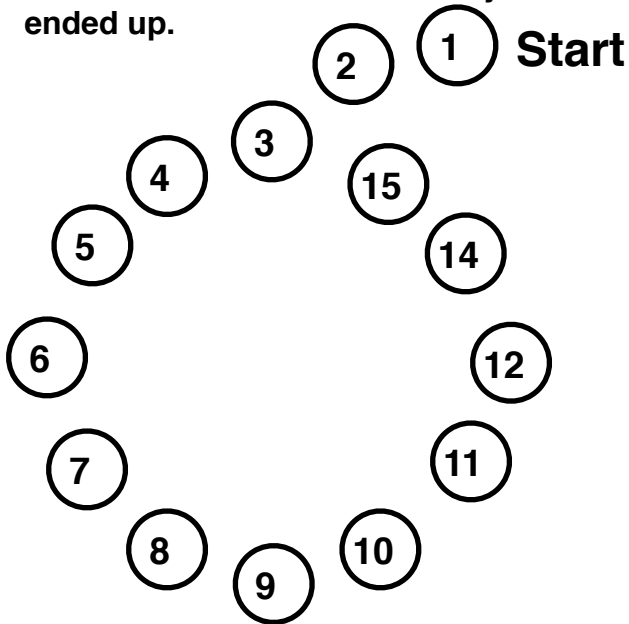
If you start at 1 and move 3 to the right or 3 to the left you end up at 4



The Magic Wheel

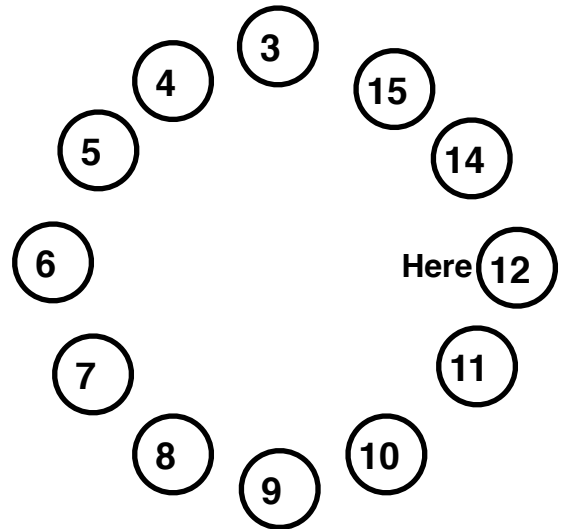
Step 1

Pick any number from 5 to 20. Starting at the top, Move left counter clock wise counting each step you take. Remember the number where you ended up.



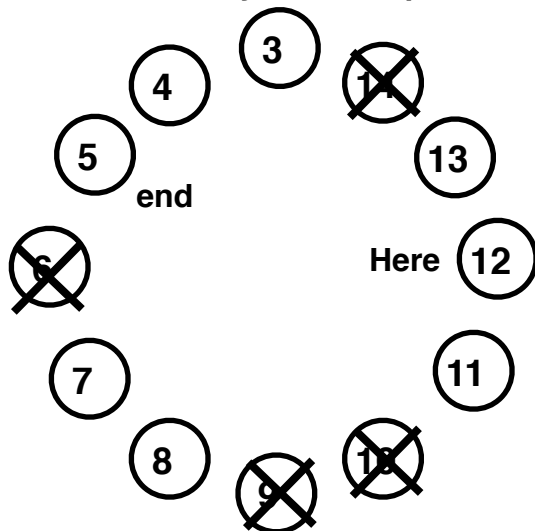
Step 2

I have removed the starting block. Now move the same number of positions you did the first time but move right clock wise as you count the position. Remember the number where you ended up.



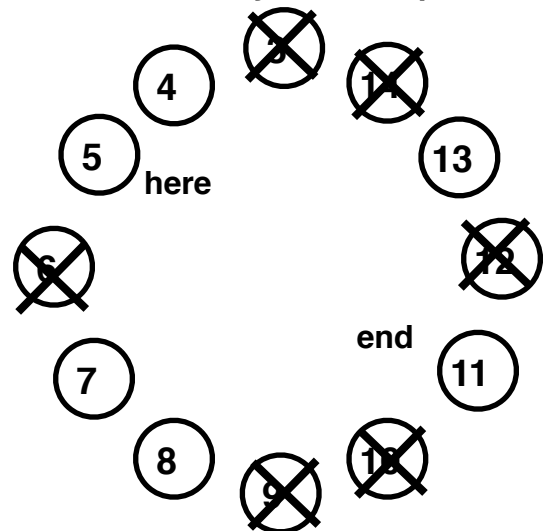
Step 3

Remove positions 6, 9, 10 and 14 and ask them to move 4 positions in either direction and they are all at position 5.



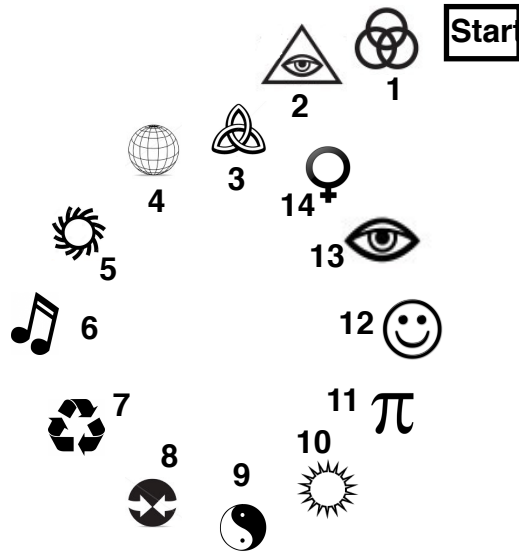
Optional Step 4

Remove positions 3 and 12 and ask them to move 3 positions in either direction and they are all at position 11.



The Magic Wheel

Preparation: Place 14 objects and a start card on a desk or table where several students can stand in front of as you stand in back. I have added the numbers to help with the explanation, they are not part of what the students see. You may use it as a guide if you want.



Start by saying they will be asked to move around the circle a few times counting by ones. Tell them that they are to do this IN THEIR MIND's and always remember the object they landed on. Say "DO NOT name the object or point to it. Only you can know your where you are at."

Step 1: Say "Think of any number between 5 and 20. Start at the rectangle labeled start and move to the left, counter clockwise, around the circle counting by 1 each time you move to a different object." Show them an example by saying "If I pick 6 then I count to 6 moving an object each time and end up at the music note. Have them pick a number and move. Tell them to remember the object they landed on."

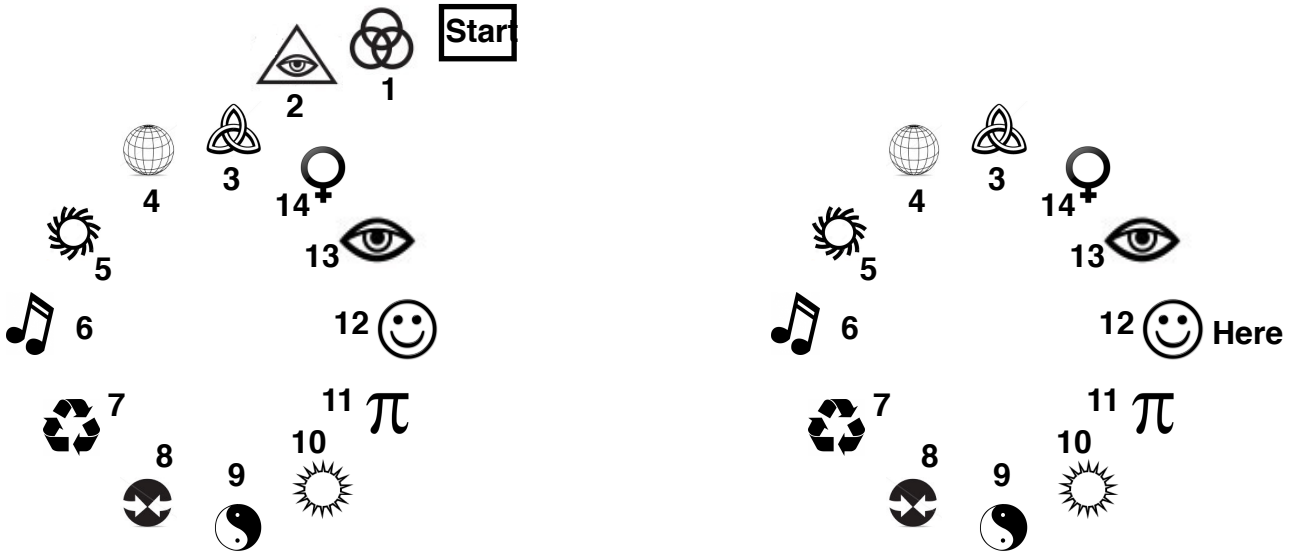
Step 2: Say "I will remove the starting block." Remove the first 3 objects leaving the circle. Say "Start at the object you just ended on and count the same number you just used but go backwards to the right (clockwise) that number of objects on the wheel. Say "For example, if went 12 steps the first time I would go 12 steps the other direction this time. Have them do this and tell them to remember the object they landed on. Note: They will all be at object 12 the smiley face."

Step 3: Say I hope none of you are on these objects and then remove objects 6, 9, 10 and 14. Tell the students to move 4 positive either right or left. Tell them to remember the object they landed on. It will be object 5 the star wheel

Step 4: Say I hope none of you are on these objects and then remove objects 3 and 12. Tell the students to move 3 spots either right or left. Tell them to remember the object they landed on. It will be It will be object 11 the pi symbol. Say that it took math skills to control your movements and in the end I think you ended up on pi.

Review:

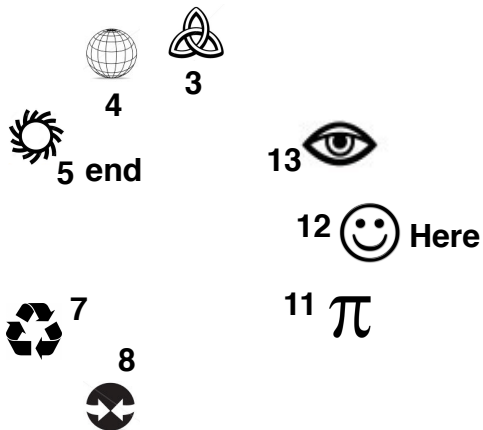
Step 1 and Step 2: Ask them to pick a number greater than the number of objects in the tail. I use 5. Limit the largest number of steps to avoid miscounting. I use 15. Ask them to move that many steps to the left. Next, remove the tail objects and ask them to move that many steps to the right. They will be at the smiley face.



Remove as many objects as you like from the circle other than the one you know they are on. Be sure that an even number of objects remain. Ask them to move a number that is half of the remaining objects in either direction. Count that number from where you know that are at yourself and state the object they are at.

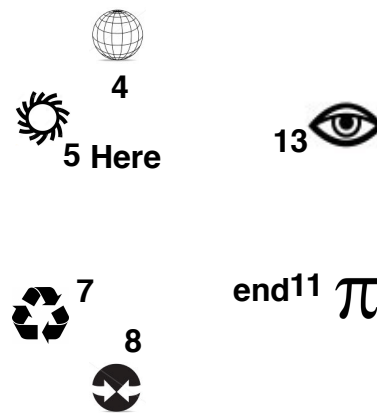
Step 3

Remove objects 6, 9, 10 and 14 and have them move 4 steps in either direction. They are at 5



Step 4

Remove objects 3 and 12 and have them move 3 steps in either direction. They are at 11 PI

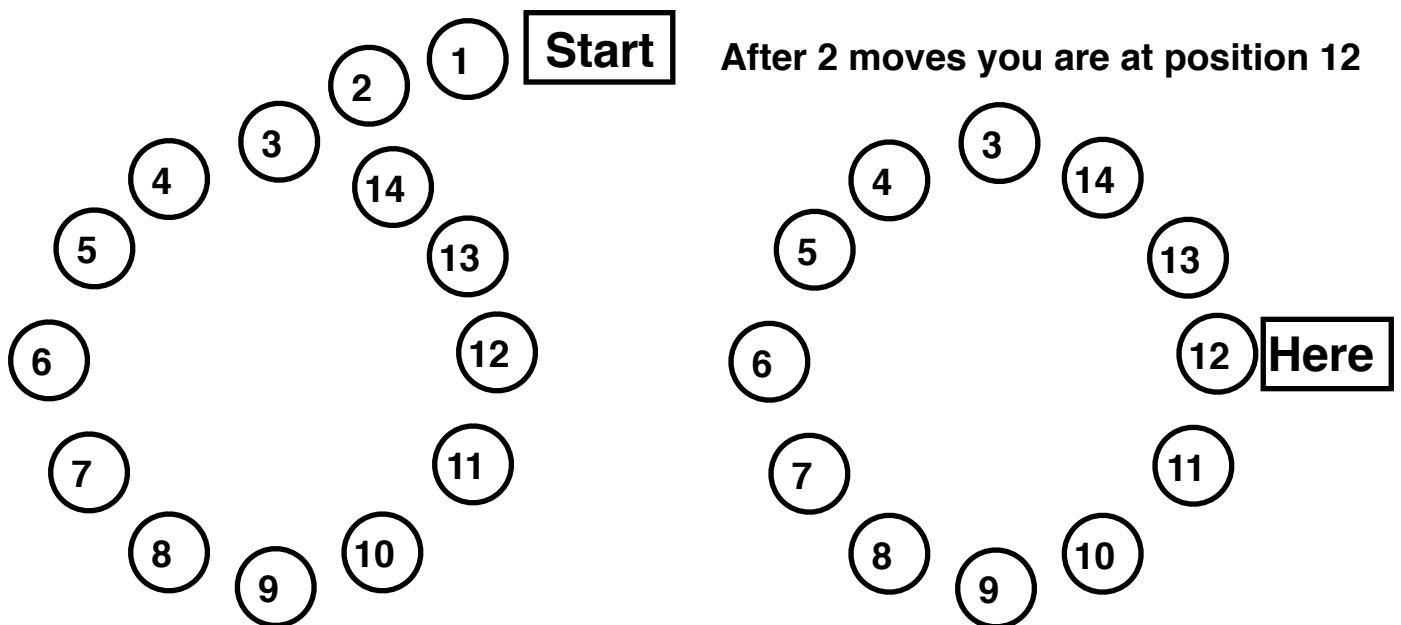


How does it Work? Tail = x objects. Your first movement is y steps $y > x$

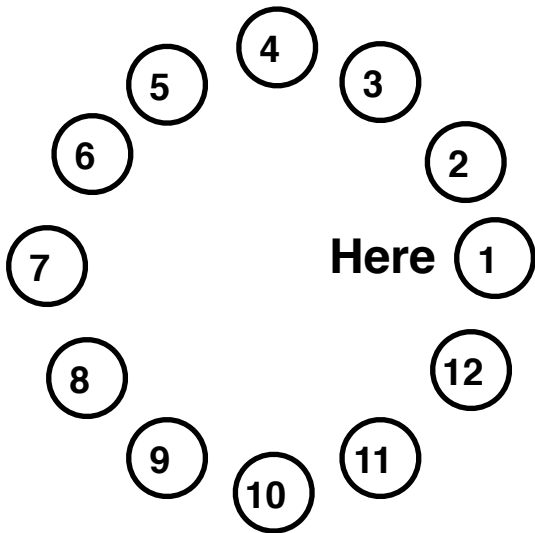
Lets say that the tail contains x objects including the start object and the circle contain y objects. You must choose a number larger than x as the number of steps your first movement will be. Lets call you first movement y steps. When you start at the top of the tail and move y steps to the left (counter clock wise) you end up at the y position on the main circle. If the x objects in the tail end are removed at this point and you move backwards to the right (clock wise) that same number of positions) you end up at a position that is x positions to the right of the top of the circle no matter how many positions you move left and then right.

WHY? You moved y positions forward , but x of those steps were used to get you on to the top of the circle. You got on the circle at the top object on the circle and continued to the left. If you then move y positions backward you will go past the top object on the circle and end up x positions to the right of that top object. Try is for several numbers and you will see this is true.

If there are there are 3 objects in the tail and you move 7 steps. You are at position 7. Remove the 3 tails objects and move backwards 7 steps. You end up 3 position to the right of position 3.



At this point you you know where they are. Everyone is at the same spot, 3 positions to the right of the object at the top of the circle. We will cal that position 1 and renumber the other positions so the rest of the trick is easy to understand.

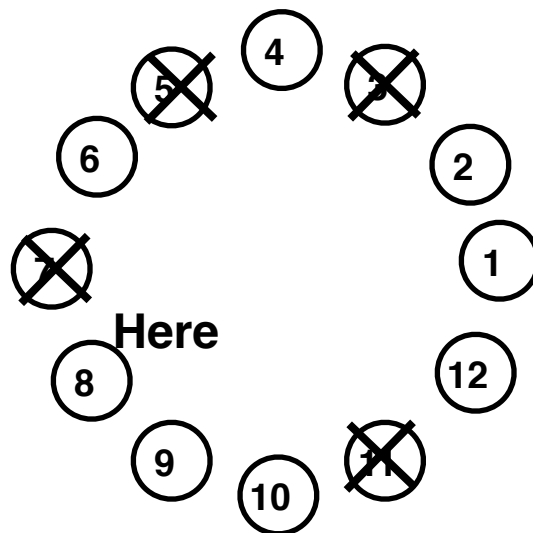


They are at position 1. Remove as many objects as you want from anywhere on the circle other than 1, but be sure that an **even number of objects remain**. Lets say w objects remain. Ask them to move $W/2$ steps in either direction. They will all end up on the same spot. That spots will be $W/2$ objects away from the stating spot.

Example

They are on position 1 which is an **odd number**. Remove positions 3, 7, 9 and 11 from the circle. Now tell them to move 4 positions in either direction. They are at position 8.

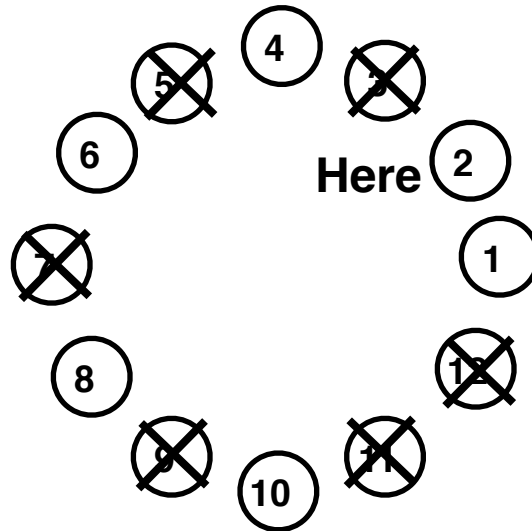
Move an 4 positions in either direction and you are at position 8.



Dvid Copperfield removes positions 1 2 and 12 and reveals you art at position 8 without further movement. If that works for him it should work for most people.

If you want to have them move 1 more time. Then remove 9 and 12 and ask them to move 3 positions in either direction to end at position 2.

Remove positions 9 and 12 and ask them to move 3 positions in either direction and you are at position 2.



Revel that they are at position 2. Have the cool pi symbol there as a good math effect.