

Challenge 1: Complete the spiral up to 144 and find the numbers that would be in the diagonal. We really enjoyed doing this (though some of us made mistakes first time).



The numbers from top left to bottom right are:

111, 73, 43, 21, 7, 1, 3, 13, 31, 57, 91, 133.

- 227
- 137
- 71
- 29
- 11
- 17
- 47
- 101
- 179
- 281

Challenge 2: Find the totals of the numbers in the diagonals in groups of 3.

We added the numbers systematically from top to bottom in groups of 3 and discovered there were ten totals.

We noticed all the totals were odd numbers. Here are some of our other observations about the 10 numbers.

Jaxon - "When you write the numbers in the order that we calculated them, I spotted a pattern going up and down from the 11 if you say them in order. Start at 11, go down 1 for 17 then up 1 (from 11) for 29, then down 2 for 47 and up 2 for 71 etc."

Alex - "The 10 totals end in odd numbers but only 1, 7 and 9. There is no 3 or 5. This surprises me because it's unusual."

We then wrote the numbers out in ascending order and some of us noticed another pattern.

11  
17 } +6  
29 } +12  
47 } +18  
71 } +24  
101 } +30  
137 } +36  
179 } +42  
227 } +48  
281 } +54

The difference between each pair of numbers when written in ascending order increases in multiples of 6.

This meant that we could predict what the next total would be if we extended the diagonal in the spiral. "It would be 341 because we would add 60 onto 281" said lots of the children.

Challenge 3a: Use the numbers to make new numbers with a total that has a 2 in the ones place.

We had so much fun with this and it generated lots of reasoning about adding even and odd numbers.

101	11
281	101
281	71

"To use 2 addends you have to choose 2 numbers that end in 1." Harvey



James - "I have noticed that there are no 3 addend number sentences because an even amount of odd numbers is the only way to get to an even number. So you can solve this problem by using 2, 4, 6 or 8 addends but not 3, 5, 7 or 9."

137	17	227	71
137	17	227	101
137	17	227	281
137	17	227	11

"You definitely get a 2 at the end if you use 3 numbers ending in 7 plus 1 number that ends in 1." Alyssa, Ayla & Hallie. Angel proved this by adding  $47 + 17 + 227 + 71 = 362$ . Poppy also noticed this when she added  $227 + 17 + 137 + 11 = 392$

Tyler and Oliver noticed you could have the 2 numbers ending in 9 combined with 2 numbers that end in 7. They show some of the possible solutions here.

29	179	11	71	101	281
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"If you choose 2 numbers that end in 9 and 4 numbers that end in 1 you get a total that ends in 2. This can only be done one way." Kiah & Leos

29	179	17	47
29	179	17	137
29	179	17	227

Carter & Alex - "we added all ten numbers and discovered their total is 1100. This was interesting because 11 was the smallest total we made and 1100 is like 11 but 100 times bigger. Also, if you add the digits in 1100 it makes 2 which is what we are trying to make!"