



INVESTIGATION



Palindromic Numbers

23432

54145

19691

83338

90909

MathSphere

Investigate palindromic numbers

A palindromic number is a number which reads the same forwards and backwards.

Starter task:

Take the number 47.

Reverse the digits and add to 47 eg

$$\begin{array}{r} 47 \\ + 74 \\ \hline 121 \end{array}$$

Is the answer a palindromic number?

Yes! (Because 121 reads the same forwards and backwards)

How many stages (additions) did it take to reach a palindromic number?

One! (because only one addition sum was needed to reach a palindromic answer)

Task: Record how many stages each two digit number takes to produce a palindromic number in a table or chart.

Investigate:

Investigate all numbers up to 100.

Are there any numbers that do not produce a palindromic number?

Which numbers are already palindromic?

Which number takes the most number of stages?

[illegible]

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Palindromic Numbers Investigation

Answer guide 1

This activity can be used across several year groups, and is a particularly appropriate investigation when children need to re-inforce their written methods of addition. It is a different way of setting a considerable number of addition sums as well as encouraging working in a logical sequence.

A palindrome is usually thought of as a word or words that can be spelt the same forwards or backwards. This can be a good Literacy lesson as there are a lot of good palindromes: eg

Was it a cat I saw?

Dennis and Edna sinned.

A man, a plan, a canal, Panama etc etc

and children enjoy making lists of their own, usually starting with mum and dad!

In the same way a palindromic number is a number which reads the same forwards and backwards.

Eg 1221 or 333

Take a two digit number, reverse it and add. Keep repeating and sooner or later, (usually sooner) a palindromic number will be produced.

Eg	56	or	28
	$\begin{array}{r} 56 \\ + 65 \\ \hline 121 \end{array}$		$\begin{array}{r} 28 \\ + 82 \\ \hline 110 \\ 011 \\ \hline 121 \end{array}$

56 is a palindromic number in one stage

28 is a palindromic number in two stages

Children quickly catch on to how to go about this - the teacher needs to emphasise that it is the number of stages which is important and that all additions should be checked.

Results can be recorded in a chart or table and on a blank number square. Note that reverse of numbers do not need to be repeated: ie if 27 has been done there is no need to do 72.

Answer guide 2

Whole class introduction:

If palindromic words has not been covered in Literacy then it might be a good idea to spend a little time on this before starting this investigation.

Take a two digit number eg 58

Reverse the digits and add the two numbers:

$$\begin{array}{r} 58 \\ + 85 \\ \hline 143 \\ + 341 \\ \hline 484 \end{array}$$

484 can be read the same forwards and backwards so is a palindromic number.

It took two additions from 58 so 58 is a two stage palindromic number.

Repeat with another number, but I recommend that you **do not** choose 89 or 98.

Note that some numbers eg 22 and 33 are already palindromic - so they are 0 stage numbers!

Does this work for all numbers up to 100?

Discuss how the task can be completed in a well ordered way. This investigation is very suitable for working in pairs, each partner taking a set of 10 numbers at a time.

Discuss ways of recording so numbers are not repeated - perhaps cross them off on a number square.

Reminders about the paper and pencil method of addition and how to set them out.

A number square could be used to record results: eg

0 stages blue

1 stage green

2 stages yellow etc and then look for a pattern in the colouring.

Answer guide 3

Here are some possible answers and notes for guidance.

A blank chart has been provided, which would be suitable for some children to use, but generally children should be encouraged to draw out their own charts and tables.

Below is a completed chart of the stages needed to make palindromic numbers up to 100.

Number of Stages	Number
0	1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 22, 33, 44, 55, 66, 77, 88, 99
1	10, 12, 13, 14, 15, 16, 17, 18, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31, 32, 34, 35, 36, 38, 40, 41, 42, 43, 45, 47, 50, 51, 52, 53, 54, 56, 60, 61, 62, 63, 65, 70, 71, 72, 74, 80, 81, 83, 90, 92, 100
2	19, 28, 37, 39, 46, 48, 49, 57, 58, 64, 67, 73, 75, 76, 82, 84, 85, 91, 93, 94,
3	59, 68, 86, 95,
4	69, 78, 87, 96
5	
6	79, 97
7	
8	
24	89, 98

Answer guide 4

Other ideas:

Discuss how the task can be completed in a well ordered way.
This investigation is very suitable for working in pairs, each partner taking a set of 10 numbers at a time.

Discuss ways of recording so numbers are not repeated - perhaps cross them off on a number square.

Reminders about the paper and pencil method of addition and how to set them out.

A number square could be used to record results: eg

0 stages blue

1 stage green

2 stages yellow etc and then look for a pattern in the colouring.

Extension activities:

See the results displayed in a number square. Is there a pattern?

Why do some numbers take more stages than others?

Why are palindromic numbers created by reversing digits?

Investigate 3 digit numbers.