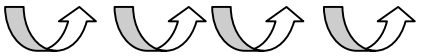
NUMBER PATTERNS

Think of these number patterns as the amount of pocket money you have in your bank

TERM	**1**	2	3	4	5	6	difference	Formula for nth term	.....
NUMBER	**5**	7	9	11	13	?			
GAP		2	2	2	2				



The **difference** is found by looking at the GAP between the numbers

THE FIRST PART OF THE FORMULA IS **k**n where **k** is the same as the gap
2n + something
2n + c

The second part of the formula is found by substituting n = 1 and working out the extra amount needed to get the FIRST term
2 x 1 = 2
3 more will get us to **5**
The formula is 2n + 3
Check when n = 2:
2 x 2 + 3 = 7 the second term

Use the formula to get the 20th term - How much money will you have in your bank after 20 weeks?

2 x 20 + 3 = **43** The 20th term is 43

Working backwards: After how many weeks will your bank hold 65 pounds?

Write

$$2n + 3 = 65$$
$$2n = 65 - 3$$
$$2n = 62$$
$$n = \mathbf{31}$$

WHAT IF THERE IS NO REGULAR GAP BETWEEN NUMBERS?

TERM	1	2	3	4	5	6
NUMBER	**4**	**13**	**26**	**43**	**64**	**89**
GAP		9	13	17	21	24
SECOND DIFFERENCES		4	4	4	4	

CALL THESE THE **FIRST DIFFERENCES**
THESE ARE NOT THE SAME
SOTHE FORMULA WILL NOT BE
Kn + c LOOK AT THE **SECOND DIFFERENCES**

THESE ARE THE SAME SO THE FORMULA WILL BE A QUADRATIC FORMULA:
$an^2 + bn + c$ and we have to find a, b and c

a is easy to find - it as always half the second difference - in this case it is **2**

so the formula is $\mathbf{2}n^2 + bn + c$ and we have to find **b** and **c.**

Start with a row of **term numbers** again	**n**	1	2	3	4	5	6	
And work out the values of $2n^2$	**$2n^2$**	2	8	18	32	50	72	
Now write down the difference between these numbers and the original numbers		(4)	(13)	(26)	(43)	(64)	(89)	
Difference:		2	5	8	11	14	17	this sequence is **bn + c**

And the formula is 3n - 1 using the method for a simple sequence described above.

Put the two parts together and what have you got? **$\underline{2n^2}$ + $\underline{3n - 1}$** **The formula for the nth term.**