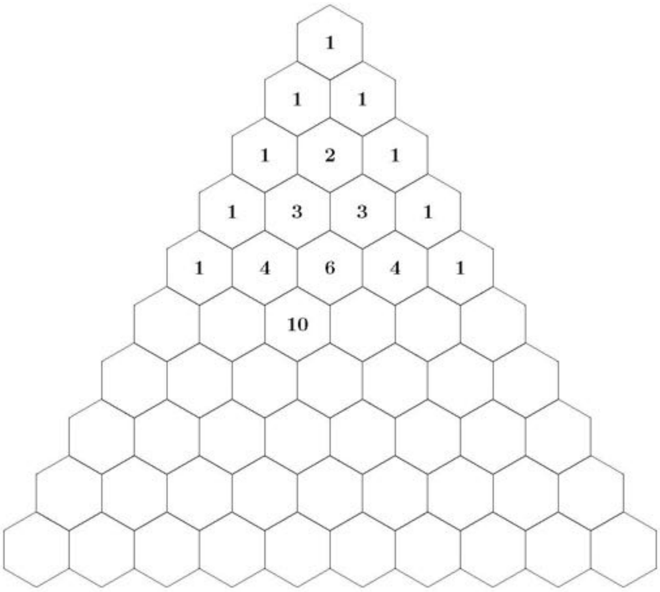
PASCAL'S TRIANGLE AND FRACTAL PATTERNS



Can you discover the rule for filling numbers in the hexagons?

Continue the pattern using the same rule. If you get it right the bottom row will start 1, 9, 36, 84, …

Shade the hexagons, all in one colour, where the number inside is even. Using a contrasting colour, shade the hexagons where the number inside is odd.

What do you see?

Can you see a way to do this without having to do any arithmetic?

As a class project, on a large grid with 21 rows, fill in the Pascal's triangle pattern of numbers. Shade the odd numbers. What do you notice about the pattern of colours?

On another 21-row grid colour in all the multiples of 3. Repeat on other grids, colouring the multiples of 5, then 7, then 9, …

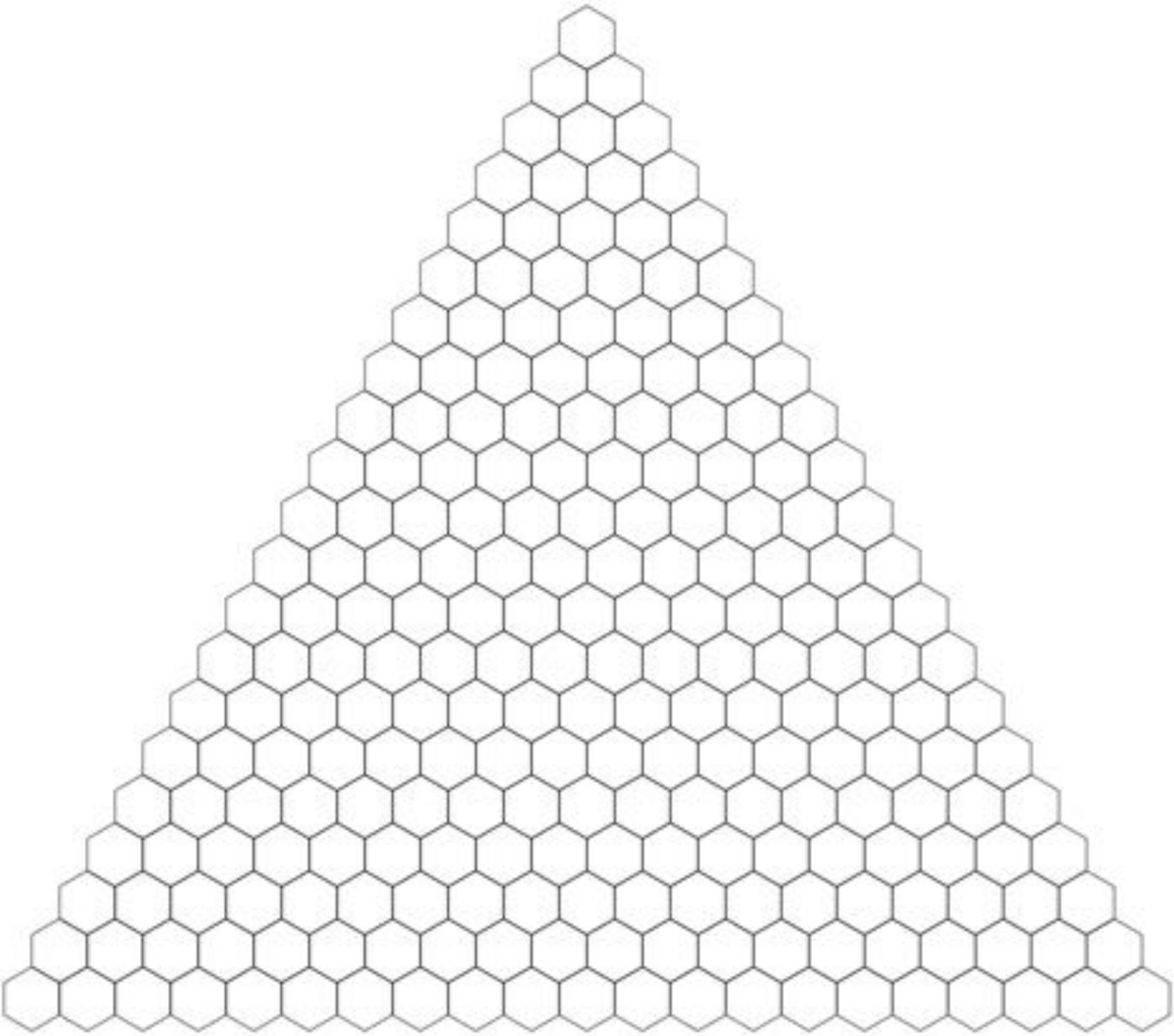
What do you notice? Have you seen these patterns before?

What happens if you look at multiples of 2, 4, … ?

Although this triangle, and the patterns associated with it, were known long before Pascal's time, it is called Pascal's triangle. It is very important in algebra and probability theory so it's useful to get to know it's properties. You may see ${}_nC_r$ on one of the buttons on your calculator; this gives the numbers on Pascal's triangle.

HELP

Each row of numbers in the triangle is formed from the numbers in the row above. Looking at the first 5 rows, together with the information that the 10th row starts 1, 9, 36, 84, … should help. Talk about the rule for filling in the numbers with other people and see if you can spot the connection with each row of numbers and the row below it.



NEXT

Work out $(1+x)^0$, $(1+x)^1$, $(1+x)^2$, $(1+x)^3$, $(1+x)^4$ and $(1+x)^5$. Look at the coefficients of the different powers of x. These are called Binomial Coefficients. Compare these coefficients with the numbers in Pascal's Triangle.

Can you explain the connection between the process of multiplying out the expansions of $(1+x)^n$ for n = 0, 1, 2, 3, 4 and 5 and the rule for entering numbers in Pascal's triangle?