



Alternating sums

Place alternating plus and minus signs across each row. For example: $1 - 4 + 6 - 4 + 1$. Evaluate these sums for rows 1 through 6. State a pattern and try to prove it.



Two halves of a row

Take any odd-numbered row. Prove that the sum of the left half equals the sum of the right half. What is the sum of each half of row 15?



The hockey-stick identity

Calculate $1 + 3 + 6 + 10 + 15$ and $1 + 4 + 10 + 20$. Locate these numbers in Pascal's triangle. State a general rule for this 'hockey stick' and explain why it works.



Diagonals and Fibonacci numbers

Add along short sloping diagonals: 1 ; 1 ; $1 + 1$; $1 + 2$; $1 + 3 + 1$; $1 + 4 + 3$; ... Write the first ten sums. What sequence appears? Explain why each new sum equals the sum of the previous two.

Extension

Shade the odd entries in the first 16 rows. Describe the pattern you see and connect it to the way each row is generated.