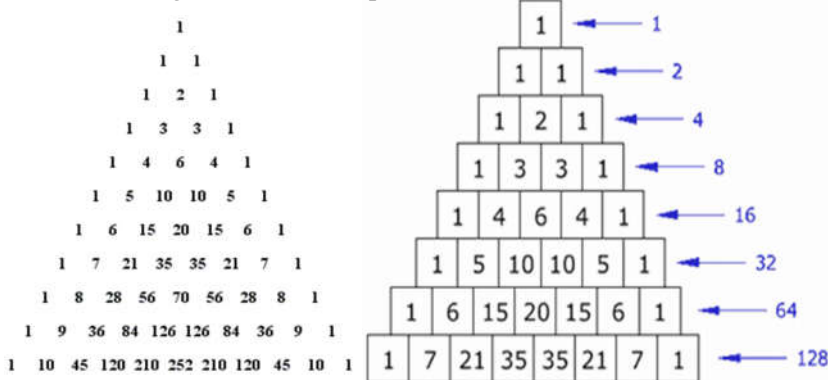


Combinations

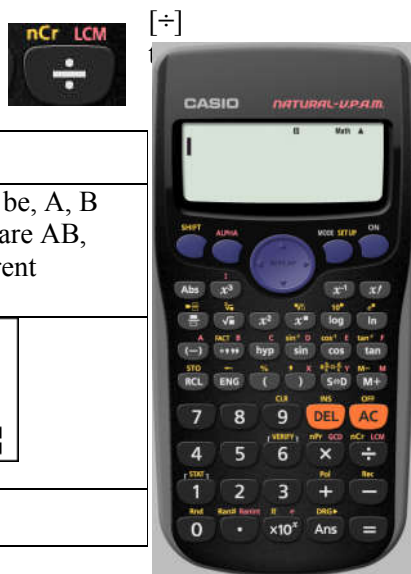
This resource was written by Derek Smith with the support of CASIO New Zealand. It may be freely distributed but remains the intellectual property of the author and CASIO.

Pascal's Triangle in different representations:



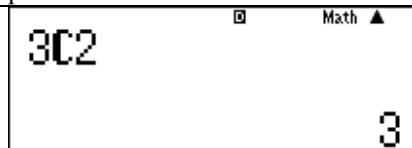
https://en.wikipedia.org/wiki/Pascal%27s_triangle

Accessing ${}^n C_r$ is via [SHIFT], then for 'nCr'. For combinations (${}^n C_r$) order of selection is **not** important.



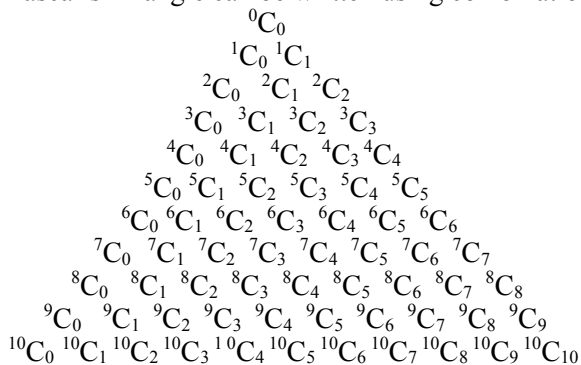
Example :

From 3 'choose' 2, let the 3 items be, A, B and C. So, possible combinations are AB, AC and BC. There are three different possibilities.



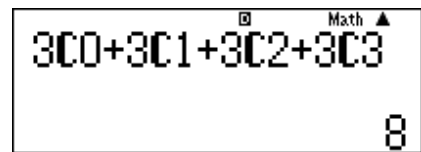
$${}^3 C_2 = 3$$

Pascal's Triangle can be written using combinations:



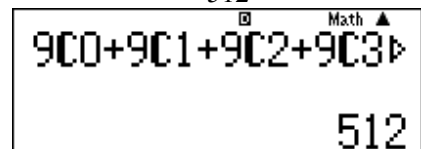
Example 1: Show that the sum of Pascal's Triangle row 4 = 8.

Answer:
$$\begin{aligned} \text{Sum} &= {}^3 C_0 + {}^3 C_1 + {}^3 C_2 + {}^3 C_3 \\ &= 1 + 3 + 3 + 1 \\ &= 8 \end{aligned}$$



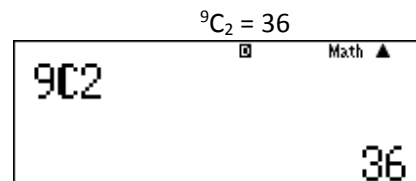
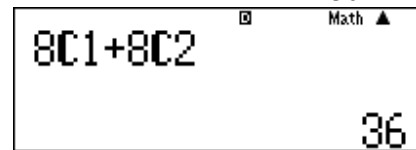
Example 2: What is the sum of Pascal's Triangle row 10?

Answer:
$$\begin{aligned} \text{Sum} &= {}^9 C_0 + {}^9 C_1 + {}^9 C_2 + {}^9 C_3 + {}^9 C_4 + \\ &\quad {}^9 C_5 + {}^9 C_6 + {}^9 C_7 + {}^9 C_8 + {}^9 C_9 \\ &= 1 + 9 + 36 + 84 + 126 + \\ &\quad 126 + 84 + 36 + 9 + 1 \\ &= 512 \end{aligned}$$



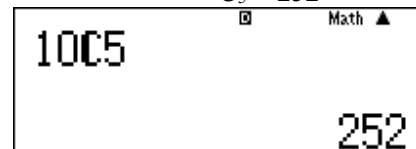
Example 3: Show that ${}^8 C_1 + {}^8 C_2 = {}^9 C_2$.

Answer:
$$\begin{aligned} {}^8 C_1 + {}^8 C_2 &= 8 + 28 \\ &= 36 \end{aligned}$$



Example 1: What number is in 6th position of the 11th row of Pascal's Triangle?

Answer: 11th row is: ${}^{10} C_2$;
 ${}^{10} C_0, {}^{10} C_1, {}^{10} C_2, {}^{10} C_3, {}^{10} C_4, {}^{10} C_5, {}^{10} C_6, {}^{10} C_7, {}^{10} C_8, {}^{10} C_9, {}^{10} C_{10}$
 6th position is: ${}^{10} C_5$
 ${}^{10} C_5 = 252$



What other relationships can you see and explore with Pascal's Triangle?

See: <https://www.cut-the-knot.org/arithmetics/combinatorics/PascalTriangleProperties.shtml>