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# Combinations Formulas

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# List of 22 Combinations Formulas

## Combinations

### 1) Maximum Value of $nCr$ when $N$ is Even

$$\text{fx } C = C\left(n, \frac{n}{2}\right)$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b\_img.jpg\)](#)

$$\text{ex } 70 = C\left(8, \frac{8}{2}\right)$$

### 2) Maximum Value of $nCr$ when $N$ is Odd

$$\text{fx } C = C\left(n_{\text{Odd}}, \frac{n_{\text{Odd}} + 1}{2}\right)$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d\_img.jpg\)](#)

$$\text{ex } 10 = C\left(5, \frac{5 + 1}{2}\right)$$

### 3) $nCr$ or $C(n,r)$

$$\text{fx } C = \frac{n!}{r! \cdot (n - r)!}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d\_img.jpg\)](#)

$$\text{ex } 70 = \frac{8!}{4! \cdot (8 - 4)!}$$



#### 4) No of Combinations of (P+Q) Things into Two Groups of P and Q Things



$$fx \quad C = \frac{(p + q)!}{(p!) \cdot (q!)}$$

[Open Calculator](#)

$$ex \quad 1716 = \frac{(7 + 6)!}{(7!) \cdot (6!)}$$

#### 5) No of Combinations of N Different Things taken Atleast One at once



$$fx \quad C = 2^n - 1$$

[Open Calculator](#)

$$ex \quad 255 = 2^8 - 1$$

#### 6) No of Combinations of N Different Things taken R at once



$$fx \quad C = C(n, r)$$

[Open Calculator](#)

$$ex \quad 70 = C(8, 4)$$

#### 7) No of Combinations of N Different Things taken R at once and Repetition Allowed



$$fx \quad C = C((n + r - 1), r)$$

[Open Calculator](#)

$$ex \quad 330 = C((8 + 4 - 1), 4)$$



### 8) No of Combinations of N Different Things taken R at once given M Specific Things Always Occur

$$\text{fx } C = C \binom{n - m}{r - m}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95\_img.jpg\)](#)

$$\text{ex } 5 = C \binom{8 - 3}{4 - 3}$$

### 9) No of Combinations of N Different Things taken R at once given M Specific Things Never Occur

$$\text{fx } C = C((n - m), r)$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2\_img.jpg\)](#)

$$\text{ex } 5 = C((8 - 3), 4)$$

### 10) No of Combinations of N Different Things, P and Q Identical Things taken Atleast One at once

$$\text{fx } C = (p + 1) \cdot (q + 1) \cdot (2^n) - 1$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7\_img.jpg\)](#)

$$\text{ex } 14335 = (7 + 1) \cdot (6 + 1) \cdot (2^8) - 1$$

### 11) No of Combinations of N Identical Things into R Different Groups if Empty Groups are Allowed

$$\text{fx } C = C(n + r - 1, r - 1)$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b\_img.jpg\)](#)

$$\text{ex } 165 = C(8 + 4 - 1, 4 - 1)$$



## 12) No of Combinations of N Identical Things into R Different Groups if Empty Groups are Not Allowed

$$\text{fx } C = C(n - 1, r - 1)$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a\_img.jpg\)](#)

$$\text{ex } 35 = C(8 - 1, 4 - 1)$$

## 13) No of Combinations of N Identical Things taken Zero or more at once

$$\text{fx } C = n + 1$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021\_img.jpg\)](#)

$$\text{ex } 9 = 8 + 1$$

## 14) Nth Catalan Number

$$\text{fx } C_n = \left( \frac{1}{n + 1} \right) \cdot C(2 \cdot n, n)$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd\_img.jpg\)](#)

$$\text{ex } 1430 = \left( \frac{1}{8 + 1} \right) \cdot C(2 \cdot 8, 8)$$

## Geometric Combinatorics

### 15) Number of Chords formed by joining N Points on Circle

$$\text{fx } N_{\text{Chords}} = C(n, 2)$$

[Open Calculator !\[\]\(e50091943b385fe16d3277389202856f\_img.jpg\)](#)

$$\text{ex } 28 = C(8, 2)$$



## 16) Number of Diagonals in N-Sided Polygon

$$\text{fx } N_{\text{Diagonals}} = C(n, 2) - n$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0\_img.jpg\)](#)

$$\text{ex } 20 = C(8, 2) - 8$$

## 17) Number of Rectangles formed by Number of Horizontal and Vertical Lines

$$\text{fx}$$
[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5\_img.jpg\)](#)

$$N_{\text{Rectangles}} = C(N_{\text{Horizontal Lines}}, 2) \cdot C(N_{\text{Vertical Lines}}, 2)$$

$$\text{ex } 1620 = C(10, 2) \cdot C(9, 2)$$

## 18) Number of Rectangles in Grid

$$\text{fx}$$
[Open Calculator !\[\]\(104fbf564e2e5a8fbd84f31656d114c7\_img.jpg\)](#)

$$N_{\text{Rectangles}} = C(N_{\text{Horizontal Lines}} + 1, 2) \cdot C(N_{\text{Vertical Lines}} + 1, 2)$$

$$\text{ex } 2475 = C(10 + 1, 2) \cdot C(9 + 1, 2)$$

## 19) Number of Straight Lines formed by joining N Non-Collinear Points

$$\text{fx } N_{\text{Straight Lines}} = C(n, 2)$$

[Open Calculator !\[\]\(097cdd6c9c875b64d9b8c9a2409491c4\_img.jpg\)](#)

$$\text{ex } 28 = C(8, 2)$$



## 20) Number of Straight Lines formed by joining N Points out of which M are Collinear

$$\text{fx } N_{\text{Straight Lines}} = C(n, 2) - C(m, 2) + 1$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5\_img.jpg\)](#)

$$\text{ex } 26 = C(8, 2) - C(3, 2) + 1$$

## 21) Number of Triangles formed by joining N Non-Collinear Points

$$\text{fx } N_{\text{Triangles}} = C(n, 3)$$

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5\_img.jpg\)](#)

$$\text{ex } 56 = C(8, 3)$$

## 22) Number of Triangles formed by joining N Points out of which M are Collinear

$$\text{fx } N_{\text{Triangles}} = C(n, 3) - C(m, 3)$$

[Open Calculator !\[\]\(c444627dab9fee9a1550c053ffaaaae2\_img.jpg\)](#)

$$\text{ex } 55 = C(8, 3) - C(3, 3)$$



## Variables Used

- **C** Number of Combinations
- **$C_n$**  Nth Catalan Number
- **m** Value of M
- **n** Value of N
- **$N_{\text{Chords}}$**  Number of Chords
- **$N_{\text{Diagonals}}$**  Number of Diagonals
- **$N_{\text{Horizontal Lines}}$**  Number of Horizontal Lines
- **$n_{\text{Odd}}$**  Value of N (Odd)
- **$N_{\text{Rectangles}}$**  Number of Rectangles
- **$N_{\text{Straight Lines}}$**  Number of Straight Lines
- **$N_{\text{Triangles}}$**  Number of Triangles
- **$N_{\text{Vertical Lines}}$**  Number of Vertical Lines
- **p** Value of P
- **q** Value of Q
- **r** Value of R





## Constants, Functions, Measurements used

- **Function:**  $C$ ,  $C(n,k)$   
*Binomial coefficient function*



## Check other formula lists

- [Combinations Formulas](#) 
- [Permutations Formulas](#) 

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