MATHEMATICS · GRADES 10-12

Pascal's triangle

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you work out the number of ways to choose a team or the odds in a game of chance without listing every possibility by hand. A coach choosing five players from a squad does not have time to write out every combination, and a card player working out the odds of a hand needs the count fast. The triangle gives those counts in a pattern you can build row by row, and the same numbers show up in coin flips and lotteries. It is a shortcut that turns a long, error prone count into a pattern you can read off.



Rule

In Pascal's triangle, every row starts and ends with 1.

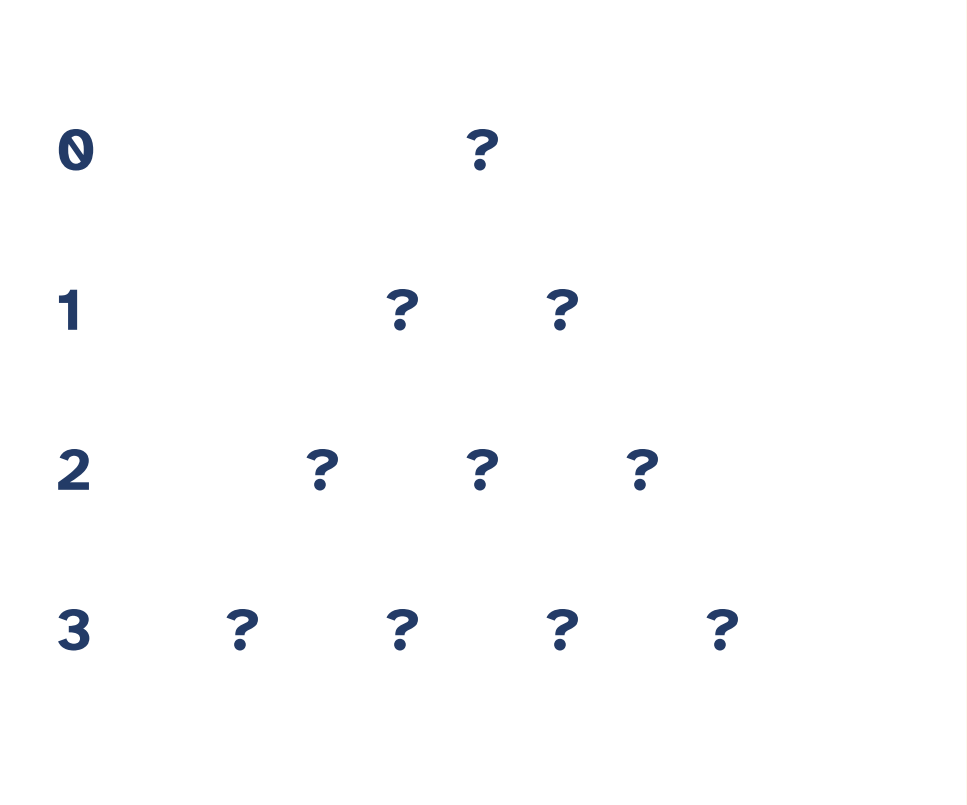
Every other number is the sum of the two numbers directly above it.

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Worked examples

EXAMPLE 1

Q Write rows 0 to 3 of Pascal's triangle.



SOLUTION

Row 0: 1

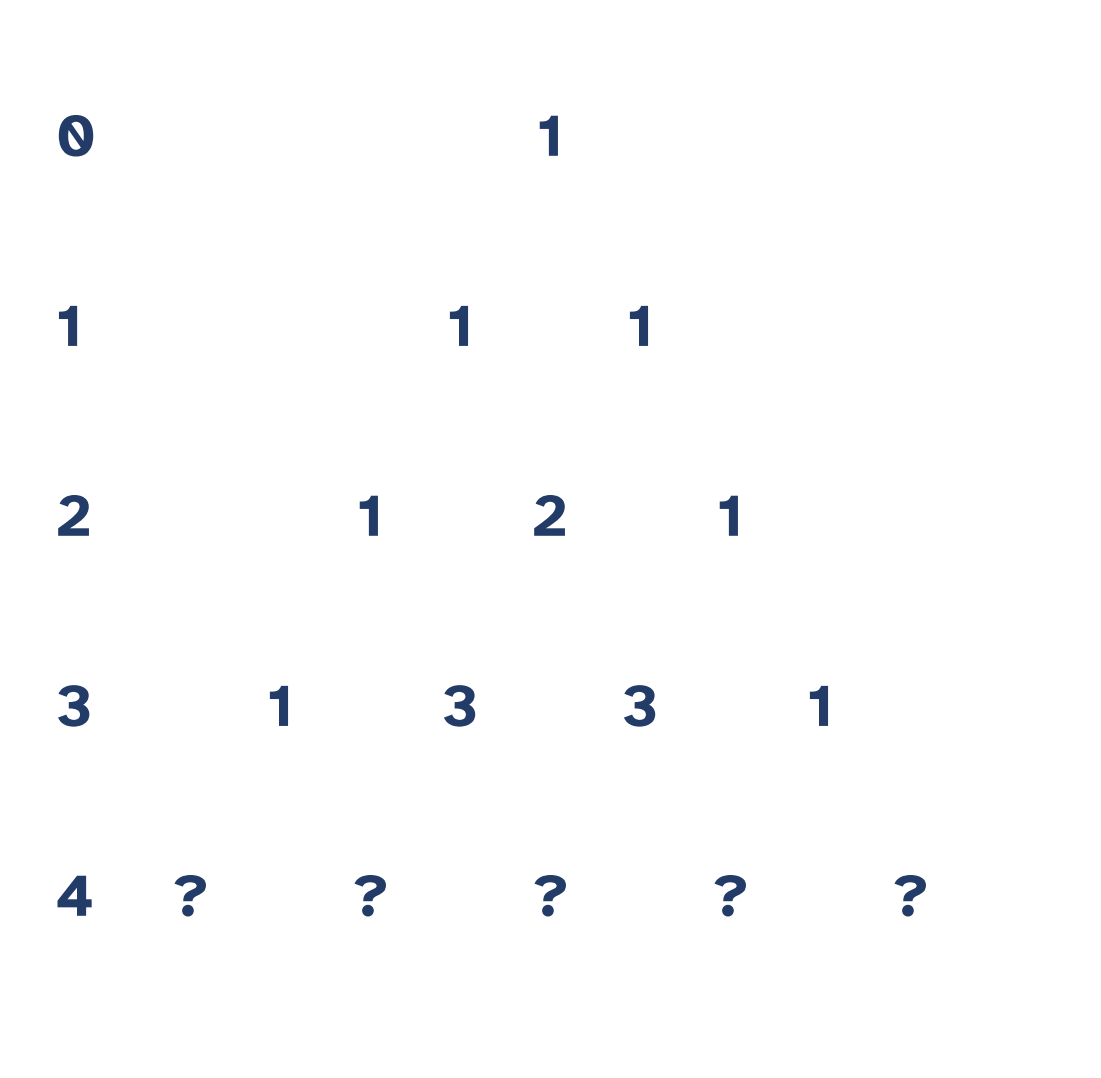
Row 1: 1, 1. Each row starts and ends with 1.

Row 2: 1, 2, 1. Row 3: 1, 3, 3, 1, since 1 + 2 = 3

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EXAMPLE 2

Q Find row 4 of Pascal's triangle.



SOLUTION

Row 3 is 1, 3, 3, 1.

Add neighbours: 1 + 3 = 4, 3 + 3 = 6, 3 + 1 = 4

Row 4: 1, 4, 6, 4, 1

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Practice questions

1

What is row 0?

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2

Write out row 1

A 1

B 1, 1

C 1, 2, 1

D 1, 1, 1

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3 Write out row 2

A 1, 1

B 1, 3, 3, 1

C 1, 2, 1

D 1, 2

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4 Write out row 3

A 1, 2, 1

B 1, 4, 6, 4, 1

C 1, 3, 2, 1

D 1, 3, 3, 1

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5 Row 4 reads 1, 4, 6, 4, 1. Use it to write row 5.

- **A** 1, 4, 6, 4, 1
- **B** 1, 5, 10, 10, 5, 1
- **C** 1, 6, 15, 20, 15, 6, 1
- **D** 1, 5, 10, 5, 1

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6 How is each number in Pascal's triangle made?

- **A** By multiplying the two numbers directly above it
- **B** By doubling the number above it
- **C** By adding the two numbers directly above it
- **D** By adding the two numbers below it

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7 Every row of Pascal's triangle begins and ends with the same number. What is it?

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8 A student expands $(x + y)^2$ and needs the coefficients 1, 2, 1. Which row gives them?

- A Row 1
- B Row 3
- C Row 2
- D Row 4

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9 What is the sum of $1 + 3 + 3 + 1$?

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10 **What is the third number in row 4 of Pascal's triangle?**

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ANSWER KEY

1. 1

2. 1, 1

3. 1, 2, 1

4. 1, 3, 3, 1

5. 1, 5, 10, 10, 5, 1

6. By adding the two numbers directly above it

7. 1

8. Row 2

9. 8

10. 6

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