MATHEMATICS · GRADES 10-12

Sigma notation

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you write a long sum, like adding up every day's earnings over a month, in one short symbol instead of writing out every number. A shop owner adding up thirty days of takings writes one compact symbol instead of a line of thirty numbers. A student adding a sequence of numbers for a test question saves time and avoids copying errors. Knowing sigma notation tells you how to write a long addition in a short form that still says exactly which numbers to add.



Rule

Sigma notation: the symbol with a starting value below and an ending value above means add up the expression for each value of the index in between.

The number below is where you start, and the number above is where you stop.

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Worked examples

EXAMPLE 1

Q Write 1 + 2 + 3 + 4 in sigma notation.

$$? = 1 + 2 + 3 + 4$$

SOLUTION

The terms are the numbers 1, 2, 3, 4, so the rule is just k.

The index k runs from 1 to 4.

In sigma notation: sum from k = 1 to 4 of k.

EXAMPLE 2

Q Evaluate the sum from k = 1 to 3 of 2k.

SOLUTION

Put k = 1, 2, 3 into 2k: 2 × 1 = 2, 2 × 2 = 4, 2 × 3 = 6.

Add them: 2 + 4 + 6.

The sum is 12.

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Practice questions

1 Write $2 + 4 + 6 + 8$ in sigma notation.

- **A** Sum from k = 1 to 4 of k
- **B** Sum from k = 1 to 4 of (2k - 1)
- **C** Sum from k = 1 to 4 of 2k
- **D** Sum from k = 1 to 4 of 3k

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2 Expand the sum from k = 1 to 4 of (3k - 1).

- **A** 2 + 5 + 8 + 11
- **B** 3 + 6 + 9 + 12
- **C** 2 + 4 + 6 + 8
- **D** 1 + 4 + 7 + 10

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3 How many terms are in the sum from $k = 2$ to 6 of k^2?

- **A** 4
- **B** 5
- **C** 6
- **D** 3

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4 What is the sum from $k = 1$ to 4 of k?

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5 What is the sum from $k = 1$ to 3 of k^3?

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6 **What is the sum from $k = 1$ to 4 of k^2?**

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7 **What is the sum from $k = 1$ to 3 of 2^k?**

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8 **What is the sum from $k = 1$ to 5 of 1?**

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9 What is the sum from k = 0 to 3 of k?

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10 In the sum from k = 1 to 4 of 2k, what does k = 1 tell you?

A. The first term is 1

B. Start with k = 1

C. The sum has 1 term

D. The answer is 1

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ANSWER KEY

1. Sum from k = 1 to 4 of 2k

2. 2 + 5 + 8 + 11

3. 5

4. 10

5. 36

6. 30

7. 14

8. 5

9. 6

10. Start with k = 1

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