



# Evaluating Summation (Sigma) Notation

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## Learning Objectives

- Identify the index, lower limit, upper limit, and summand of a sigma expression
- Evaluate finite summations of linear expressions such as  $2n$  and  $2n+5$
- Evaluate finite summations of exponential expressions such as  $-2^{n-1}$  and  $(1/2)^n$
- Apply summation properties to compute sums efficiently

Evaluate each summation by substituting each integer value of the index into the summand and adding the resulting terms.

### 1. Evaluate the summation.

$$\sum_{n=1}^5 2n$$

Answer: \_\_\_\_\_

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### 2. Evaluate the summation.

$$\sum_{n=3}^5 (2n + 5)$$

Answer: \_\_\_\_\_

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### 3. Evaluate the summation.

$$\sum_{n=2}^5 -2^{n-1}$$

Answer: \_\_\_\_\_

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### 4. Evaluate the summation.

$$\sum_{n=0}^4 \left(\frac{1}{2}\right)^n$$

Answer: \_\_\_\_\_

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### 5. Identify the upper limit, lower limit, index of summation, and summand.

$$\sum_{k=2}^7 (3k - 1)$$

Answer: \_\_\_\_\_

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**6. Evaluate the summation.**

$$\sum_{n=1}^4 (n^2 + 1)$$

Answer: \_\_\_\_\_

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**7. Evaluate the summation.**

$$\sum_{i=1}^6 4$$

Answer: \_\_\_\_\_

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**8. Evaluate the summation.**

$$\sum_{n=1}^4 3^n$$

Answer: \_\_\_\_\_

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**9. Evaluate the summation.**

$$\sum_{k=1}^5 (-1)^k k$$

Answer: \_\_\_\_\_

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**10. Evaluate the summation.**

$$\sum_{n=2}^4 \frac{1}{n}$$

Answer: \_\_\_\_\_





This worksheet covers evaluating sigma (summation) notation: identifying parts of the notation, computing summations of linear expressions ( $2n$ ,  $2n+5$ ), and computing summations of exponential expressions ( $-2^{n-1}$ ,  $(1/2)^n$ ) over given index ranges, as shown in the chapters of the video.

## Solutions

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1. Evaluate the summation.

$$\sum_{n=1}^5 2n$$

→ Substitute  $n$  equals 1, 2, 3, 4, and 5 into  $2n$  to get 2, 4, 6, 8, and 10.

→ Add the terms: 2 plus 4 plus 6 plus 8 plus 10 equals 30.

**Answer:**     30

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2. Evaluate the summation.

$$\sum_{n=3}^5 (2n + 5)$$

→ Substitute  $n$  equals 3, 4, and 5 into  $2n$  plus 5 to get 11, 13, and 15.

→ Add the terms: 11 plus 13 plus 15 equals 39.

**Answer:**     39

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3. Evaluate the summation.

$$\sum_{n=2}^5 -2^{n-1}$$

→ Substitute  $n$  equals 2, 3, 4, and 5 into negative 2 raised to the  $n$  minus 1 power.

→ This gives negative 2, negative 4, negative 8, and negative 16.

→ Add the terms: negative 2 plus negative 4 plus negative 8 plus negative 16 equals negative 30.

**Answer:**     -30

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4. Evaluate the summation.

$$\sum_{n=0}^4 \left(\frac{1}{2}\right)^n$$

→ Substitute  $n$  equals 0, 1, 2, 3, and 4 into one half raised to the  $n$  power.

→ This gives 1, one half, one fourth, one eighth, and one sixteenth.

→ Write each term with a common denominator of 16: sixteen sixteenths, eight sixteenths, four sixteenths, two sixteenths, and one sixteenth.

→ Add the numerators to get thirty-one sixteenths.

**Answer:**      $\frac{31}{16}$

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5. Identify the upper limit, lower limit, index of summation, and summand.

$$\sum_{k=2}^7 (3k - 1)$$

- The number below the sigma symbol is the lower limit, which is 2.
- The number above the sigma symbol is the upper limit, which is 7.
- The variable used in the expression is the index, which is  $k$ .
- The expression to be summed is the summand, which is three  $k$  minus one.

**Answer:** lower = 2, upper = 7, index =  $k$ , summand =  $3k - 1$

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6. Evaluate the summation.

$$\sum_{n=1}^4 (n^2 + 1)$$

- Substitute  $n$  equals 1, 2, 3, and 4 into  $n$  squared plus 1 to get 2, 5, 10, and 17.
- Add the terms: 2 plus 5 plus 10 plus 17 equals 34.

**Answer:** 34

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7. Evaluate the summation.

$$\sum_{i=1}^6 4$$

- The summand is the constant 4, which does not change with the index.
- There are six terms from  $i$  equals 1 through 6, so multiply 4 by 6 to get 24.

**Answer:** 24

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8. Evaluate the summation.

$$\sum_{n=1}^4 3^n$$

- Substitute  $n$  equals 1, 2, 3, and 4 into 3 raised to the  $n$  power to get 3, 9, 27, and 81.
- Add the terms: 3 plus 9 plus 27 plus 81 equals 120.

**Answer:** 120

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9. Evaluate the summation.

$$\sum_{k=1}^5 (-1)^k k$$

- Substitute  $k$  equals 1, 2, 3, 4, and 5 to get negative 1, 2, negative 3, 4, and negative 5.
- Add the terms: negative 1 plus 2 plus negative 3 plus 4 plus negative 5 equals negative 3.

**Answer:** -3

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10. Evaluate the summation.

$$\sum_{n=2}^4 \frac{1}{n}$$

- Substitute  $n$  equals 2, 3, and 4 into one over  $n$  to get one half, one third, and one fourth.
- Use a common denominator of 12 to rewrite as six twelfths, four twelfths, and three twelfths.
- Add the numerators to get thirteen twelfths.

**Answer:**  $\frac{13}{12}$

