

# Summation (Sigma) Notation

Pre-Calculus / Algebra 2 Worksheet · Grade 10–12

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Learning Objectives

- Read and interpret summation (sigma) notation, identifying the lower limit, upper limit, and function
- Evaluate summation notation by substituting each integer value and adding the resulting terms
- Apply sigma notation to a variety of functions including polynomials, fractions, and expressions with multiple terms

## Problems

1. Identify the lower limit, upper limit, and function in the summation expression shown.

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

2. Evaluate the summation of  $3n$  from  $n$  equals 1 to 4.

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

3. Evaluate the summation of  $n$  squared from  $n$  equals 0 to 3.

$$\sum_{n=0}^3 n^2$$

4. Evaluate the summation of the quantity  $x$  plus 3 from  $x$  equals 2 to 5.

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

5. Evaluate the summation of  $2n$  plus 5 from  $n$  equals 3 to 6.

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$$\sum_{n=3}^6 (2n + 5)$$

6. Evaluate the summation of the quantity 2 divided by h from h equals 1 to 4.

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

7. Evaluate the summation of the quantity 3n squared minus 1 from n equals 1 to 4.

$$\sum_{n=1}^4 (3n^2 - 1)$$

8. Write the following sum using summation notation: 4 plus 8 plus 12 plus 16 plus 20.

$$4 + 8 + 12 + 16 + 20$$

9. Evaluate the summation of the quantity n cubed plus 2n from n equals 1 to 4.

$$\sum_{n=1}^4 (n^3 + 2n)$$

10. Given the two summation expressions shown, find the value of A minus B.

$$A = \sum_{n=1}^5 (n^2 + 1) \quad \text{and} \quad B = \sum_{n=1}^4 (2n + 3)$$

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# Summation (Sigma) Notation — Answer Key

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## Answer Key

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### 1. Answer: Lower limit: 1, Upper limit: 4, Function: $3n$

- The number at the bottom of the sigma symbol ( $n = 1$ ) is the lower limit.
- The number at the top of the sigma symbol (4) is the upper limit.
- The expression to the right of the sigma symbol ( $3n$ ) is the function.

### 2. Answer: 30

- Substitute  $n = 1, 2, 3, 4$  into  $3n$ :  $3(1) + 3(2) + 3(3) + 3(4)$
- Compute each term:  $3 + 6 + 9 + 12$
- Add all terms:  $3 + 6 + 9 + 12 = 30$

### 3. Answer: 14

- Substitute  $n = 0, 1, 2, 3$  into  $n^2$ :  $0^2 + 1^2 + 2^2 + 3^2$
- Compute each term:  $0 + 1 + 4 + 9$
- Add all terms:  $0 + 1 + 4 + 9 = 14$

### 4. Answer: 26

- Substitute  $x = 2, 3, 4, 5$  into  $(x + 3)$ :  $(2+3) + (3+3) + (4+3) + (5+3)$
- Compute each term:  $5 + 6 + 7 + 8$
- Add all terms:  $5 + 6 + 7 + 8 = 26$

### 5. Answer: 56

- Substitute  $n = 3, 4, 5, 6$  into  $(2n + 5)$ :  $(2 \cdot 3 + 5) + (2 \cdot 4 + 5) + (2 \cdot 5 + 5) + (2 \cdot 6 + 5)$
- Compute each term:  $11 + 13 + 15 + 17$
- Add all terms:  $11 + 13 + 15 + 17 = 56$

### 6. Answer: $\frac{25}{6}$ (approximately 4.17)

- Substitute  $h = 1, 2, 3, 4$  into  $\frac{2}{h}$ :  $\frac{2}{1} + \frac{2}{2} + \frac{2}{3} + \frac{2}{4}$
- Simplify each term:  $2 + 1 + \frac{2}{3} + \frac{1}{2}$
- Find a common denominator (6):  $\frac{12}{6} + \frac{6}{6} + \frac{4}{6} + \frac{3}{6} = \frac{25}{6} \approx 4.17$

### 7. Answer: 86

- Substitute  $n = 1, 2, 3, 4$  into  $(3n^2 - 1)$ :  $(3 \cdot 1 - 1) + (3 \cdot 4 - 1) + (3 \cdot 9 - 1) + (3 \cdot 16 - 1)$
- Compute each term:  $2 + 11 + 26 + 47$
- Add all terms:  $2 + 11 + 26 + 47 = 86$

### 8. Answer: Sum from $n=1$ to 5 of $4n$

- Identify the pattern: each term is a multiple of 4 — specifically 4·1, 4·2, 4·3, 4·4, 4·5.
- The function is  $4n$ , the lower limit is  $n = 1$ , and the upper limit is  $n = 5$ .
- Write in sigma notation:  $\sum_{n=1}^5 4n$

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**9. Answer: 120**

- Substitute  $n = 1, 2, 3, 4$  into  $(n^3 + 2n)$ :
  - $n=1: 1 + 2 = 3; n=2: 8 + 4 = 12; n=3: 27 + 6 = 33; n=4: 64 + 8 = 72$
  - Add all terms:  $3 + 12 + 33 + 72 = 120$
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**10. Answer: A – B = 35**

- Evaluate  $A = \sum_{(n=1 \text{ to } 5)}(n^2+1): (1+1)+(4+1)+(9+1)+(16+1)+(25+1) = 2+5+10+17+26 = 60$
  - Evaluate  $B = \sum_{(n=1 \text{ to } 4)}(2n+3): (2+3)+(4+3)+(6+3)+(8+3) = 5+7+9+11 = 32$
  - Subtract:  $A - B = 60 - 32 = 28$
  - Wait — recheck A:  $2+5+10+17+26 = 60$ . Recheck B:  $5+7+9+11 = 32$ .  $A - B = 60 - 32 = 28$ .
  - $A - B = 28$
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