

1. What number comes next in each sequence below?

1, 3, 6, 10, 15, 21, 28, _____

Answer: 36

1;

$1 + 2 = 3$;

$1 + 2 + 3 = 6$;

$1 + 2 + 3 + 4 = 10$;

$1 + 2 + 3 + 4 + 5 = 15$;

$1 + 2 + 3 + 4 + 5 + 6 = 21$;

$1 + 2 + 3 + 4 + 5 + 6 + 7 = 28$;

$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 = 36$;

The n th term in the sequence is given by $n(n + 1)/2$, and the numbers are often referred to as triangular numbers.

2. 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, _____

Answer: 55

$0 + 1 = 1$;

$1 + 1 = 2$;

$1 + 2 = 3$;

$2 + 3 = 5$;

$3 + 5 = 8$;

$5 + 8 = 13$;

$8 + 13 = 21$;

$13 + 21 = 34$;

$21 + 34 = 55$;

Each term (starting with the third term) in the sequence is the sum of the two terms preceding it. The series is often referred to as the Fibonacci series.

Fibonacci (1175) believed that this series was followed by various natural phenomena. In fact, the number of leaves on the stems of particular plants follows this series.

3. 2, 6, 12, 20, 30, 42, 56, _____

Answer: 72

$$(1)(2) = 2;$$

$$(2)(3) = 6;$$

$$(3)(4) = 12;$$

$$(4)(5) = 20;$$

$$(5)(6) = 30;$$

$$(6)(7) = 42;$$

$$(7)(8) = 56;$$

$$(8)(9) = 72;$$

The n th term in the sequence is given by $n(n + 1)$.

4. 1, 2, 6, 24, 120, _____

Answer: 720

$$1 = 1;$$

$$(1)(2) = 2;$$

$$(1)(2)(3) = 6;$$

$$(1)(2)(3)(4) = 24;$$

$$(1)(2)(3)(4)(5) = 120;$$

$$(1)(2)(3)(4)(5)(6) = 720;$$

The n th term in the sequence is given by $n!$ (factorial of n), which is defined as the product of all integers from 1 to n .

What number comes in the blank in each sequence below?

5. 200, 196, 180, 116, _____

Answer: -140

$$200 - 196 = 4; 196 - 180 = 16; 180 - 116 = 64;$$

The differences between two consecutive numbers are 4, 16, 64, ... (each number starting with 4 is multiplied by 4 to get the next number).

$$\text{So, } 116 - 4(64) = 116 - 256 = -140.$$

6. 213, 426, _____, 852, 1065, 1278

Answer: 639

$$213 + 213 = 426; 426 + 213 = 639; 639 + 213 = 852;$$

$$852 + 213 = 1065; 1065 + 213 = 1278;$$

The numbers simply increase by 213.

7. 8, 27, 64, _____, 216, 343

Answer: 125

The terms are merely the cubes of integers starting with 2. Thus,

$$2^3 = 2 \times 2 \times 2 = 8; 3^3 = 3 \times 3 \times 3 = 27; 4^3 = 4 \times 4 \times 4 = 64;$$

$$5^3 = 5 \times 5 \times 5 = 125; 6^3 = 6 \times 6 \times 6 = 216; 7^3 = 7 \times 7 \times 7 = 343;$$

8. 3, 10, 20, 27, _____, 44

Answer: 37

The odd terms continually increase by 7, i.e., 3, 20, 37, ...

The even terms also continually increase by 7, i.e., 10, 27, 44, ...

Alternatively, add 7 and 10 alternately starting with 3.

9. _____, 0.99, 9.9, 99, 990, 9900

Answer: 0.099

Each number is one-tenth the number following it.

Thus, $(1/10) \times 0.99 = 0.099$

10. 243, 162, 108, 72, _____, 32

Answer: 48

Each number is two-thirds the number preceding it.

Thus, $72 \times 2/3 = 48$