

Sequences, Series, and the Binomial Theorem

Arithmetic and geometric sequences, series, proof by induction, and binomial expansion.

Name _____ Date _____

32 main 2-up grid 2 pages

Completion Reward



Shown here as a small pack artifact, not a preview destination.

1. Which sequence is arithmetic?

term number	value
1	4
2	7
3	10
4	13

Check whether each term changes by the same amount from the previous term.

- A. 3, 6, 12, 24
- B. 1, 4, 9, 16
- C. 4, 7, 10, 13
- D. 2, 5, 11, 23

2. Which sequence is geometric?

term number	value
1	2
2	6
3	18
4	54

Check whether each term is obtained by multiplying by the same factor.

- A. 2, 5, 8, 11
- B. 1, 3, 6, 10
- C. 4, 8, 13, 19
- D. 2, 6, 18, 54

3. What is the goal of mathematical induction?

stage	goal
base case	show true at $n = 1$
inductive step	assume true at k and prove true at $k + 1$

Induction starts with a base case and then proves the truth carries from $n = k$ to $n = k + 1$.

- A. To prove a statement is true for every positive integer in a pattern.
- B. To estimate a sequence with a graph.
- C. To factor a polynomial.
- D. To verify a statement for the first few cases only.

4. In the expansion of $(a + b)^n$, what do binomial coefficients count?

power	coefficients
2	1, 2, 1
3	1, 3, 3, 1
4	1, 4, 6, 4, 1

The coefficients record how many ways matching a-and-b products appear in the expansion.

- A. The roots of the polynomial
- B. The slope of each term
- C. How many ways a term can be formed in the expansion
- D. The degree drop between terms

5. What does a recursive formula need besides a recurrence rule?

n	a_n
1	start here
2	from a_1
3	from a_2

The rule can only generate new terms after an initial value is given.

- A. A determinant
- B. A starting value
- C. A graph intercept
- D. A binomial coefficient

6. Which formula matches 10, 13, 16, 19, ...?

- A. $a_n = 10(3^{n-1})$
- B. $a_n = 3 + 10n$
- C. $a_n = 10 + n^2$
- D. $a_n = 10 + 3(n - 1)$

7. Which formula matches 3, 12, 48, 192, ...?

- A. $a_n = 3 + 4(n - 1)$
- B. $a_n = 12(3^{n-1})$
- C. $a_n = 3(4^{n-1})$
- D. $a_n = 4(3^{n-1})$

8. Which recursive rule matches 4, 9, 14, 19, ...?

n	a_n
1	4
2	9
3	14
4	19

Each new term is the previous term plus the same difference.

- A. $a_1 = 4, a_n = 5a_{(n-1)}$
- B. $a_1 = 4, a_n = a_{(n-1)} + 5$
- C. $a_1 = 9, a_n = a_{(n-1)} + 4$
- D. $a_1 = 4, a_n = a_{(n-1)} - 5$

10. A student says 2, 6, 18, 54 is arithmetic because the numbers keep changing. What is the mistake?

- A. Arithmetic sequences must grow faster.
- B. Geometric sequences cannot have whole numbers.
- C. They should subtract 2 from every term first.
- D. The pattern has a constant ratio, not a constant difference.

11. Find the next term after 6, 10, 14, 18. Answer with a number.

12. Find the next term after 3, 9, 27, 81. Answer with a number.

13. For $a_n = 5 + 3(n - 1)$, find a_4 . Answer with a number.

14. For $a_n = 2(4^{n-1})$, find a_3 . Answer with a number.

15. Find the sum of the first 4 terms of 2, 5, 8, 11. Answer with a number.

16. Find the sum of the first 4 terms of 1, 2, 4, 8.
Answer with a number.

17. What is the coefficient of x in the expansion of $(x + 1)^2$? Answer with a number.

18. What is the coefficient of x^2 in $(x + 1)^3$?
Answer with a number.

19. For 7, 12, 17, 22, what is the 6th term? Answer with a number.

20. For 2, 6, 18, 54, what is the 5th term? Answer with a number.

21. Find the sum of the first 3 terms of 8, 11, 14, ...
Answer with a number.

22. Find the sum of the first 3 terms of 5, 10, 20, ...
Answer with a number.

23. If $a_1 = 3$ and $a_n = a_{(n-1)} + 4$, what is a_4 ?
Answer with a number.

24. If $a_1 = 2$ and $a_n = 3a_{(n-1)}$, what is a_4 ?
Answer with a number.

25. Write an explicit formula for the sequence 4, 7, 10, 13, ... Answer in the form $n = \dots$

n	a_n
1	4
2	7
3	10
4	13

The formula reproduces the same constant-difference table.

26. Write an explicit formula for the sequence 5, 10, 20, 40, ... Answer in the form $n = \dots$

n	a_n
1	5
2	10
3	20
4	40

The explicit rule recreates a constant-ratio sequence.

27. Expand $(x + 2)^2$. Answer with an equivalent expression.

term	coefficient	power of x
1	1	2
2	2	1
3	1	0

The coefficient row 1, 2, 1 organizes the expansion of a square.

28. Expand $(x + 1)^3$. Answer with an equivalent expression.

term	coefficient	power of x
1	1	3
2	3	2
3	3	1
4	1	0

The row 1, 3, 3, 1 tracks the combined terms in a cube expansion.

29. Write an explicit formula for 2, 6, 10, 14, ...
Answer in the form $n = \dots$

30. Write an explicit formula for 7, 21, 63, 189, ...
Answer in the form $n = \dots$

31. Expand $(x - 3)^2$. Answer with an equivalent expression.

32. Expand $(x - 1)^3$. Answer with an equivalent expression.