Sequences, Induction, and the Binomial Theorem

Arithmetic and geometric sequences, 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?

A. 2, 4, 8, 16, ...
B. 1, 1, 2, 3, ...
C. 3, 7, 11, 15, ...
D. 5, 9, 12, 14, ...

2. Which sequence is geometric?

A. 2, 5, 8, 11, ...
B. 2, 6, 18, 54, ...
C. 1, 4, 9, 16, ...
D. 3, 5, 7, 11, ...

3. What is the purpose of mathematical induction?

A. To prove a statement is true for every positive integer in a sequence of cases
B. To guess the next term in a pattern from a graph
C. To estimate a derivative numerically
D. To turn any recursive formula into an explicit one automatically

4. Where do the coefficients in a binomial expansion come from?

A. Pascal's triangle or combinations
B. Only the quadratic formula
C. The unit circle
D. Repeated subtraction of exponents

5. What does a recursive formula do?

A. Defines a term using earlier terms
B. Gives every term directly from n only
C. Always creates a geometric sequence
D. Never needs a first term

6. Which formula is an explicit form for an arithmetic sequence?

A. a_n = a_1r^n
B. a_n = a_1 + (n - 1)d
C. a_n = n!
D. a_n = 2^n + 1 always

7. Which formula is an explicit form for a geometric sequence?

A. a_n = a_1 + (n - 1)d
B. a_n = n + 1
C. a_n = n^2
D. a_n = a_1r^(n - 1)

8. What does 5! mean?

A. 5 + 4 + 3 + 2 + 1
B. 5^5
C. 5 x 5
D. 5 x 4 x 3 x 2 x 1

9. After checking the base case in an induction proof, what comes next?

A. Assume the statement for n and prove it for n + 1
B. Check a second random value of n and stop
C. Expand the statement with the binomial theorem
D. Take the derivative of both sides

10. To decide whether a sequence is geometric, what should you examine?

A. Only the first term
B. The sum of the first and last terms
C. The derivative
D. The ratio between consecutive terms

11. A student says 2, 6, 18, 54 is arithmetic because it keeps getting bigger. What is wrong?

A. The sequence is decreasing
B. Arithmetic sequences can never be positive
C. Nothing is wrong
D. Arithmetic requires a constant difference, not just growth

12. A student expands (x + y)^2 as x^2 + y^2. What is missing?

A. A constant 1
B. A denominator
C. Nothing is missing
D. The middle term 2xy

13. Find the next term of 4, 9, 14, 19, ... Answer with a number.

14. Find the next term of 2, 10, 50, 250, ... Answer with a number.

15. For the arithmetic sequence with a1 = 7 and d = 4, find a5. Answer with a number.

16. For the geometric sequence with a1 = 3 and r = 2, find a5. Answer with a number.

17. Compute 6!. Answer with a number.

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

19. What is the coefficient of x^2 in (x + 1)^4? Answer with a number.

20. Find the sum of the first 5 terms of 2, 5, 8, 11, 14. Answer with a number.

21. Find the sum of the first 4 terms of 3, 6, 12, 24. Answer with a number.

22. If a1 = 2 and a_n = a_(n-1) + 3, find a4. Answer with a number.

23. If a1 = 5 and a_n = 2a_(n-1), find a4. Answer with a number.

24. What is the middle coefficient in the expansion of (x + y)^4? Answer with a number.

25. **Write an explicit formula for the arithmetic sequence with a1 = 4 and d = 3. Answer in the form n = ...**

26. **Write an explicit formula for the geometric sequence with a1 = 5 and r = 2. Answer in the form n = ...**

27. **Write a recursive formula for 3, 7, 11, 15, ... Answer as an equation.**

28. **Write a recursive formula for 2, 6, 18, 54, ... Answer as an equation.**

29. **Write the expansion of (x + y)^2. Answer as an equation.**

30. **Write the expansion of (x + 1)^3. Answer as an equation.**

31. **Which explicit formula matches the arithmetic sequence 5, 8, 11, 14, ...?**

A. a_n = 5 + 3(n - 1)
B. a_n = 5(3)^(n - 1)
C. a_n = 3 + 5n
D. a_n = n^2 + 4

32. **Which explicit formula matches the geometric sequence 3, 6, 12, 24, ...?**

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