Arithmetic Sequences as Linear Functions

Name: _____	Date: _____	Score: _____ / 26

Quick Review

An **arithmetic sequence** adds the same number — the **common difference** d — to get from one term to the next. **Explicit formula**: $a_n = a_1 + (n-1)d$, where a_1 is the first term and n is the term number. **Recursive formula**: $a_1 =$ first term; $a_n = a_{n-1} + d$ for $n \geq 2$. Arithmetic sequences are **linear functions** of the term number: plot n on the x-axis and a_n on the y-axis, and the points sit on a straight line. The common difference d is the *slope*, and $a_1 - d$ (term "zero") is the y-intercept.

PRACTICE

Find d, write the explicit formula, or find the indicated term.

1. $2, 9, 16, 23, \ldots;\ d,\ a_n$ _____

2. $20, 15, 10, 5, \ldots;\ d,\ a_n$ _____

3. $-4, -1, 2, 5, \ldots;\ a_{10}$ _____

4. $a_1 = 3,\ d = 7;\ a_8$ _____

5. $a_1 = 50,\ d = -4;\ a_{12}$ _____

6. $a_5 = 22,\ d = 3;\ a_1$ _____

7. $1, 1.5, 2, 2.5, \ldots;\ a_{20}$ _____

8. $a_1 = 100,\ d = -10;$ recursive _____

9. $6, 6, 6, 6, \ldots;\ d$ _____

10. $a_1 = -8,\ d = 5;\ a_{15}$ _____

11. $a_3 = 10,\ a_7 = 26;\ d$ _____

12. $4, 11, 18, 25, \ldots;\ f(n)$ _____

13. $a_1 = 12,\ d = 4;\ a_{20}$ _____

14. $-3, 1, 5, 9, \ldots;\ d$ _____

15. $a_n = 2n + 11;\ a_1$ _____

16. $5, 2, -1, -4, \ldots;\ a_{12}$ _____

17. $a_4 = 21,\ d = -2;\ a_1$ _____

18. $a_1 = 0,\ d = \frac{1}{2};\ a_{20}$ _____

19. Which term of $3, 8, 13, \ldots$ is 58? _____

20. Slope of the line for $a_n = 4n - 7$ _____

VISUAL PRACTICE

Use the graph, table, chart, or diagram to answer the question.

21. Use the table to write the rule.

n	1	2	3	4
a_n	4	9	14	19

Answer: _____

22. Use the table to write the sequence rule.

n	1	2	3	4
a_n	7	10	13	16

Answer: _____

Word Problems

23. A theater has 20 seats in row 1. Each row behind has 3 more. How many seats in row 15? _____

24. Maria saves: week 1 \$45, week 2 \$60, week 3 \$75. Find the explicit formula and how much she'll have at week 10. _____

25. A construction crew lays 40 bricks the first day and 8 more each day after. How many bricks on day 20? _____

26. A diver descends 5 feet per second from the surface. Write a function for depth $d(t)$ in feet after t seconds (depth downward), and find the depth at 30 seconds. _____

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Answer Keys

1. $d = 7,\ a_n = 7n - 5$
2. $d = -5,\ a_n = -5n + 25$
3. 23
4. 52
5. 6
6. 10
7. 10.5
8. $a_n = a_{n-1} - 10$
9. $d = 0$; yes, arithmetic
10. 62
11. $d = 4,\ a_1 = 2$
12. $f(n) = 7n - 3$
13. 88
14. $d = 4$
15. 13
16. -28
17. 27
18. $\frac{19}{2}$
19. $n = 12$
20. 4
21. $a_n = 5n - 1$
22. $a_n = 3n + 4$
23. $a_{15} = 62$
24. $a_n = 15n + 30;\ \$180$
25. $a_{20} = 192$
26. $d(t) = 5t;\ 150$ ft

Step-by-Step Tutor Notes

1. Take it one clear step at a time and keep the original question in mind. Difference: $9 - 2 = 7$. Explicit: $a_n = 2 + (n-1)(7) = 7n - 5$. So the answer is $d = 7,\ a_n = 7n - 5$.
2. Going down by 5 each time: $d = -5$. $a_n = 20 + (n-1)(-5) = -5n + 25$.
3. Focus on the main idea of the problem, then simplify carefully. $d = 3$. $a_{10} = -4 + (10-1)(3) = -4 + 27 = 23$. So the answer is 23.
4. Use the clue in the question first, then let the arithmetic finish the job. $a_8 = 3 + (8-1)(7) = 3 + 49 = 52$. So the answer is 52.
5. Start with the definition the problem is testing, then apply it directly. $a_{12} = 50 + (12-1)(-4) = 50 - 44 = 6$. So the answer is 6.
6. Use the clue in the question first, then let the arithmetic finish the job. $a_5 = a_1 + 4d$, so $22 = a_1 + 12$, giving $a_1 = 10$. So the answer is 10.
7. Start with the definition the problem is testing, then apply it directly. $d = 0.5$. $a_{20} = 1 + (19)(0.5) = 1 + 9.5 = 10.5$. So the answer is 10.5.
8. Use the clue in the question first, then let the arithmetic finish the job. Recursive form: previous term minus 10. So the answer is $a_n = a_{n-1} - 10$.
9. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Common difference is 0. Technically arithmetic — adding 0 is a valid common difference. After simplifying, the answer is $d = 0$; yes, arithmetic.
10. This is a good place to slow down, check the notation, and simplify cleanly. $a_{15} = -8 + (14)(5) = -8 + 70 = 62$. So the answer is 62.
11. Between a_3 and a_7 are 4 steps: $26 - 10 = 16 = 4d$, so $d = 4$. Then $a_1 = a_3 - 2d = 10 - 8 = 2$.
12. Use the clue in the question first, then let the arithmetic finish the job. $d = 7$, $a_1 = 4$. So $f(n) = 4 + (n-1)(7) = 7n - 3$. So the answer is $f(n) = 7n - 3$.
13. Focus on the main idea of the problem, then simplify carefully. $a_{20} = 12 + (19)(4) = 12 + 76 = 88$. So the answer is 88.
14. This is a good place to slow down, check the notation, and simplify cleanly. $1 - (-3) = 4$. Confirm: $5 - 1 = 4$, $9 - 5 = 4$. Yes, $d = 4$. So the answer is $d = 4$.
15. The first term is found at $n = 1$. Evaluate $a_1 = 2(1) + 11 = 13$. The coefficient 2 also tells you the sequence increases by 2 each step.
16. Use the clue in the question first, then let the arithmetic finish the job. $d = -3$, $a_1 = 5$. $a_{12} = 5 + (11)(-3) = 5 - 33 = -28$. So the answer is -28.
17. Use the clue in the question first, then let the arithmetic finish the job. $a_4 = a_1 + 3d$, so $21 = a_1 - 6$, giving $a_1 = 27$. So the answer is 27.
18. Start with the definition the problem is testing, then apply it directly. $a_{20} = 0 + (19)(\frac{1}{2}) = \frac{19}{2}$. So the answer is $\frac{19}{2}$.
19. $d = 5$. Set $a_n = 58$: $3 + (n-1)(5) = 58$, so $5(n-1) = 55$, $n - 1 = 11$, $n = 12$.
20. Compare the change in output to the change in input, because slope is a rate of change. The coefficient of n is the common difference, which is the slope: 4. So the requested value is 4.
21. The common difference is 5. Since $a_1 = 4$, the rule is $a_n = 4 + 5(n-1) = 5n - 1$.
22. The common difference is 3, and the rule that gives 7 at $n = 1$ is $a_n = 3n + 4$.
23. Set up the model from the story, then calculate carefully. $a_1 = 20$, $d = 3$. $a_{15} = 20 + (14)(3) = 20 + 42 = 62$ seats.
24. $d = 15$, $a_1 = 45$. $a_n = 45 + (n-1)(15) = 15n + 30$. At $n = 10$: $a_{10} = 15(10) + 30 = \$180$.
25. Set up the model from the story, then calculate carefully. $a_1 = 40$, $d = 8$. $a_{20} = 40 + (19)(8) = 40 + 152 = 192$ bricks.
26. At $t = 0$ the diver is at depth 0 (surface), and depth grows by 5 ft/sec. So $d(t) = 5t$. At $t = 30$: $d(30) = 150$ feet.

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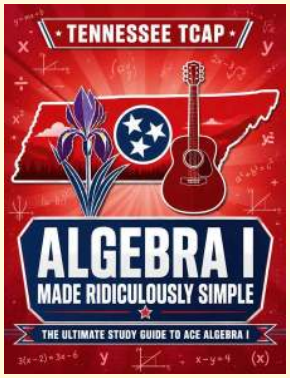

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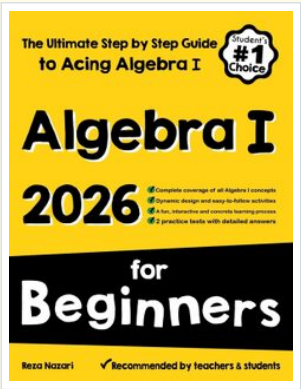

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