

Arithmetic Sequences as Linear Functions

Name: _____ Date: _____ Score: _____ / 26

Q 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, ...; d, a_n _____ | 11. $a_3 = 10, a_7 = 26; d$ _____ |
| 2. 20, 15, 10, 5, ...; d, a_n _____ | 12. 4, 11, 18, 25, ...; $f(n)$ _____ |
| 3. -4, -1, 2, 5, ...; a_{10} _____ | 13. $a_1 = 12, d = 4; a_{20}$ _____ |
| 4. $a_1 = 3, d = 7; a_8$ _____ | 14. -3, 1, 5, 9, ...; d _____ |
| 5. $a_1 = 50, d = -4; a_{12}$ _____ | 15. $a_n = 2n + 11; a_1$ _____ |
| 6. $a_5 = 22, d = 3; a_1$ _____ | 16. 5, 2, -1, -4, ...; a_{12} _____ |
| 7. 1, 1.5, 2, 2.5, ...; a_{20} _____ | 17. $a_4 = 21, d = -2; a_1$ _____ |
| 8. $a_1 = 100, d = -10$; recursive _____ | 18. $a_1 = 0, d = \frac{1}{2}; a_{20}$ _____ |
| 9. 6, 6, 6, 6, ...; d _____ | 19. Which term of 3, 8, 13, ... is 58? _____ |
| 10. $a_1 = -8, d = 5; a_{15}$ _____ | 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. _____



Answer Keys

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

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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