

Arithmetic Sequences

Name: _____ Date: _____ Score: _____ / 24

Quick Review

An **arithmetic sequence** is a list of numbers where you add the *same amount* each step. That fixed amount is the **common difference** d — find it by subtracting any term from the one after it. To jump straight to the n th term, use the rule $a_n = a_1 + (n - 1)d$, where a_1 is the first term. For example, in 3, 7, 11, 15, ... the common difference is $d = 4$, and the 10th term is $a_{10} = 3 + (10 - 1)(4) = 39$. This is really a linear function in disguise — the term number is the input!

◊ **Example:** Find the 10th term of the arithmetic sequence 3, 8, 13, 18, ...
 ⇒ First spot the common difference: $8 - 3 = 5$, and $13 - 8 = 5$ too, so $d = 5$. The first term is $a_1 = 3$. Now use the rule $a_n = a_1 + (n - 1)d$ with $n = 10$: $a_{10} = 3 + (10 - 1)(5) = 3 + 9 \times 5 = 3 + 45 = 48$. So the 10th term is 48. The rule lets you skip ahead without listing every term!

Answer: $a_{10} = 48$

PRACTICE

Find the requested term of each arithmetic sequence.

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|-----------------------------------|-------|--|-------|
| 1. 3, 8, 13, 18, ...; a_{10} | _____ | 11. 5, 11, 17, 23, ...; a_8 | _____ |
| 2. 7, 5, 3, 1, ...; a_8 | _____ | 12. 20, 17, 14, 11, ...; a_7 | _____ |
| 3. 2, 6, 10, 14, ...; a_{12} | _____ | 13. 6, 10, 14, 18, ...; a_{10} | _____ |
| 4. 10, 13, 16, 19, ...; a_{15} | _____ | 14. -10, -6, -2, 2, ...; a_{12} | _____ |
| 5. -5, 1, 7, 13, ...; a_{20} | _____ | 15. 50, 45, 40, 35, ...; a_9 | _____ |
| 6. 100, 93, 86, 79, ...; a_{11} | _____ | 16. 8, 15, 22, 29, ...; a_{10} | _____ |
| 7. 4, 8, 12, 16, ...; a_{25} | _____ | 17. 3, 3.5, 4, 4.5, ...; a_{11} | _____ |
| 8. 0, 9, 18, 27, ...; a_{10} | _____ | 18. Find d for 14, 21, 28, 35, ... | _____ |
| 9. 12, 9, 6, 3, ...; a_9 | _____ | 19. Find a_1 if $a_5 = 23$ and $d = 4$ | _____ |
| 10. 1, 3, 5, 7, ...; a_{50} | _____ | 20. Is 100 a term of 4, 8, 12, 16, ...? | _____ |

Word Problems

21. A theater has 18 seats in the first row, 22 in the second, 26 in the third, and so on. How many seats are in the 10th row?

22. A diver descends so that her depth is 5 ft after 1 minute, 8 ft after 2 minutes, 11 ft after 3 minutes, and so on. How deep is she after 12 minutes?

23. A savings jar starts with \$60 and \$7 is added each week. Treating week 1 as the \$60 start, how much is in the jar in week 15?

24. A stack of boxes shrinks: the bottom layer has 40 boxes, the next has 36, then 32, and so on, losing 4 each layer. How many boxes are in the 9th layer?



Answer Keys

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|--------|--------------|
| 1. 48 | 13. 42 |
| 2. -7 | 14. 34 |
| 3. 46 | 15. 10 |
| 4. 52 | 16. 71 |
| 5. 109 | 17. 8 |
| 6. 30 | 18. 7 |
| 7. 100 | 19. 7 |
| 8. 81 | 20. yes |
| 9. -12 | 21. 54 seats |
| 10. 99 | 22. 38 feet |
| 11. 47 | 23. \$158 |
| 12. 2 | 24. 8 boxes |

Step-by-Step Explanations

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| <p>1. Here $d = 5$ and $a_1 = 3$, so $a_{10} = 3 + 9(5) = 48$.</p> <p>2. Here $d = -2$ and $a_1 = 7$, so $a_8 = 7 + 7(-2) = 7 - 14 = -7$.</p> <p>3. Here $d = 4$ and $a_1 = 2$, so $a_{12} = 2 + 11(4) = 2 + 44 = 46$.</p> <p>4. Here $d = 3$ and $a_1 = 10$, so $a_{15} = 10 + 14(3) = 10 + 42 = 52$.</p> <p>5. Here $d = 6$ and $a_1 = -5$, so $a_{20} = -5 + 19(6) = -5 + 114 = 109$.</p> <p>6. Here $d = -7$ and $a_1 = 100$, so $a_{11} = 100 + 10(-7) = 100 - 70 = 30$.</p> <p>7. Here $d = 4$ and $a_1 = 4$, so $a_{25} = 4 + 24(4) = 4 + 96 = 100$.</p> <p>8. Here $d = 9$ and $a_1 = 0$, so $a_{10} = 0 + 9(9) = 81$.</p> <p>9. Here $d = -3$ and $a_1 = 12$, so $a_9 = 12 + 8(-3) = 12 - 24 = -12$.</p> <p>10. Here $d = 2$ and $a_1 = 1$, so $a_{50} = 1 + 49(2) = 1 + 98 = 99$.</p> <p>11. Here $d = 6$ and $a_1 = 5$, so $a_8 = 5 + 7(6) = 5 + 42 = 47$.</p> <p>12. Here $d = -3$ and $a_1 = 20$, so $a_7 = 20 + 6(-3) = 20 - 18 = 2$.</p> <p>13. Here $d = 4$ and $a_1 = 6$, so $a_{10} = 6 + 9(4) = 6 + 36 = 42$.</p> <p>14. Here $d = 4$ and $a_1 = -10$, so $a_{12} = -10 + 11(4) = -10 + 44 = 34$.</p> <p>15. Here $d = -5$ and $a_1 = 50$, so $a_9 = 50 + 8(-5) = 50 - 40 = 10$.</p> | <p>16. Here $d = 7$ and $a_1 = 8$, so $a_{10} = 8 + 9(7) = 8 + 63 = 71$.</p> <p>17. Here $d = 0.5$ and $a_1 = 3$, so $a_{11} = 3 + 10(0.5) = 3 + 5 = 8$.</p> <p>18. Subtract consecutive terms: $21 - 14 = 7$, so the common difference is $d = 7$.</p> <p>19. Use $a_5 = a_1 + 4d$: $23 = a_1 + 4(4) = a_1 + 16$, so $a_1 = 7$.</p> <p>20. This sequence is the multiples of 4, and $100 = 4 \times 25$, so 100 is the 25th term — yes.</p> <p>21. This is arithmetic with $a_1 = 18$ and $d = 4$. The 10th row has $a_{10} = 18 + 9(4) = 18 + 36 = 54$ seats.</p> <p>22. The depths form an arithmetic sequence with $a_1 = 5$ and $d = 3$. After 12 minutes the depth is $a_{12} = 5 + 11(3) = 5 + 33 = 38$ feet.</p> <p>23. With $a_1 = 60$ and $d = 7$, week 15 has $a_{15} = 60 + 14(7) = 60 + 98 = 158$ dollars.</p> <p>24. This is arithmetic with $a_1 = 40$ and $d = -4$. The 9th layer has $a_9 = 40 + 8(-4) = 40 - 32 = 8$ boxes.</p> |
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