

# 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.

- |                                   |       |  |       |
|-----------------------------------|-------|--|-------|
| 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

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

### Step-by-Step Explanations

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



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