Nth Term of a Sequence - Worksheet

Skill

Group A - Stating the common difference

State the common difference for each sequence given the sequence and the n^{th} term:

1) $3,\ 7,\ 11,\ 15,\ 19,\ \ldots$

$4n - 1$

2) $2,\ 5,\ 8,\ 11,\ 14,\ \ldots$

$3n - 1$

3) $5,\ 7,\ 9,\ 11,\ 13,\ \ldots$

$2n + 3$

4) $12,\ 7,\ 2,\ -2,\ -7,\ \ldots$

$17 - 5n$

5) $1.8,\ 2.2,\ 2.6,\ 3,\ 3,4,\ \ldots$

$0.4n + 1.4$

6) $\frac{1}{5},\ \frac{3}{5},\ 1,\ 1\frac{2}{5},\ \ldots$

$\frac{2n}{5} - \frac{1}{5}$

7) $-9,\ -10.5,\ -12,\ \ldots$

$-(1.5n + 7.5)$

8) $11,\ 4,\ -3,\ \ldots,$

$18 - 7n$

9) $-1, -1\frac{1}{2}, -2,\ \ldots$

$\frac{-(1+n)}{2}$

Group B - Increasing arithmetic sequence

Find the n^{th} term for these increasing arithmetic sequences:

1) $2,\ 4,\ 6,\ 8,\ 10,\ \ldots$

2) $1,\ 3,\ 5,\ 7,\ 9,\ \ldots$

3) $3,\ 6,\ 9,\ 12,\ 15,\ \ldots.$

4) $4,\ 7,\ 10,\ 13,\ 16,\ \ldots$

5) $14,\ 19,\ 24,\ 29,\ 34,\ \ldots$

6) $1.7,\ 2.5,\ 3.3,\ 4.1,\ 4.9,\ \ldots$

7) $-17,\ -7,\ 3,\ 13,\ \ldots$

8) $\frac{3}{4},\ 1\frac{1}{2},\ 2\frac{1}{4},\ 3,\ 3\frac{3}{4},\ \ldots$

9) $-2.5,\ -1.9,\ -1.3,\ \ldots$

Group C - Decreasing arithmetic sequence

Find the n^{th} term for these decreasing arithmetic sequences:

1) $-2,\ -4,\ -6,\ \ldots$

2) $-1,\ -2,\ -3,\ \ldots$

3) $-4,\ -8,\ -12,\ \ldots$

4) $14,\ 11,\ 8,\ 5,\ 2,\ \ldots$

5) $8,\ 1,\ -6,\ -13,\ \ldots$

6) $-1.1,\ -2.2,\ -3.3,\ \ldots$

7) $-67,\ -78,\ -89,\ \ldots$

8) $-2\frac{1}{3}, -3, -3\frac{2}{3},\ \ldots$

9) $\frac{2}{5}, -\frac{3}{5}, -\frac{4}{5}, \ldots$

Nth Term of a Sequence - Worksheet

Applied

1) The first four terms of a sequence are $7,\ 11,\ 15,\ 19$.

(a) Circle the expression for the n^{th} term.

$n + 6$ $\quad$ $n + 4$ $\quad$ $4n + 3$ $\quad$ $7n + 4$ $\quad$ $7n$

(b) Calculate the value of the 12^{th} term.

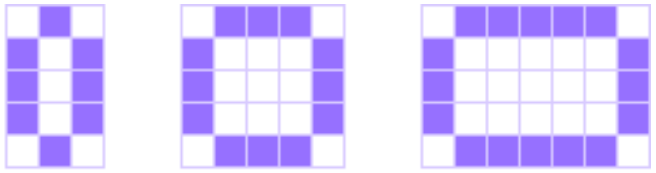
(c) Show that the value 403 is in the sequence.

2) Work out an expression for the n^{th} term of the arithmetic sequence.

$$-3,\ -3.4,\ -3.8,\ -4.2,\ -4.6,\ \ldots$$

Give your answer in the simplest form $\frac{an+b}{10}$ where a and b are integers.

3) Peter arranges blue and white tiles into patterns to make an arithmetic sequence. Below are the first 3 terms.



Pattern 1 $\quad$ Pattern 2 $\quad$ Pattern 3

(a) Write an expression for the number of blue tiles in Pattern n.

(b) Peter wants to create a pattern that has 31 white tiles.
How many blue tiles would he need to complete the pattern?

(c) Luke says that it is possible to create a pattern using 82 blue tiles.
Is Luke correct? Explain your answer.

Nth Term of a Sequence - Exam Questions

1) Joe has written out an arithmetic sequence for how much he earned per hour over a 5 hour shift last night at a restaurant:

£17.87, £27.24, £36.61, £45.98, £55.35.

(a) How much money does Joe earn per hour?

.....

(1)

(b) Joe added the tips he received at the beginning of this sequence. Write the nth term of the sequence in the form $an + b$, where a and b are correct to 2 decimal places.

.....

(2)

(3 marks)

---

2) **(a)** A gardener wants to install a fence in a field. The table below describes the number of vertical and horizontal posts that are required to build a $5m$ fence.

State the number of horizontal fence posts needed for a fence that is $6m$ long.

Length of Fence (m)	1	2	3	4	5
Number of Vertical Posts	2	3	4	5	6
Number of Horizontal Posts	3	6	9	12	15
Total Number of Posts	5	9	13	17	21

.....

(1)

Nth Term of a Sequence - Exam Questions

(b) Find the n^{th} term for the total number of fence posts required for a field of length n.

.....

(2)

(c) How many fence posts would the gardener need in total to build a fence that is $12m$ long?

.....

(1)

(4 marks)

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3) A car depreciates in value by £500 every year after it is bought. The car is bought for £7,000.

State the value of the car at the end of n years.

.....

(2 marks)

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4) **(a)** At a driving range, the number of golf balls that can be dispensed from the machine follows an arithmetic sequence. It costs £1 for every 25 golf balls. On one day, the machine accidentally dispensed 5 extra balls for the first £1 in the machine.

Complete the table to show the number of golf balls the first member can dispense from the machine.

Cost (£s)	**1**	**2**	**3**	**4**	**5**
Number of Golf Balls					

(1)

Nth Term of a Sequence - Exam Questions

(b) How many golf balls would the same member dispense if he paid £10 into the machine?

.....

(2)

(c) The next member dispenses 230 golf balls from the machine. How much money is he charged?

.....

(2)

(5 marks)

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5) **(a)** In a traditional mill, a water wheel drives a runnerstone to grind flour. For each turn of the water wheel, the runnerstone revolves $2\frac{1}{4}$ times.

Generate the sequence to show the number of turns of the runnerstone for each turn of the water wheel.

Number of Revolutions of the Water Wheel	**1**	**2**	**3**	**4**	**5**
Number of Revolutions of the Runnerstone					

(2)

(b) Write the n^{th} term for the sequence in the form $\frac{a}{b}n$ where a and b are integers.

.....

(2)

(c) The water wheel takes 200 litres of water during each revolution. How much water is needed for the runnerstone to revolve 45 times? State the units in your answer.

.....

(2)

(6 marks)

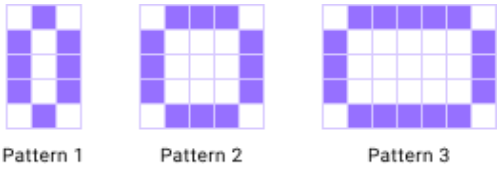
Nth Term of a Sequence - Answers

	Question	Answer
	Skill Questions	
Group A	State the common difference for each sequence given the sequence and the n^{th} term:	
	1) $3,\ 7,\ 11,\ 15,\ 19,\ ...,\quad 4n-1$	**1)** $d=4$
	2) $2,\ 5,\ 8,\ 11,\ 14,\ ...,\quad 3n-1$	**2)** $d=3$
	3) $5,\ 7,\ 9,\ 11,\ 13,\ ...,\quad 2n+3$	**3)** $d=2$
	4) $12,\ 7,\ 2,\ -2,\ -7,\ ...,\quad 17-5n$	**4)** $d=-5$
	5) $1.8,\ 2.2,\ 2.6,\ 3,\ 3,4,\ ...,\quad 0.4n+1.4$	**5)** $d=0.4$
	6) $\frac{1}{5},\ \frac{3}{5},\ 1,\ 1\frac{2}{5},\ ...,\quad \frac{2n}{5}-\frac{1}{5}$	**6)** $d=\frac{2}{5}$
	7) $-9,\ -10.5,\ -12,\ ...,\quad -(1.5n+7.5)$	**7)** $d=-1.5$
	8) $11,\ 4,\ -3,\ ...,\quad 18-7n$	**8)** $d=-7$
	9) $-1,-1\frac{1}{2},-2,\ ...,\quad \frac{-(1+n)}{2}$	**9)** $d=-\frac{1}{2}$
Group B	Find the n^{th} term for these increasing arithmetic sequences:	
	1) $2,\ 4,\ 6,\ 8,\ 10,\ ...$	**1)** $2n$
	2) $1,\ 3,\ 5,\ 7,\ 9,\ ...$	**2)** $2n-1$
	3) $3,\ 6,\ 9,\ 12,\ 15,\ ...$	**3)** $3n$
	4) $4,\ 7,\ 10,\ 13,\ 16,\ ...$	**4)** $3n+1$
	5) $14,\ 19,\ 24,\ 29,\ 34,\ ...$	**5)** $5n+9$
	6) $1.7,\ 2.5,3.3,\ 4.1,\ 4.9,\ ...$	**6)** $0.8n+0.9$
	7) $-17,\ -7,\ 3,\ 13,\ ...$	**7)** $10n-27$
	8) $\frac{3}{4},\ 1\frac{1}{2},\ 2\frac{1}{4},\ 3,\ 3\frac{3}{4}$	**8)** $\frac{3n}{4}$
	9) $-2.5,\ -1.9,\ -1.3,\ ...$	**9)** $0.6n-3.1$

Nth Term of a Sequence - Answers

Group C	Find the n^{th} term for these decreasing arithmetic sequences:	
	1) $-2,\ -4,\ -6,\ ...$	**1)** $-2n$
	2) $-1,\ -2,\ -3,\ ...$	**2)** $-n$
	3) $-4,\ -8,\ -12,\ ...$	**3)** $-4n$
	4) $14,\ 11,\ 8,\ 5,\ 2,\ ...$	**4)** $17-3n$
	5) $8,\ 1,\ -6,\ -13,\ ...$	**5)** $15-7n$
	6) $-1.1,\ -2.2,\ -3.3,\ ...$	**6)** $-1.1n$
	7) $-67,\ -78,\ -89,\ ...$	**7)** $-11n-56$
	8) $-2\frac{1}{3}, -3, -3\frac{2}{3},\ ...$	**8)** $-1\frac{2}{3}-\frac{2n}{3}$
	9) $-\frac{2}{5}, -\frac{3}{5}, -\frac{4}{5},\ ...$	**9)** $-\frac{n+1}{5}$

Nth Term of a Sequence - Answers

	Question	Answer
	Applied Questions	
1)	The first four terms of a sequence are $7,\ 11,\ 15,\ 19$. **(a)** Circle the expression for the n^{th} term. $n + 6 \quad n + 4 \quad 4n + 3 \quad 7n + 4 \quad 7n$	**(a)** $4n + 3$
	(b) Calculate the value of the 12^{th} term.	**(b)** $4 \times 12 + 3 = 51$
	(c) Show that the value 403 is in the sequence.	**(c)** $4n + 3 = 403$ $4n = 400$ and so $n = 100$ 100^{th} term $= 403$
2)	Work out an expression for the n^{th} term of the arithmetic sequence. $-3,\ -3.4,\ -3.8,\ -4.2,\ -4.6,\ ...$ Give your answer in the simplest form $\frac{an+b}{10}$ where a and b are integers.	$-0.4n - 2.6$ $= -\frac{4}{10}n - \frac{26}{10}$ $= -\frac{2}{5}n - \frac{13}{5}$ $= \frac{-2n-13}{5}$
3)	Peter arranges blue and white tiles into patterns to make an arithmetic sequence. Below are the first 3 terms.  Pattern 1 Pattern 2 Pattern 3 **(a)** Write an expression for the number of blue tiles in Pattern n.	**(a)** $4n + 4$
	(b) Peter wants to create a pattern that has 31 white tiles. How many blue tiles would he need to complete the pattern?	**(b)** Pattern number 5 contains 24 blue tiles
	(c) Luke says that it is possible to create a pattern using 82 blue tiles. Is Luke correct? Explain your answer.	**(c)** No. $4n + 4 = 4(n + 1)$ so always a multiple of 4. 82 is not a multiple of 4.

Nth Term of a Sequence - Mark Scheme

<table>
<tr><th></th><th>Question</th><th>Answer</th><th></th></tr>
<tr><td></td><td>Exam Questions</td><td></td><td></td></tr>
<tr><td>1)

(a)</td><td>Joe has written out an arithmetic sequence for how much he earned per hour over a 5 hour shift last night at a restaurant:

£17.87, £27.24, £36.61, £45.98, £55.35.

How much money does Joe earn per hour?</td><td>(a) £9.37</td><td>(1)</td></tr>
<tr><td>(b)</td><td>Joe added the tips he received at the beginning of this sequence. Write the n^{th} term of the sequence in the form $an + b$, where a and b are correct to 2 decimal places.</td><td>(b) $9.37n \pm 8.5$
$9.37n + 8.50$</td><td>(1)
(1)</td></tr>
<tr><td>2)

(a)</td><td>A gardener wants to install a fence in a field. The table below describes the number of vertical and horizontal posts that are required to build a $5m$ fence.
<table><tr><td>Length of Fence (m)</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Number of Vertical Posts</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>Number of Horizontal Posts</td><td>3</td><td>6</td><td>9</td><td>12</td><td>15</td></tr><tr><td>Total Number of Posts</td><td>5</td><td>9</td><td>13</td><td>17</td><td>21</td></tr></table>State the number of horizontal fence posts needed for a fence that is $6m$ long.</td><td>(a) 18</td><td>(1)</td></tr>
<tr><td>(b)</td><td>Find the nth term for the total number of fence posts required for a field of length n.</td><td>(b) $4n \pm 1$
$4n + 1$</td><td>(1)
(1)</td></tr>
<tr><td>(c)</td><td>How many fence posts would the gardener need in total to build a fence that is $12m$ long?</td><td>(c) $4 \times 12 + 1 = 49$</td><td>(1)</td></tr>
<tr><td>3)</td><td>A car depreciates in value by £500 every year after it is bought. The car is bought for £7,000.

State the value of the car at the end of n years.</td><td>$-500n$
$7000 - 500n$</td><td>(1)
(1)</td></tr>
</table>

Nth Term of a Sequence - Mark Scheme

4)	**(a)**	At a driving range, the number of golf balls that can be dispensed from the machine follows an arithmetic sequence. It costs £1 for every 25 golf ball. On one day, the machine accidentally dispensed 5 extra balls for the first £1 in the machine. Complete the table to show the number of golf balls the first member can dispense from the machine. Cost (£s) | 1 | 2 | 3 | 4 | 5 Number of Golf Balls | | | | |	**(a)** 30, 55, 80, 105, 130	**(1)**
	(b)	How many golf balls would the same member dispense if he paid £10 into the machine?	**(b)** $25 \times 10 + 5$ $= 255$	**(1)** **(1)**
	(c)	The next member dispenses 230 golf balls from the machine. How much money is he charged?	**(c)** $\frac{230-5}{25}$ $= 9$	**(1)** **(1)**
5)	**(a)**	In a traditional mill, a water wheel drives a runnerstone to grind flour. For each turn of the water wheel, the runnerstone revolves $2\frac{1}{4}$ times. Generate the sequence to show the number of turns of the runnerstone for each turn of the water wheel. Revolutions (Water Wheel) | **1** | **2** | **3** | **4** | **5** Revolutions (Runnerstone) | | | | |	**(a)** $2\frac{1}{4}$, $4\frac{1}{2}$, $6\frac{3}{4}$, 9, $11\frac{1}{4}$ Minimum 4 correct All 5 correct	**(1)** **(1)**
	(b)	Write the n^{th} term for the sequence in the form $\frac{a}{b}n$ where a and b are integers.	**(b)** $2\frac{1}{4} = \frac{9}{4}$ $\frac{9}{4}n$	**(1)** **(1)**
	(c)	The water wheel takes 200 litres of water during each revolution. How much water is needed for the runnerstone to revolve 45 times? State the units in your answer.	**(c)** $45 \div \frac{9}{4} = 20$ $20 \times 200 = 4000L$	**(1)** **(1)**