Worksheet - Sequences

Year: Year 7 · 20

Show your working.

Question 1

Question 1 – Continuing sequences *(Section A · Skills practice)*

Write down the next three terms of each sequence and describe the rule in words.

a. 4, 9, 14, 19, ...
b. 50, 44, 38, 32, ...
c. 2, 6, 18, 54, ...
d. 1, 4, 9, 16, ...
e. 1, 1, 2, 3, 5, 8, ...

Question 2

Question 2 – The nth term of a linear sequence *(Section A · Skills practice)*

Find the nth term of each sequence.

a. 5, 8, 11, 14, ...
b. 2, 7, 12, 17, ...
c. 20, 17, 14, 11, ...
d. 1, 5, 9, 13, ...
e. 7, 9, 11, 13, ...

Question 3

Question 3 – Using the nth term *(Section A · Skills practice)*

The nth term of a sequence is 4n + 3.

a. Write down the first four terms.
b. Find the 20th term.
c. Find the 100th term.
d. Is 83 a term in the sequence? Show how you know.
e. Is 50 a term in the sequence? Show how you know.

Question 4

Question 4 – Term-to-term and position-to-term rules *(Section A · Skills practice)*

A sequence starts at 3 and its term-to-term rule is "multiply by 2 and subtract 1".

a. Write down the first five terms.

b. Explain why this sequence is not linear.
c. Another sequence has the position-to-term rule "multiply the position number by 6 and subtract 4". Write down the first four terms.
d. Find the position of the term 50 in the second sequence.

Question 5

Question 5 – Special sequences *(Section A · Skills practice)*

Answer these questions about important sequences.

a. Write down the first six square numbers.
b. Write down the first five triangular numbers.
c. Write down the first five cube numbers.
d. Write down the first six powers of 2 starting at 2.
e. Which of these numbers are square numbers: 49, 50, 64, 100, 120?

Question 6

Question 6 – Finding missing terms *(Section A · Skills practice)*

Each sequence below is linear. Find the missing terms.

a. 3, __, __, 18, ...
b. __, 14, 20, __, 32
c. 50, __, __, __, 10
d. The 3rd term is 11 and the 7th term is 31. Find the first term and the common difference.

Question 7

Question 7 – Saving money *(Section B · Real-life practice)*

Jamal puts £5 in a money box in the first week. He puts in £5 in week 1, £8 in week 2, £11 in week 3 and so on, adding £3 more each week.

a. How much does he put in during week 4 and week 5?
b. Write a formula for the amount he puts in during week n.
c. How much does he put in during week 12?
d. In which week does he first put in more than £50?

Question 8

Question 8 – Building with matchsticks *(Section B · Real-life practice)*

Zara uses matchsticks to build a pattern of houses side by side. One house uses 5 matchsticks, two houses use 9 and three houses use 13.

a. How many matchsticks are needed for 4 houses?

b. Find an expression for the number of matchsticks for n houses.
c. How many matchsticks are needed for 30 houses?
d. Zara has 150 matchsticks. How many houses can she build and how many matchsticks are left over?

Question 9

Question 9 – Seating in a theatre *(Section B · Real-life practice)*

In a school theatre there are 12 seats in the first row. Each row has 2 more seats than the row in front of it.

a. How many seats are in row 5?
b. Write a formula for the number of seats in row n.
c. Which row has 40 seats?
d. The theatre has 15 rows. How many seats are in the back row and how many seats are there in total?

Question 10

Question 10 – A taxi fare pattern *(Section B · Real-life practice)*

A taxi charges £4 for the first mile and £2.50 for each extra mile. The cost of a journey of n miles forms a sequence.

Miles n	1	2	3	4
Cost (£)	4	6.50	9	11.50

a. Check that the table follows the rule.
b. Write a formula for the cost of n miles.
c. Find the cost of a 10-mile journey.
d. Hana pays £34. How many miles did she travel?

Question 11

Question 11 – Population of rabbits *(Section B · Real-life practice)*

A field has 6 rabbits. The population doubles each year.

Year	0	1	2	3	4
Rabbits	6	12	24		

a. Complete the table.
b. Is the sequence linear? Explain.
c. How many rabbits will there be after 6 years?
d. After how many years will there first be more than 1 000 rabbits?

Question 12

Question 12 – Stacking tins *(Section B · Real-life practice)*

In a supermarket display tins are stacked in a triangle: 1 tin in the top row, 2 in the second row, 3 in the third row and so on.

a. How many tins are in a stack with 5 rows?
b. How many tins are in the 8th row?
c. Complete the sequence of total number of tins for 1, 2, 3, 4, 5 rows.
d. The supermarket has 100 tins. What is the largest number of complete rows they can make, and how many tins are left over?

Question 13

Question 13 – Plant growth *(Section B · Real-life practice)*

A sunflower is 12 cm tall at the start of the experiment and grows 7 cm every week.

a. Write the height after weeks 1, 2, 3 and 4.
b. Write a formula for the height after n weeks.
c. What is the height after 10 weeks?
d. When will the plant first be taller than 2 m?

Question 14

Question 14 – Training for a 10 km race *(Section B · Real-life practice)*

Amira is training for a charity 10 km run. In week 1 she runs a total of 4 km. Each week she increases her total distance by 1.5 km.

a. Write down her total distance for weeks 1 to 5.
b. Write a formula for her distance in week n.
c. In which week does she first run more than 10 km in total?
d. Her coach says that she will run 20 km in week 12. Is the coach right?

Question 15

Question 15 – Matching rules and sequences *(Section C · Problem solving)*

Match each sequence to its nth term. Give a reason for each match. Not all rules are used.

Sequence	Rules
A: 3, 7, 11, 15, ...	$2n + 1$
B: 3, 5, 7, 9, ...	$4n - 1$
C: 3, 6, 9, 12, ...	$3n$
D: 3, 9, 27, 81, ...	3^n

a. Match A, B, C and D to the rules.
b. Find the 10th term of each sequence.
c. Which rule produces the largest 10th term?
d. Write down a rule that gives the same first term as these sequences but has difference 6.

Question 16

Question 16 – Pattern of tiles *(Section C · Problem solving)*

A patio is made from black and white square tiles. Pattern 1 has 1 black tile surrounded by 8 white tiles, pattern 2 has 4 black tiles surrounded by 12 white tiles, and pattern 3 has 9 black tiles surrounded by 16 white tiles.

Pattern	1	2	3	4
Black tiles	1	4	9	
White tiles	8	12	16	

a. Complete the table for pattern 4.
b. Write an expression for the number of white tiles in pattern n.
c. Write an expression for the number of black tiles in pattern n.
d. Which pattern has 36 white tiles? How many black tiles does it have?

Question 17

Question 17 – Fibonacci and rabbits *(Section C · Problem solving)*

The Fibonacci sequence begins 1, 1, 2, 3, 5, 8, ... Each term is the sum of the two terms before it.

a. Write down the first 12 terms.
b. Find the sum of the first 5 terms and compare it with the 7th term minus 1.
c. Which terms are even? Describe the pattern.
d. Maya starts a different sequence with 2, 5 and uses the same rule. Write the first 8 terms.

Question 18

Question 18 – Spot the mistake *(Section C · Problem solving)*

Each pupil made one mistake. Find it and correct it.

a. Ali: the nth term of 7, 10, 13, 16 is 7n + 3.
b. Beth: the 10th term of 3n - 2 is 3 × 8 = 24.
c. Carl: 31 is in the sequence 4n + 5 because 31 - 5 = 26 and 26 ÷ 2 = 13.
d. Dina: the next term in 2, 4, 8, 16 is 24 because we add 8.

Question 19

Question 19 – Comparing two savers *(Section C · Problem solving)*

Ali starts with £20 in his bank account and saves £5 each week. Bea starts with £5 and saves £8 each week.

Week	0	1	2	3	4	5
Ali (£)	20					
Bea (£)	5					

a. Complete the table.
b. Write a formula for each person.
c. After how many weeks do they have the same amount?
d. How much more than the other does the person who saves more have after 10 weeks?

Question 20

Question 20 – Challenge: the dot pattern *(Section D · Challenge)*

The number of dots in pattern n of a sequence is given by $n^2 + 2$. A pupil says this sequence is linear because it goes 3, 6, 11, 18, ...

a. Work out the differences. Is the sequence linear?
b. Work out the second differences.
c. What do the second differences tell you about the nth term?
d. Which pattern contains 51 dots?