

Special sequences and rules from patterns

About 50 minutes No calculator 40 marks



Hints online, answers free with an account:
mathswariz.uk/worksheets/gcse-special-sequences-and-rules-from-patterns/

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

- A1** Needed today [2 marks]

Work out $\sqrt{15^2 + 8^2}$.

A2 Last lesson [2 marks]

The 1st term of a linear sequence is -3 and the 7th term is 21. Find an expression for the n th term.

Answer

Answer

- A3** From chapter 2 [2 marks]

80% of the workers in a factory are men. 65% of the men and 25% of the women work part-time. What percentage of all the workers work part-time?

A4 Key Stage 3 [2 marks]

Find the missing number:
 $30 \times 26 = 13 \times \square$.

Answer

Answer

B Example, then your turn

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

Find the n th term of 10, 30, 90, 270, ... and work out the 6th term.

Hint Each term is the one before times 3.

- B1** Find the n th term of 13, 26, 52, 104, ... and work out the 7th term. [3 marks]

Answer and

EXAMPLE 2

A sequence starts 5, p , and each term after that is the sum of the two before. The 4th term is 29. Find p and the 5th term.

Hint Write the 3rd and 4th terms in terms of p .

- B2** A sequence starts 3, b , and each term after that is the sum of the two before. The 4th term is 23. Find b and the 5th term. [3 marks]

Answer $b = \dots$ and

C Practice

C1 Write down the 10th triangular number. [1 mark]

Answer

C2 Write down the cube number between 300 and 400. [1 mark]

Answer

C3 A geometric sequence has first term 640 and common ratio $\frac{1}{2}$. [2 marks]
Work out the 6th term.

Answer

C4 Which term of the sequence with n th term $n^2 + 4$ is equal to 200? [2 marks]

Answer

C5 Work out the first term of the sequence 5, 15, 45, 135, ... that is greater than 2000. [2 marks]

Answer

C6 In a geometric sequence the 2nd term is 6 and the 4th term is 54. Every term is positive. Work out the 6th term. [2 marks]

Answer

D Exam-style questions

D1 Here are the first four terms of a sequence: 1, 8, 27, 64. Mia says, "The 10th term is 30, because it is 3×10 ." [2 marks]

Explain why Mia is wrong, and write down the correct 10th term.

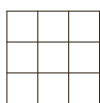
D2 The diagram shows the first three patterns in a sequence. Pattern n is 3 rows of n squares made from matchsticks.



Pattern 1



Pattern 2



Pattern 3

(a) Find an expression, in terms of n , for the number of matchsticks in pattern n . [2 marks]

Answer

(b) Show that no pattern uses exactly 100 matchsticks. [2 marks]

- (c) One pattern uses 213 matchsticks. How many squares does it have? You must show your working. [3 marks]

Answer

Total for D2: 7 marks

- D3 The first three terms of a geometric sequence are x , $x + 12$ and $x + 30$. Work out the value of x and the 4th term of the sequence. You must show your working. [4 marks]

Answer $x = \dots\dots$ fourth term $\dots\dots$

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1 How many of the first 50 triangular numbers are even? [3 marks]

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1 **Hint 1** Write out the first eight triangular numbers and mark each one odd or even.
- Hint 2** 1, 3, 6, 10, 15, 21, 28, 36 go odd, odd, even, even, then repeat in blocks of 4.
- Hint 3** Each block of 4 has 2 even. 48 terms make 12 blocks, so 24 even, and the 49th and 50th are odd.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

I can recognise square, cube and triangular numbers and continue them. ☐ ☐ ☐

I can find and use the n th term of a geometric sequence and a sequence that adds the two before. ☐ ☐ ☐

I can find a rule from a growing pattern and use it. ☐ ☐ ☐