

Name:

Level 2 Further Maths



Quadratic Sequences

Corbettmaths

Ensure you have: Pencil or pen

### Guidance

1. Read each question carefully before you begin answering it.
2. Check your answers seem right.
3. Always show your workings

Revision for this topic

[www.corbettmaths.com/more/further-maths/](http://www.corbettmaths.com/more/further-maths/)



1. The first four terms of a quadratic sequence are shown below  
Work out the next term.

$$\begin{array}{cccccc}
 9 & 13 & 19 & 27 & 37 & \\
 & 4 & 6 & 8 & 10 & \\
 & & (2) & 2 & 2 & 
 \end{array}$$

**37**

(2)

2. The  $n^{\text{th}}$  term of a quadratic sequence is  $n^2 - 3n + 8$

Work out the difference between the 10th and 15th terms.

$$\begin{array}{l}
 n = 10 \quad 10^2 - 3 \times 10 + 8 = 78 \\
 n = 15 \quad 15^2 - 3 \times 15 + 8 = 188
 \end{array}$$

$$188 - 78 = 110$$

**110**

(2)

3. A sequence has an  $n^{\text{th}}$  term of  $n^2 - 6n + 11$

Work out which term in the sequence has a value of 27

$$\begin{array}{l}
 n^2 - 6n + 11 = 27 \\
 n^2 - 6n - 16 = 0 \\
 (n - 8)(n + 2) = 0 \\
 n = 8
 \end{array}$$

**8<sup>th</sup> term**

(2)

4. The first five terms of a sequence are shown below.

6, 13, 24, 39, 58 ... ..

Work out an expression for the nth term of the sequence

$$\begin{array}{cccccc}
 6 & 13 & 24 & 39 & 58 & \\
 7 & 11 & 15 & 19 & & \\
 4 & 4 & 4 & & & 
 \end{array}$$

$$\begin{aligned}
 2a &= 4 \\
 a &= 2
 \end{aligned}$$

$$\begin{aligned}
 3a + b &= 7 \\
 6 + b &= 7 \\
 b &= 1
 \end{aligned}$$

$$\begin{aligned}
 a + b + c &= 6 \\
 2 + 1 + c &= 6 \\
 3 + c &= 6 \\
 c &= 3
 \end{aligned}$$

$$\underline{\underline{2n^2 + n + 3}}$$

(4)

5. The first five terms of a sequence are shown below.

9, 24, 45, 72, 105 ... ..

Work out an expression for the nth term of the sequence

$$\begin{array}{cccccc}
 9 & 24 & 45 & 72 & 105 & \dots \\
 15 & 21 & 27 & 33 & & \\
 6 & 6 & 6 & & & 
 \end{array}$$

$$\begin{aligned}
 2a &= 6 \\
 a &= 3
 \end{aligned}$$

$$\begin{aligned}
 3a + b &= 15 \\
 9 + b &= 15 \\
 b &= 6
 \end{aligned}$$

$$\begin{aligned}
 a + b + c &= 9 \\
 c &= 0
 \end{aligned}$$

$$\underline{\underline{3n^2 + 6n}}$$

(4)

6. The first five terms of a sequence are shown below.

-6, -1, 6, 15, 26 ...

Work out an expression for the nth term of the sequence

$$\begin{array}{cccccc} -6 & -1 & 6 & 15 & 26 & \\ & 5 & 7 & 9 & 11 & \\ & & 2 & 2 & 2 & \end{array}$$

$$2a = 2$$

$$a = 1$$

$$3a + b = 5$$

$$3 + b = 5$$

$$b = 2$$

$$a + b + c = -6$$

$$3 + c = -6$$

$$c = -9$$

$$\frac{n^2 + 2n - 9}{(4)}$$

7. The first five terms of a sequence are shown below.

100, 96, 90, 82, 72 ...

Work out an expression for the nth term of the sequence

$$\begin{array}{cccccc} 100 & 96 & 90 & 82 & 72 & \\ -4 & -6 & -8 & -10 & & \\ -2 & -2 & -2 & & & \end{array}$$

$$a = -1$$

$$3a + b = -4$$

$$-3 + b = -4$$

$$b = -1$$

$$a + b + c = 100$$

$$-2 + c = 100$$

$$c = 102$$

$$\frac{-n^2 - n + 102}{(4)}$$

8. The first five terms of a sequence are shown below.

2.5, 5, 8.5, 13, 18.5 ...

Work out an expression for the nth term of the sequence

$$\begin{array}{cccccc} 2.5 & 5 & 8.5 & 13 & 18.5 & \\ 2.5 & 3.5 & 4.5 & 5.5 & & \\ & 1 & 1 & 1 & & \end{array}$$

$$2a = 1$$

$$a = 0.5$$

$$3a + b = 2.5$$

$$1.5 + b = 2.5$$

$$b = 1$$

$$a + b + c = 2.5$$

$$1.5 + c = 2.5$$

$$c = 1$$

$$\frac{0.5n^2 + n + 1}{(4)}$$

9. The first five terms of a sequence are shown below.

-17, -30, -49, -74, -105 ... ..

Work out an expression for the nth term of the sequence

$$\begin{array}{cccccc} -17 & -30 & -49 & -74 & -105 & \\ -13 & -19 & -25 & -31 & & \\ -6 & -6 & -6 & & & \end{array}$$

$$a = -3$$

$$3a + b = -13$$

$$-9 + b = -13$$

$$b = -4$$

$$a + b + c = -17$$

$$-7 + c = -17$$

$$c = -10$$

$$\frac{-3n^2 - 4n - 10}{(4)}$$

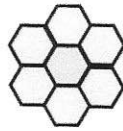
10. Here is a tile.



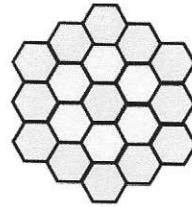
Here is a sequence of patterns made from these tiles.



Pattern 1



Pattern 2



Pattern 3

How many of these tiles are needed to make Pattern number 12?

1      7      19      ...  
       6      12  
           6

$$a = 3$$

$$3a + b = 6$$

$$a + b = 6$$

$$b = -3$$

$$a + b + c = 1$$

$$c = 1$$

$$3n^2 - 3n + 1$$

$$3 \times 12^2 - 3 \times 12 + 1$$

397

~~397~~

(5)

11. The  $n$ th term of a sequence is  $n^2 + 6n$   
Two consecutive terms in the sequence have a difference of 35

Work out the two terms.

$$(n+1)^2 + 6(n+1) - n^2 - 6n = 35$$

$$\cancel{n^2} + 2n + 1 + \cancel{6n} + 6 - \cancel{n^2} - \cancel{6n} = 35$$

$$2n + 7 = 35$$

$$2n = 28$$

$$n = 14$$

..... 14 and 15 .....  
(4)

12. Prove that every term in the sequence  $n^2 - 10n + 28$  is positive

$$(n-5)^2 - 25 + 28$$

$$(n-5)^2 + 3$$

$$(n-5)^2 \geq 0$$

$$\therefore (n-5)^2 + 3 > 0$$

QED

(4)

13. The  $n$ th term of a sequence is  $\frac{n^2 + 9}{6n^2 - 1}$

Find the limiting value of  $\frac{n^2 + 9}{6n^2 - 1}$  as  $n \rightarrow \infty$

$$\frac{(\infty)}{6(\infty)}$$

$$\frac{1}{6}$$

(2)

14. The first 4 terms of a sequence are: 404, 394, 379, 359 ... ..

Which term is the first to be negative?

$$\begin{array}{cccc} 404 & 394 & 379 & 359 \\ & -10 & -15 & -20 \\ & & -5 & -5 \end{array}$$

$$2a = -5$$

$$a = -2.5$$

$$3a + b = -10$$

$$-7.5 + b = -10$$

$$b = -2.5$$

$$a + b + c = 404$$

$$-5 + c = 404$$

$$c = 409$$

$$-2.5n^2 - 2.5n + 409$$

~~404 394 379 359~~

$$n = 10 \quad 134$$

$$n = 11 \quad 79$$

$$n = 12 \quad 19$$

$$n = 13 \quad -46$$

~~n~~ 13<sup>th</sup> term

(5)