AQA Level 2 Further mathematics Further algebra

Section 4: Proof and sequences

Section test

Questions 1 and 2 are about the linear sequence 20, 17, 14, 11, 8, …
The nth term of the sequence is given by $an + b$.

1) The value of a is

(a) 3
(b) -3
(c) 20
(d) 23
(e) I don't know

2) The value of b is

(a) 20
(b) -3
(c) 23
(d) 3
(e) I don't know

Questions 3, 4 and 5 are about the quadratic sequence 2, 9, 18, 29, 42, …
The nth term of the sequence is given by $pn^2 + qn + r$.

3) The value of p is

(a) 2
(b) 1
(c) -2
(d) -1
(e) I don't know

4) The value of q is

(a) 4
(b) 2
(c) -1
(d) 1
(e) I don't know

5) The value of r is

(a) -3
(b) 2
(c) 0
(d) -1
(e) I don't know

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Questions 6 and 7 are about the sequence with *n*th term $n(n+1)$.

6) The 5^{th} term of this sequence is

(a) 30
(b) 20
(c) 25
(d) 56
(e) I don't know

7) The last term of this sequence is 240.
How many terms are in the sequence?

(a) 14
(b) 16
(c) 15
(d) 17
(e) I don't know

8) A sequence has *n*th term $n^2 + kn - 3$.
The 9^{th} term is three times the 5^{th} term.
The value of *k* is

(a) 2
(b) 3
(c) 1
(d) -1
(e) I don't know

Questions 9 and 10 are about the sequence with *n*th term $\frac{3-2n}{8n+1}$

9) The 3^{rd} term of the sequence is

(a) $\frac{3}{32}$
(b) $\frac{9}{25}$
(c) $\frac{9}{32}$
(d) $-\frac{3}{25}$
(e) I don't know

10) The limit of the sequence as $n \to \infty$ is

(a) 0.25
(b) 4
(c) -0.25
(d) -4
(e) I don't know

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Solutions to section test

1) The correct answer is (b)

Each term decreases by 3, so the nth term must involve $-3n$
So $a = -3$

2) The correct answer is (c)

nth term is $-3n + b$
1st term is 20, so $-3 + b = 20$
$b = 23$

3) The correct answer is (b)

The sequence has nth term $pn^2 + qn + r$.

Terms	2	9	18	29	42
Differences		7	9	11	13
Second differences			2	2	2

So $p = 1$.

4) The correct answer is (a)

Terms	2	9	18	29	42
pn^2	1	4	9	16	25
$qn + r$	1	5	9	13	17

The values of $qn + r$ go up by 4 each time, so $q = 4$.

5) The correct answer is (a)

The nth term is $n^2 + 4n + r$
1st term = 2, so $1 + 4 + r = 2$
so $r = -3$

6) The correct answer is (a)

nth term $= n(n+1)$
5th term $= 5(5+1) = 5 \times 6 = 30$

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7) The correct answer is (c)

$\text{nth term} = n(n+1)$

$240 = n(n+1)$

$n^2 + n - 240 = 0$

$(n-15)(n+16) = 0$

$n = 15 \text{ or } n = -16$

Since the number of terms must be positive, there are 15 terms in the sequence.

8) The correct answer is (a)

$5^{\text{th}} \text{ term} = 5^2 + 5k - 3 = 22 + 5k$

$9^{\text{th}} \text{ term} = 9^2 + 9k - 3 = 78 + 9k$

$78 + 9k = 3(22 + 5k)$

$78 + 9k = 66 + 15k$

$12 = 6k$

$k = 2$

9) The correct answer is (d)

$$\text{nth term} = \frac{3-2n}{8n+1}$$

$$3^{\text{rd}} \text{ term} = \frac{3-2\times3}{8\times3+1} = \frac{3-6}{25+1} = \frac{-3}{25} = -\frac{3}{25}$$

10) The correct answer is (c)

As $n \to \infty$, $3 - 2n \to -2n$

$8n + 1 \to 8n$

$$\frac{3-2n}{8n+1} \to \frac{-2n}{8n} = -\frac{1}{4}$$

The limit of the sequence is -0.25.