Test answers - Sequences

Year: Year 7 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. The gaps are $11 - 5 = 6$, $17 - 11 = 6$ and $23 - 17 = 6$, so the sequence goes up by 6. The next two terms are $23 + 6 =$**29** and $29 + 6 =$**35**. (1 mark)
b. The term-to-term rule is: start at 5 and add 6 each time. Both the first term and the step are needed for the mark. (1 mark)
c. Here the differences grow, so test a multiplier: $6 \div 2 = 3$ and $18 \div 6 = 3$. Each term is multiplied by 3: $54 \times 3 =$**162** and $162 \times 3 =$**486**. (1 mark)
d. A square number is a whole number times itself: $1^2, 2^2, 3^2, 4^2, 5^2$ give **1, 4, 9, 16, 25**. (1 mark)

Answer to Question 2 (4 marks)

a. The common difference is 3, so the nth term starts with $3n$ (1 mark). The sequence $3n$ gives 3, 6, 9, 12…; each term of our sequence is 1 more, so the nth term is $3n + 1$ (1 mark).
b. Substitute $n = 50$: $3 \times 50 + 1 = 150 + 1 =$**151**. (1 mark)
c. Set $3n + 1 = 100$. Subtract 1: $3n = 99$, then divide by 3: $n = 33$. This is a whole number, so **yes**, 100 is the 33rd term. (1 mark)

Check (a): with $n = 1$, $3 \times 1 + 1 = 4$, and with $n = 4$, $3 \times 4 + 1 = 13$, matching the first and fourth terms given.

Answer to Question 3 (4 marks)

a. Substitute $n = 1, 2, 3$ into $5n - 2$: $5 - 2 = 3$, $10 - 2 = 8$, $15 - 2 = 13$. The first three terms are **3, 8, 13**. (1 mark)
b. Set the nth term equal to 63: $5n - 2 = 63$ (1 mark). Add 2 to both sides: $5n = 65$. Divide by 5: $n = 13$, so 63 is the 13th term (1 mark).
c. Solve $5n - 2 = 100$: $5n = 102$ and $n = 20.4$. The position of a term must be a whole number, so **no**, 100 is not in the sequence. (1 mark)

Another way to see (c): every term ends in 3 or 8, because the terms go up in fives starting from 3. The number 100 ends in 0, so it can never appear. The nearest terms are 98 and 103.

Answer to Question 4 (4 marks)

a. The numbers of slabs go 6, 10, 14, increasing by 4 each time. Pattern 4 needs

$14 + 4 =$**18** slabs. (1 mark)

b. The difference of 4 tells us the nth term starts with $4n$ (1 mark). For $n = 1$, $4n = 4$ but we need 6, so add 2. The nth term is $4n + 2$ (1 mark).
c. The builder needs $4n + 2 \leq 100$. Subtract 2: $4n \leq 98$, so $n \leq 24.5$. Pattern numbers are whole, so the largest is **pattern 24**, which uses $4 \times 24 + 2 = 98$ slabs. (1 mark)

Pattern 25 would need $4 \times 25 + 2 = 102$ slabs, two more than the builder has, so it cannot be completed.

Answer to Question 5 (4 marks)

a. Sofia starts with £30 and adds £12 every month. After n months she has $30 + 12n$ pounds. (1 mark)
b. Leo starts with £10 and adds £16 every month: $10 + 16n$ pounds. (1 mark)
c. Make the two expressions equal: $30 + 12n = 10 + 16n$ (1 mark). Subtract $12n$ from both sides: $30 = 10 + 4n$. Subtract 10: $20 = 4n$, so $n =$**5 months** (1 mark).

Check: Sofia has $30 + 12 \times 5 = 90$ pounds and Leo has $10 + 16 \times 5 = 90$ pounds after 5 months. Leo starts £20 behind but catches up £4 every month, and $20 \div 4 = 5$. After that, Leo has more money than Sofia.