Grade 12 Mathematics

Sequences & Series

Revision Questions

2025

QUESTION 2

2.1 Given the infinite geometric series: $(t+10)+(t-2)+(t+4)+\ldots$

2.1.1 Show that $t=-2$ (3)

2.1.2 Calculate the value of T_{25}. Write your answer in the form $T_n = b^x$ (3)

2.1.3 Calculate the sum of the infinite series. (2)

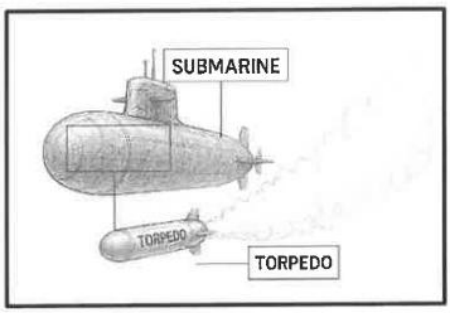
2.2 Given $\sum_{p=k}^{117}(4p-1)=26\,675$

2.2.1 Write down the difference between T_6 and T_{14} (2)

2.2.2 Calculate the value of k. (5)
[15]

QUESTION 3

The depth of a torpedo below sea level forms a quadratic pattern, where 0 metres is at sea level. A submarine tracked a torpedo in one-second intervals.



The depth (in metres) that the torpedo reached is given in the table below.

	Depth (in metres)
At the end of the first second	36
At the end of the first 2 seconds	71
At the end of the first 3 seconds	104

3.1 Calculate the depth of the torpedo at the end of the first 5 seconds. (2)

3.2 Show that the depth of the torpedo at the end of n seconds was $T_n = -n^2 + 38n - 1$ (3)

3.3 Calculate the maximum depth that the torpedo reached. (3)

3.4 After how many seconds was the torpedo at 104 m below sea level for the second time? (2)
[10]

QUESTION 2

2.1 The first term of an arithmetic series is 7. The common difference of this series is 5 and the series contains 20 terms.

2.1.1 Calculate the sum of this series. (2)

2.1.2 The original arithmetic series is extended to 75 terms. The sum of these 75 terms is 14 400. Using sigma notation, write down an equation for the sum of the terms added to the original series. (4)

2.2 The sequence of the first differences of a quadratic pattern is: 1 ; 3 ; 5 ; ...

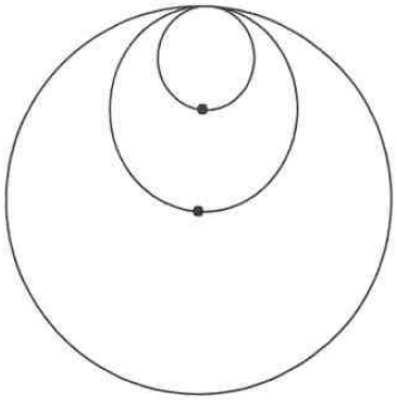
2.2.1 If T_{99} of this quadratic pattern is 9 632, calculate the value of T_{98}. (3)

2.2.2 If it is further given that the third term of the quadratic pattern is 32, determine the general term, T_n, of the quadratic pattern. (5)

[14]

QUESTION 3

A circle with radius 6 cm is drawn.
A second, smaller circle is drawn through the centre of the first circle and also touches the first circle internally, as shown in the diagram.
A third, smaller circle is drawn through the centre of the second circle and touches the second circle internally. The process of drawing circles continues and forms a geometric pattern.



3.1 Write down the radius of the 3rd circle. (2)

3.2 Calculate the sum of the areas of the first 10 circles. (4)

3.3 Which circle has a diameter of $\frac{3}{128}$ cm? (4)

[10]

QUESTION 2

2.1 Given the arithmetic series: $7 + 12 + 17 + \ldots$

2.1.1 Determine the value of T_{91} (3)

2.1.2 Calculate S_{91} (2)

2.1.3 Calculate the value of n for which $T_n = 517$ (3)

2.2 The following information is given about a quadratic number pattern:

$T_1 = 3$, $T_2 - T_1 = 9$ and $T_3 - T_2 = 21$

2.2.1 Show that $T_5 = 111$ (2)

2.2.2 Show that the general term of the quadratic pattern is $T_n = 6n^2 - 9n + 6$ (3)

2.2.3 Show that the pattern is increasing for all $n \in N$. (3)
[16]

QUESTION 3

3.1 Given the geometric series: $3 + 6 + 12 + \ldots$ to n terms.

3.1.1 Write down the general term of this series. (1)

3.1.2 Calculate the value of k such that: $\sum_{p=1}^{k} \frac{3}{2}(2)^p = 98\,301$ (4)

3.2 A geometric sequence and an arithmetic sequence have the same first term.

- The common ratio of the geometric sequence is $\frac{1}{3}$
- The common difference of the arithmetic sequence is 3
- The sum of 22 terms of the arithmetic sequence is 734 more than the sum to infinity of the geometric sequence.

Calculate the value of the first term. (5)
[10]

NOV 2022

QUESTION 2

2.1 The first term of a geometric series is 14 and the 6^{th} term is 448.

2.1.1 Calculate the value of the constant ratio, r. (2)

2.1.2 Determine the number of consecutive terms that must be added to the first 6 terms of the series in order to obtain a sum of $114\,674$. (4)

2.1.3 If the first term of another series is 448 and the 6^{th} term is 14, calculate the sum to infinity of the new series. (3)

2.2 If $\sum_{p=0}^{k}\left(\frac{1}{3}p+\frac{1}{6}\right)=20\frac{1}{6}$, determine the value of k. (5)

[14]

QUESTION 3

It is given that the general term of a quadratic number pattern is $T_n = n^2 + bn + 9$ and the first term of the first differences is 7.

3.1 Show that $b = 4$. (2)

3.2 Determine the value of the 60^{th} term of this number pattern. (2)

3.3 Determine the general term for the sequence of first differences of the quadratic number pattern. Write your answer in the form $T_p = mp + q$. (3)

3.4 Which TWO consecutive terms in the quadratic number pattern have a first difference of 157? (3)

[10]

NOV 2021

QUESTION 2

Given the geometric series: $x + 90 + 81 + \ldots$

2.1 Calculate the value of x. (2)

2.2 Show that the sum of the first n terms is $S_n = 1\,000\left(1-(0{,}9)^n\right)$. (2)

2.3 Hence, or otherwise, calculate the sum to infinity. (2)

[6]

QUESTION 3

Consider the quadratic number pattern: $-145\ ;\ -122\ ;\ -101\ ;\ \ldots$

3.1 Write down the value of T_4. (1)

3.2 Show that the general term of this number pattern is $T_n = -n^2 + 26n - 170$. (3)

3.3 Between which TWO terms of the quadratic number pattern will there be a difference of -121? (4)

3.4 What value must be added to each term in the number pattern so that the value of the maximum term in the new number pattern formed will be 1? (3)

[11]

QUESTION 4

Consider the linear pattern: $5\ ;\ 7\ ;\ 9\ ;\ \ldots$

4.1 Determine T_{51}. (3)

4.2 Calculate the sum of the first 51 terms. (2)

4.3 Write down the expansion of $\sum_{n=1}^{5000}(2n+3)$. Show only the first 3 terms and the last term of the expansion. (1)

4.4 Hence, or otherwise, calculate $\sum_{n=1}^{5000}(2n+3) + \sum_{n=1}^{4999}(-2n-1)$.

ALL working details must be shown. (4)

[10]

NOV 2020

QUESTION 2

2.1 $7\ ;\ x\ ;\ y\ ;\ -11\ ;\ \ldots$ is an arithmetic sequence. Determine the values of x and y. (4)

2.2 Given the quadratic number pattern: $-3\ ;\ 6\ ;\ 27\ ;\ 60\ ;\ \ldots$

2.2.1 Determine the general term of the pattern in the form $T_n = an^2 + bn + c$. (4)

2.2.2 Calculate the value of the 50^{th} term of the pattern. (2)

2.2.3 Show that the sum of the first n first-differences of this pattern can be given by $S_n = 6n^2 + 3n$. (3)

2.2.4 How many consecutive first-differences were added to the first term of the quadratic number pattern to obtain a term in the quadratic number pattern that has a value of 21 060? (4)

[17]

QUESTION 3

3.1 Prove that $\sum_{k=1}^{\infty} 4.3^{2-k}$ is a convergent geometric series. Show ALL your calculations. (3)

3.2 If $\sum_{k=p}^{\infty} 4.3^{2-k} = \frac{2}{9}$, determine the value of p. (5)

[8]

NOV 2019

QUESTION 2

2.1 Given the quadratic sequence: 321 ; 290 ; 261 ; 234 ; ....

2.1.1 Write down the values of the next TWO terms of the sequence. (2)

2.1.2 Determine the general term of the sequence in the form $T_n = an^2 + bn + c$. (4)

2.1.3 Which term(s) of the sequence will have a value of 74? (4)

2.1.4 Which term in the sequence has the least value? (2)

2.2 Given the geometric series: $\frac{5}{8} + \frac{5}{16} + \frac{5}{32} + ... = K$

2.2.1 Determine the value of K if the series has 21 terms. (3)

2.2.2 Determine the largest value of n for which $T_n > \frac{5}{8192}$ (4)

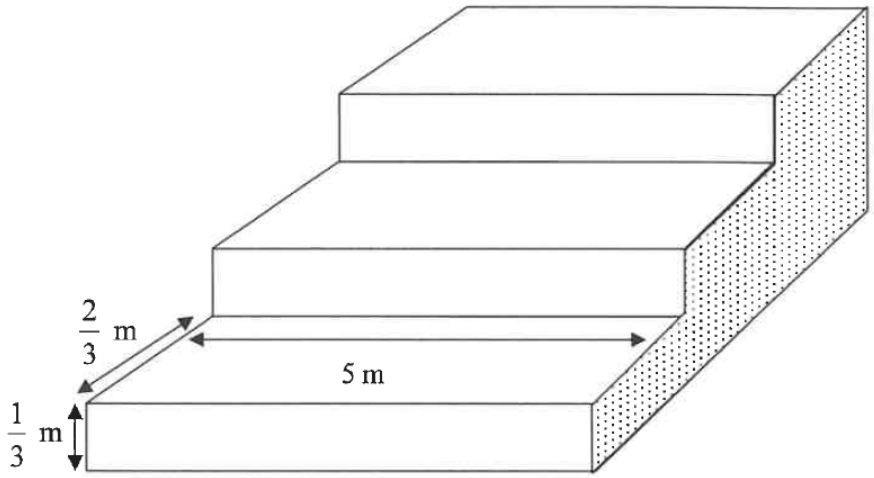
[19]

QUESTION 3

3.1 Without using a calculator, determine the value of: $\sum_{y=3}^{10} \frac{1}{y-2} - \sum_{y=3}^{10} \frac{1}{y-1}$ (3)

3.2 A steel pavilion at a sports ground comprises of a series of 12 steps, of which the first 3 are shown in the diagram below.

Each step is 5 m wide. Each step has a rise of $\frac{1}{3}$ m and has a tread of $\frac{2}{3}$ m, as shown in the diagram below.



The open side (shaded on sketch) on each side of the pavilion must be covered with metal sheeting. Calculate the area (in m^2) of metal sheeting needed to cover both open sides. (6)

[9]

NOV 2018

QUESTION 2

2.1 Given the quadratic sequence: 2 ; 3 ; 10 ; 23 ; …

2.1.1 Write down the next term of the sequence. (1)

2.1.2 Determine the n^{th} term of the sequence. (4)

2.1.3 Calculate the 20^{th} term of the sequence. (2)

2.2 Given the arithmetic sequence: 35 ; 28 ; 21 ; …

Calculate which term of the sequence will have a value of –140. (3)

2.3 For which value of n will the sum of the first n terms of the arithmetic sequence in QUESTION 2.2 be equal to the n^{th} term of the quadratic sequence in QUESTION 2.1? (6)

[16]

QUESTION 3

A geometric series has a constant ratio of $\frac{1}{2}$ and a sum to infinity of 6.

3.1 Calculate the first term of the series. (2)

3.2 Calculate the 8^{th} term of the series. (2)

3.3 Given: $\sum_{k=1}^{n} 3(2)^{1-k} = 5{,}8125$ Calculate the value of n. (4)

3.4 If $\sum_{k=1}^{20} 3(2)^{1-k} = p$, write down $\sum_{k=1}^{20} 24(2)^{-k}$ in terms of p. (3)

[11]

NOV 2017

QUESTION 2

2.1 Given the following quadratic number pattern: 5 ; –4 ; –19 ; –40 ; …

2.1.1 Determine the constant second difference of the sequence. (2)

2.1.2 Determine the n^{th} term (T_n) of the pattern. (4)

2.1.3 Which term of the pattern will be equal to $-25\,939$? (3)

2.2 The first three terms of an arithmetic sequence are $2k-7$; $k+8$ and $2k-1$.

2.2.1 Calculate the value of the 15^{th} term of the sequence. (5)

2.2.2 Calculate the sum of the first 30 even terms of the sequence. (4)

[18]

QUESTION 3

A convergent geometric series consisting of only positive terms has first term a, constant ratio r and n^{th} term, T_n, such that $\sum_{n=3}^{\infty} T_n = \frac{1}{4}$.

3.1 If $T_1 + T_2 = 2$, write down an expression for a in terms of r. (2)

3.2 Calculate the values of a and r. (6)

[8]

NOV 2016

QUESTION 2

Given the finite arithmetic sequence: 5 ; 1 ; –3 ; ... ; –83 ; –87

2.1 Write down the fourth term (T_4) of the sequence. (1)

2.2 Calculate the number of terms in the sequence. (3)

2.3 Calculate the sum of all the negative numbers in the sequence. (3)

2.4 Consider the sequence: 5 ; 1 ; –3 ; ... ; –83 ; –87 ; ... ; –4 187
Determine the number of terms in this sequence that will be exactly divisible by 5. (4)
[11]

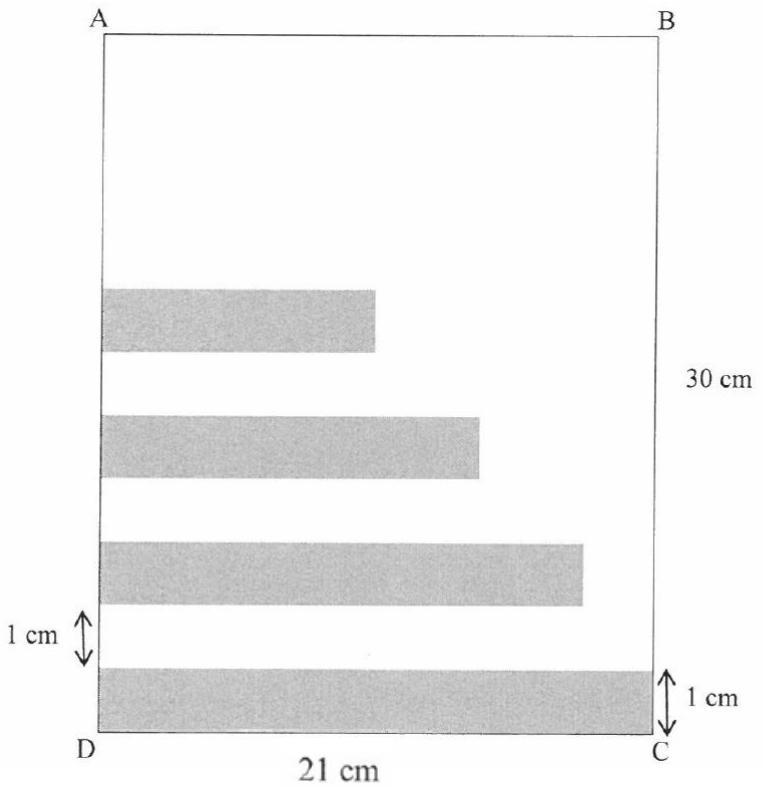
QUESTION 3

3.1 The first four terms of a quadratic number pattern are -1 ; x ; 3 ; $x + 8$

3.1.1 Calculate the value(s) of x. (4)

3.1.2 If $x = 0$, determine the position of the first term in the quadratic number pattern for which the sum of the first n first differences will be greater than 250. (4)

3.2 Rectangles of width 1 cm are drawn from the edge of a sheet of paper that is 30 cm long such that there is a 1 cm gap between one rectangle and the next. The length of the first rectangle is 21 cm and the length of each successive rectangle is 85% of the length of the previous rectangle until there are rectangles drawn along the entire length of AD. Each rectangle is coloured grey.



3.2.1 Calculate the length of the 10^{th} rectangle. (3)

3.2.2 Calculate the percentage of the paper that is coloured grey. (4)
[15]

21 cm

3.2.1 Calculate the length of the 10^{th} rectangle. (3)

3.2.2 Calculate the percentage of the paper that is coloured grey. (4)
[15]

NOV 2015

QUESTION 2

The following geometric sequence is given: 10 ; 5 ; 2,5 ; 1,25 ; ...

2.1 Calculate the value of the 5^{th} term, T_5, of this sequence. (2)

2.2 Determine the n^{th} term, T_n, in terms of n. (2)

2.3 Explain why the infinite series $10 + 5 + 2{,}5 + 1{,}25 + \ldots$ converges. (2)

2.4 Determine $S_\infty - S_n$ in the form ab^n, where S_n is the sum of the first n terms of the sequence. (4)
[10]

QUESTION 3

Consider the series: $S_n = -3 + 5 + 13 + 21 + \ldots$ to n terms.

3.1 Determine the general term of the series in the form $T_k = bk + c$. (2)

3.2 Write S_n in sigma notation. (2)

3.3 Show that $S_n = 4n^2 - 7n$. (3)

3.4 Another sequence is defined as:

$Q_1 = -6$
$Q_2 = -6 - 3$
$Q_3 = -6 - 3 + 5$
$Q_4 = -6 - 3 + 5 + 13$
$Q_5 = -6 - 3 + 5 + 13 + 21$

3.4.1 Write down a numerical expression for Q_6. (2)

3.4.2 Calculate the value of Q_{129}. (3)
[12]

NOV 2014

QUESTION 2

Given the arithmetic series: $2 + 9 + 16 + \ldots$ (to 251 terms).

2.1 Write down the fourth term of the series. **(1)**

2.2 Calculate the 251^{st} term of the series. (3)

2.3 Express the series in sigma notation. (2)

2.4 Calculate the sum of the series. (2)

2.5 How many terms in the series are divisible by 4? (4)
[12]

QUESTION 3

3.1 Given the quadratic sequence: $-1 ; -7 ; -11 ; p ; \ldots$

3.1.1 Write down the value of p. (2)

3.1.2 Determine the n^{th} term of the sequence. (4)

3.1.3 The first difference between two consecutive terms of the sequence is 96. Calculate the values of these two terms. (4)

3.2 The first three terms of a geometric sequence are: $16 ; 4 ; 1$

3.2.1 Calculate the value of the 12^{th} term. (Leave your answer in simplified exponential form.) (3)

3.2.2 Calculate the sum of the first 10 terms of the sequence. (2)

3.3 Determine the value of: $\left(1+\frac{1}{2}\right)\left(1+\frac{1}{3}\right)\left(1+\frac{1}{4}\right)\left(1+\frac{1}{5}\right)\ldots$ up to 98 factors. (4)
[19]