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VCE Specialist Mathematics ½
Sequences & Series [1.3]
Homework

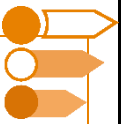
Homework Outline:

Compulsory Knowledge	Pg 2 – Pg 15
Extension Work	Pg 16 – Pg 25



Section A: Compulsory Questions

Sub-Section [1.3.1]: Finding Sequence from Recurrence Relations



Question 1



Construct the first five terms for the sequence given by, $t_n = 3 + t_{n-1}$, where $t_1 = 3$.

Question 2



Given that $t_n = 5 \cdot t_{n-1}$ and $t_1 = 2$, find the value of n for which t_n is equal to 250.

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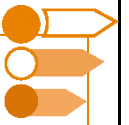
Question 3


Given that $t_n = 4 \cdot t_n^2$ and $t_1 = 3$, find the value of t_3 .

Question 4 Tech-Active.


Given $t_{n+1} = t_n + \frac{1}{t_n}$ and $t_1 = 7$, find the value of n for which t_n is equal to $\frac{2549}{350}$.

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Sub-Section [1.3.2]: Finding Arithmetic Sequence, Mean, and Series

Question 5



Consider the arithmetic sequence $t_n = 6n + 3$.

a. Find t_{10} .

b. Find the arithmetic mean of t_5 and t_{15} .

c. Evaluate S_5 .

Question 6



It is known that, $t_2 = 8$ and $t_4 = 18$.

a. Find the first term and the common difference of the sequence.

b. Find the general term t_n .

c. Evaluate S_4 .

Question 7



Find the sum of all the multiples of 4 between 0 and 100.

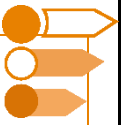
$$4 + 8 + \dots + 96 + 100$$

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Question 8 Tech-Active.

Given that $S_4 = 64$ and $S_{10} = 280$, find the values of a (the first term) and d (the common difference) and hence, write down the general term t_n of the sequence.

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Sub-Section [1.3.3]: Finding Geometric Sequence, Mean, and Series

Question 9



Given $t_n = 7 \left(\frac{1}{2} \right)^n$.

a. Find t_6 .

b. Find the geometric mean of t_5 and t_7 .

c. Evaluate S_5 .

Question 10



It is known that, $t_2 = \frac{8}{9}$ and $t_4 = \frac{8}{81}$.

a. Find the common ratio (given that it is positive) and first term.

b. Find the general term t_n .

c. Evaluate S_4 .

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Question 11


Consider $t_n = \frac{1}{2} \cdot t_{n-1}$. Find t_1 if, $S_{10} = \frac{3069}{256}$.

Question 12 Tech-Active.


Given that $S_5 = 155$ and $S_8 = 1275$, find the values of a (the first term) and d (the common difference) and hence, write down the general term t_n of the sequence.

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Sub-Section [1.3.4]: Infinite Geometric Series

Question 13



Identify first term, common ratio and hence, find the value of series.

$$\frac{9}{5} + \frac{9}{25} + \frac{9}{125} + \frac{9}{625} + \dots$$

Question 14



Identify first term, common ratio and hence, find the value of series.

$$2 - \frac{2}{3} + \frac{2}{9} - \frac{2}{27} + \dots$$

Question 15


Find the value of r , given that:

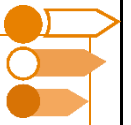
$$3 + 3r + 3r^2 + 3r^3 + \dots = 9$$

Question 16 Tech-Active.


Find the value of a , given that:

$$a - \frac{a}{2} + \frac{a}{4} - \frac{a}{8} + \frac{a}{16} + \dots = 18$$

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Sub-Section: The 'Final Boss'

Question 17



Consider a geometric sequence, $t_n = 6 \cdot r^{n-1}$ where, $-1 < r < 1$. Suppose that, $S_2 = \frac{48}{7}$.

- a.** Show that, $r = \frac{1}{7}$.

- b.** Write the rule for S_n .

c. Find the value of S_{∞} .

d. Hypothetically, you would need to add an infinite number of terms to obtain S_{∞} . What is the least number of terms you need to add so that, the sum S_n is “sufficiently close” to S_{∞} ? For the purpose of this question, this means to find the smallest value of n so that, $S_n > 0.99S_{\infty}$.

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Section B: Supplementary Questions

Sub-Section [1.3.1]: Finding Sequence from Recurrence Relations



Question 18



Given $t_n = 6 + 4 \cdot t_{n-1}$ and $t_1 = 3$, find the value of t_3 . Is the sequence an arithmetic sequence, geometric sequence, or neither?

Question 19



Given $t_n = t_{n-1}^{t_{n-1}}$ and $t_1 = 2$, find the value of n so that, $t_n = 256$.

Question 20


Given $t_n = t_{n-1}^2$ and $t_1 = 3$, find the smallest n so that, $t_n > 100$.

Question 21


Given $t_n = -t_{n-1}$ and $t_1 = 2$. Write down the first few terms in the sequence and hence, write down a formula for the general term t_n .

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Sub-Section[1.3.2]: Finding Arithmetic Sequence, Mean, and Series

Question 22



Consider the arithmetic sequence, $t_n = t_{n-1} + 5$ and $t_1 = 2$.

a. Find t_{10} .

b. Find the arithmetic mean of t_3 and t_{10} .

c. Evaluate S_4 .

Question 23



Find the value of x so that, the arithmetic mean of 8 and $2x + 6$ is 17.

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Question 24


Let $t_n = 5 + dn$. Find the value of d if, $S_4 = 50$.

Question 25


Given that $t_4 = 16$ and $S_8 = 136$, find the values of a (the first term) and d (the common difference) and hence, write down the general term t_n of the sequence.

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Sub-Section [1.3.3]: Finding Geometric Sequence, Mean, and Series

Question 26



Given $t_n = 4t_{n-1}$ and $t_1 = 3$.

a. Find t_3 .

b. Find the geometric mean of t_2 and t_5 .

c. Evaluate S_5 .

Question 27



Suppose that t_n is a geometric series such that, $t_5 = 40.5$ and $t_9 = 3280.5$. Find the common ratio of the geometric series.

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Question 28


Let $t_n = 4 \cdot r^n$. Find the value(s) of r given that, the geometric mean between t_4 and t_8 is 256.

Question 29


Given $t_n = 6 \cdot t_{n-1}$ and $t_1 = 7$. Find the smallest value of n so that, S_n first exceeds 1000.

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Sub-Section [1.3.4]: Infinite Geometric Series

Question 30



Find the value of the infinite series:

$$\frac{7}{2} - \frac{7}{4} + \frac{7}{8} - \frac{7}{16} + \dots$$

Question 31



Find the value of the infinite series:

$$2 + \frac{2}{7} + \frac{2}{49} + \frac{2}{343} + \dots$$

Question 32


Find the value of r , given that:

$$5 + 5r + 5r^2 + 5r^3 + \dots = \frac{45}{8}$$

Question 33


Find the value of a , given that:

$$a - \frac{a}{6} + \frac{a}{36} - \frac{a}{216} + \dots = \frac{54}{5}$$

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