

Geometric Series

Level 1 – 2

1. Find the value of the following geometric series using an appropriate formula:

a) $t_1 = 2, r = 3, n = 5$

b) $t_1 = 64, r = \frac{1}{2}, n = 8$

c) $t_1 = 1, r = -2, n = 12$

d) $t_1 = 1600, r = -\frac{1}{4}, n = 7$

e) $t_1 = 20, r = 1, n = 60$

f) $t_1 = -4, r = 2, n = 6$

g) $t_1 = 2700, r = \frac{1}{3}, n = 5$

h) $t_1 = 5, r = -1, n = 16$

i) $t_1 = 1, r = \frac{1}{2}, n = 1000$

j) $t_1 = 0, r = 3, n = 57$

2. Find the value of the following geometric series using an appropriate formula:

a) 7, 14, 28, 56, 112, 224

b) 1000, 500, 250, 125

c) 2, -4, 8, -16, 32, -64, 128, -256

d) $81, 27, 9, 3, 1, 1/3, 1/9$

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e) $-1600, 400, -100, 25, -6.25$

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Level 3 – 4

3. Find the value of the following geometric series using an appropriate formula:

a) $1 + 2 + 4 + \dots + 4096$

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b) $16000 + 8000 + 4000 + \dots + 250$

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c) $1 + 3 + 9 + \dots + 243$

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d) $3 + -6 + 12 + \dots + -384$

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e) $1/16 + -1/4 + 1 + \dots + -1024$

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f) $10+1+0.1+\dots +0.00000000001$

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g) $9 + -0.9 + 0.09 + \dots + 9 \times 10^{-6}$

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4. Find the value of the geometric series satisfying the following:

a) $t_n = 3 \times 2^{n-1}$ $n = 7$

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b) $t_n = (-2)^n$ $n = 10$

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c) $t_n = \frac{t_{n-1}}{2}$ $t_1 = 4096$ $n = 9$

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Level 5 – 6

5. Each year Paul’s salary increases by 10% of the previous year’s salary. If the salary during his first year is \$30,000, calculate how much money he is paid in total during the first ten years.

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6. The first term of a geometric sequence is 5. The third term is 45. Find the sum(s) of the first eight terms.

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7. The third term of a geometric sequence is 40. The sixth term is 5. Find the sum of the first ten terms.

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8. A geometric series contains 3 terms. Its value is equal to 65. If the first term is 5, calculate the values(s) of the common ratio.

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9. The sum of the first n terms of a geometric sequence is $S_n = \frac{3(2^n - 1)}{2}$. Determine the first four terms of the sequence.

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Level 7 – 8

10. The sum of the first n terms of a sequence is $S_n = a(b^n - 1)$ where $a, b \in R$. Prove that the sequence is geometric.

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11. A ball is dropped from a height of 10 m. Each bounce it makes causes it to rebound to 80% of the previous bounce height. Calculate the total distance the ball has travelled when it touches the ground for the tenth time.

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12. The growth of a tree follows a geometric progression. In the first month a tree grows by 100 cm. In the second month it grows by 90 cm. In the third month it grows by 81 cm etc.

a) Write down an expression showing by how much the tree grows on the n^{th} month.

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b) Write down an expression showing the total height of the tree at the end of the n^{th} month.

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c) Determine an upper limit for the total height that the tree can grow. Explain your answer.

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13. The series S_n is geometric with n terms:

$$S_n = a + ar + ar^2 + \dots + ar^{n-1}$$

a) If $|r| < 1$ what can you say about the value of r^n as $n \rightarrow \infty$?

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b) Hence, determine an expression for the sum to infinity S_∞ when $|r| < 1$.

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14. Each week new people are infected by a particular virus. The amount of newly infected people on any given week is equal to 50% of the amount of newly infected people the previous week. In week 1 there are 100,000 newly infected people. Determine the maximum number of people who will catch the virus.

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