Sequences and Series

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. The 5th term of the GP 1, 5, 25, … is:

(a) 625 **(b)** −625 **(c)** 125 **(d)** 3125

2. The sum of the first 8 terms of the GP 5, −10, 20, … is:

(a) 855 **(b)** 1280 **(c)** −425 **(d)** −420

3. The geometric mean of 1 and 441 is:

(a) 441 **(b)** 22 **(c)** 221 **(d)** 21

4. For the numbers 1 and 81, the arithmetic mean A and geometric mean G are:

(a) A = 41, G = 9 **(b)** A = 9, G = 41 **(c)** A = 41, G = 81 **(d)** A = 82, G = 9

5. In a geometric progression, each term after the first is found by:

(a) multiplying the previous term by a fixed number

(b) squaring the previous term

(c) adding the two previous terms

(d) adding a fixed number to the previous term

6. The value of $1^2 + 2^2 + 3^2 + \ldots + 16^2$ is:

(a) 18,496 **(b)** 1,496 **(c)** 1,512 **(d)** 1,240

7. Which term of the GP 3, 6, 12, … is 384?

(a) the 8th **(b)** the 10th **(c)** the 9th **(d)** the 7th

8. Assertion (A): For 2 and 8, the AM (5) is greater than or equal to the GM (4).
Reason (R): For any two positive numbers, AM ≥ GM.

(a) Both A and R are true, and R is the correct explanation of A.

(b) Both A and R are true, but R is not the correct explanation of A.

(c) A is true, but R is false.

(d) A is false, but R is true.

Section B — Short answer — 8 × 2 = 16 marks

9. For the GP 6, 24, 96, …, find the common ratio and the 9th term.

10. Find the sum of the first 6 terms of the GP 16, 32/3, 64/9, ….

11. Insert 2 geometric means between 5 and 320.

12. The 5th term of a GP is 324 and the 6th term is −972. Find the first term and the common ratio.

13. Find the sum to 13 terms of the series $1 \times 2 + 2 \times 3 + 3 \times 4 + \ldots$.

14. A culture has 30 bacteria, and the number doubles every hour. How many bacteria are there at the end of the 10th hour? How many at the end of the 2nd hour?

15. The arithmetic mean of two positive numbers is 101/2 and their geometric mean is 10. Find the numbers.

16. Rs 5,000 is invested at 20% a year, compounded yearly. Write the amounts after 1, 2 and 2 years. Why do they form a GP?

Section C — Word problems — 4 × 4 = 16 marks

17. Find the sum $\Sigma\ (k^2 + 3k + 5)$ for $k = 1$ to 7.

18. Three numbers in GP have a sum of 21 and a product of 64. Find the numbers.

19. Find the sum to 6 terms of 7 + 77 + 777 + …, and write the general formula.

20. Plan A: save Rs 100 in the first month and Rs 200 more each month after that. Plan B: save Rs 100 in the first month and double the amount every month. Find the total saved in 7 months under each plan. Which plan saves more?

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Answer key

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Q	Answer	Working
1	**(a) 625**	$a\,r^4 = 1 \times (5)^4$
2	**(c) −425**	$a(r^8 - 1) \div (r - 1)$
3	**(d) 21**	$\sqrt{(1 \times 441)} = \sqrt{441}$
4	**(a) A = 41, G = 9**	$A = (1 + 81) \div 2$; $G = \sqrt{81}$
5	**(a) multiplying the previous term by a fixed number**	—
6	**(b) 1,496**	$n(n + 1)(2n + 1)/6$
7	**(a) the 8th**	$3 \times (2)^{n-1} = 384$
8	**(a) Both A and R are true, and R is the correct explanation of A.**	A is true: AM = 5, GM = 4. R is true and explains A.
9	**r = 4; 9th term = 393216**	$r = 24 \div 6$
10	**10640/243**	$S = a(1 - r^6) \div (1 - r)$, $a = 16$, $r = 2/3$
11	**20, 80**	$320 = 5 \times r^3$, so $r = 4$
12	**a = 4, r = −3**	$r^1 = -972 \div 324 = -3$
13	**910**	$\Sigma\, k(k + 1) = \Sigma k^2 + \Sigma k = 819 + 91$
14	**30,720; 120**	GP with $a = 30$, $r = 2$: 30×2^{10}
15	**1 and 100**	they are the roots of $x^2 - 101x + 100 = 0$
16	**Rs 6,000, Rs 7,200, … Rs 7,200; each year's amount is 6/5 times the year before**	$A = P(1 + r/100)^n$
17	**259**	$1 \times \Sigma k^2 + 3 \times \Sigma k + 5 \times 7 = 1 \times 140 + 3 \times 28 + 35$
18	**1, 4, 16**	take a/r, a, ar: $a^3 = 64$, so $a = 4$; then $4/r + 4 + 4r = 21$
19	**864,192; $S = (7/81)(10^{n+1} - 10 - 9n)$**	$7 + 77 + \ldots = (7/9)[(10 - 1) + (10^2 - 1) + \ldots + (10^n - 1)]$
20	**Plan A: Rs 4,900 (AP); Plan B: Rs 12,700 (GP); Plan B saves more**	AP: $n/2\,[2a + (n - 1)d]$; GP: $a(2^n - 1)$