CBSE Class–11 Mathematics

NCERT Solutions

Chapter - 9 Sequences and Series

Exercise 9.1

Write the first five terms of each of the sequences in Exercises 1 to 6 whose n^{th} terms are:

1. $a_n = n(n+2)$

Ans. Given: $a_n = n(n+2)$

Putting $n = 1, 2, 3, 4$ and 5, we get,

$a_1 = 1(1+2) = 1\times 3 = 3$

$a_2 = 2(2+2) = 2\times 4 = 8$

$a_3 = 3(3+2) = 3\times 5 = 15$

$a_4 = 4(4+2) = 4\times 6 = 24$

$a_5 = 5(5+2) = 5\times 7 = 35$

Therefore, the first five terms are 3, 8, 15, 24 and 35.

2. $a_n = \frac{n}{n+1}$

Ans. Given: $a_n = \frac{n}{n+1}$

Putting $n = 1, 2, 3, 4$ and 5, we get,

$a_1 = \frac{1}{1+1} = \frac{1}{2}$

$a_2 = \frac{2}{2+1} = \frac{2}{3}$

$a_3 = \frac{3}{3+1} = \frac{3}{4}$

$a_4 = \frac{4}{4+1} = \frac{4}{5}$

$a_5 = \frac{5}{5+1} = \frac{5}{6}$

Therefore, the first five terms are $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}$ and $\frac{5}{6}$.

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3. $a_n = 2^n$

Ans. Given: $a_n = 2^n$

Putting $n = 1, 2, 3, 4$ and 5, we get,

$a_1 = 2^1 = 2$

$a_2 = 2^2 = 4$

$a_3 = 2^3 = 8$

$a_4 = 2^4 = 16$

$a_5 = 2^5 = 32$

Therefore, the first five terms are 2, 4, 8, 16 and 32.

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4. $a_n = \frac{2n-3}{6}$

Ans. Given: $a_n = \frac{2n-3}{6}$

Putting $n = 1, 2, 3, 4$ and 5, we get,

$a_1 = \frac{2\times1-3}{6} = \frac{2-3}{6} = \frac{-1}{6}$

$a_2 = \frac{2\times2-3}{6} = \frac{4-3}{6} = \frac{1}{6}$

$a_3 = \frac{2\times3-3}{6} = \frac{6-3}{6} = \frac{3}{6} = \frac{1}{2}$

$a_4 = \frac{2\times4-3}{6} = \frac{8-3}{6} = \frac{5}{6}$

$a_5 = \frac{2\times5-3}{6} = \frac{10-3}{6} = \frac{7}{6}$

Therefore, the first five terms are $\frac{-1}{6}, \frac{1}{6}, \frac{1}{2}, \frac{5}{6}$ and $\frac{7}{6}$.

5. $a_n = (-1)^{n-1}.5^{n+1}$

Ans. Given: $a_n = (-1)^{n-1}.5^{n+1}$

Putting $n = 1, 2, 3, 4$ and 5, we get,

$a_1 = (-1)^{1-1}.5^{1+1} = (-1)^0.5^2 = 1\times25 = 25$

$a_2 = (-1)^{2-1}5^{2+1} = (-1)^1.5^3 = -1\times125 = -125$

$a_3 = (-1)^{3-1}.5^{3+1} = (-1)^2.5^4 = 1\times625 = 625$

$a_4 = (-1)^{4-1}.5^{4+1} = (-1)^3.5^5 = -1 \times 3125 = -3125$

$a_5 = (-1)^{5-1}.5^{5+1} = (-1)^4.5^6 = 1 \times 15625 = 15625$

Therefore, the first five terms are $25, -125, 625, -3125$ and 15625.

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6. $a_n = n.\frac{n^2+5}{4}$

Ans. Given: $a_n = n.\frac{n^2+5}{4}$

Putting $n = 1, 2, 3, 4$ and 5, we get,

$a_1 = 1.\frac{1^2+5}{4} = 1.\frac{1+5}{4} = \frac{6}{4} = \frac{3}{2}$

$a_2 = 2.\frac{2^2+5}{4} = 2.\frac{4+5}{4} = \frac{18}{4} = \frac{9}{2}$

$a_3 = 3.\frac{3^2+5}{4} = 3.\frac{9+5}{4} = 3 \times \frac{14}{4} = \frac{42}{4} = \frac{21}{2}$

$a_4 = 4.\frac{4^2+5}{4} = 4.\frac{16+5}{4} = \frac{84}{4} = 21$

$a_5 = 5.\frac{5^2+5}{4} = 5.\frac{25+5}{4} = 5 \times \frac{30}{4} = \frac{150}{4} = \frac{75}{2}$

Therefore, the first five terms are $\frac{3}{2}, \frac{9}{2}, \frac{21}{2}, 21$ and $\frac{75}{2}$.

Find the indicated terms in each of the sequences in Exercises 7 to 10 where n^{th} terms are:

7. $a_n = 4n - 3; \quad a_{17}, a_{24}$

Ans. Given: $a_n = 4n - 3$

$\therefore a_{17} = 4 \times 17 - 3 = 68 - 3 = 65$

$a_{24} = 4 \times 24 - 3 = 96 - 3 = 93$

Therefore, 17th and 24th terms are 65 and 93 respectively.

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8. $a_n = \frac{n^2}{2^n}; \quad a_7$

Ans. Given: $a_n = \frac{n^2}{2^n}$

$\therefore a_7 = \frac{7^2}{2^7} = \frac{49}{128}$

Therefore, 7th term is $\frac{49}{128}$.

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9. $a_n = (-1)^{n-1} n^3; \quad a_9$

Ans. Given: $a_n = (-1)^{n-1} n^3$

$\therefore a_9 = (-1)^{9-1} \times (9)^3 = (-1)^8 \times 729 = 729$

Therefore, 9th term is 729.

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10. $a_n = \frac{n(n-2)}{n+3}; \quad a_{20}$

Ans. Given: $a_n = \frac{n(n-2)}{n+3}$

$$\therefore a_{20} = \frac{20(20-2)}{20+3} = \frac{20\times18}{23} = \frac{360}{23}$$

Therefore, 20^{th} term is $\frac{360}{23}$.

Write the first five terms of each of the sequences in Exercises 11 to 13 and obtain the corresponding series:

11. $a_1 = 3$, $a_n = 3a_{n-1} + 2$ **for all** $n > 1$

Ans. Given: $a_1 = 3$, $a_n = 3a_{n-1} + 2$ for all $n > 1$

Putting $n = 2, 3, 4$ and 5, we get

$$a_2 = 3a_{2-1} + 2 = 3a_1 + 2 = 3\times3 + 2 = 9 + 2 = 11$$

$$a_3 = 3a_{3-1} + 2 = 3a_2 + 2 = 3\times11 + 2 = 33 + 2 = 35$$

$$a_4 = 3a_{4-1} + 2 = 3a_3 + 2 = 3\times35 + 2 = 105 + 2 = 107$$

$$a_5 = 3a_{5-1} + 2 = 3a_4 + 2 = 3\times107 + 2 = 321 + 2 = 323$$

Hence the first five terms are 3,11,35,107,323.

Therefore, corresponding series is 3 + 11 + 35 + 107 + 323 + ...

12. $a_1 = -1$, $a_n = \frac{a_{n-1}}{n}, n \geq 2$

Ans. Given: $a_1 = -1$, $a_n = \frac{a_{n-1}}{n}, n \geq 2$

Putting $n = 2, 3, 4$ and 5, we get

$$a_2 = \frac{a_{2-1}}{2} = \frac{a_1}{2} = \frac{-1}{2}$$

$$a_3 = \frac{a_{3-1}}{3} = \frac{a_2}{3} = \frac{-\frac{1}{2}}{3} = \frac{-1}{6}$$

$$a_4 = \frac{a_{4-1}}{4} = \frac{a_3}{4} = \frac{-\frac{1}{6}}{4} = \frac{-1}{24}$$

$$a_5 = \frac{a_{5-1}}{5} = \frac{a_4}{5} = \frac{-\frac{1}{24}}{5} = \frac{-1}{120}$$

Hence the first five terms are $-1, \frac{-1}{2}, \frac{-1}{6}, \frac{-1}{24}, \frac{-1}{120}$

$\therefore$ Corresponding series is $-1 + \left(\frac{-1}{2}\right) + \left(\frac{-1}{6}\right) + \left(\frac{-1}{24}\right) + \left(\frac{-1}{120}\right) \ldots\ldots\ldots\ldots$

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13. $a_1 = a_2 = 2,\ \ a_n = a_{n-1} - 1, n > 2$

Ans. Given: $a_1 = a_2 = 2,\ \ a_n = a_{n-1} - 1, n > 2$

Putting $n = 3, 4$ and 5, we get

$$a_3 = a_{3-1} - 1 = a_2 - 1 = 2 - 1 = 1$$

$$a_4 = a_{4-1} - 1 = a_3 - 1 = 1 - 1 = 0$$

$$a_5 = a_{5-1} - 1 = a_4 - 1 = 0 - 1 = -1$$

Hence the first five terms are 2,2,1,0,-1.

Therefore, corresponding series is $2 + 2 + 1 + 0 + (-1) + \ldots\ldots$

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14. The Fibonacci sequence is defined by $1 = a_1 = a_2$ and $a_{n-1} + a_{n-2}, n > 2$. Find $\frac{a_{n+1}}{a_n}$, for $n = 1, 2, 3, 4, 5$.

Ans. Given: $a_1 = a_2 = 1$ and $a_{n-1} + a_{n-2}, n > 2$

Putting $n =$ 3, 4, 5 and 6, we have

$$a_3 = a_{3-1} + a_{3-2} = a_2 + a_1 = 1 + 1 = 2$$

$$a_4 = a_{4-1} + a_{4-2} = a_3 + a_2 = 2 + 1 = 3$$

$$a_5 = a_{5-1} + a_{5-2} = a_4 + a_3 = 3 + 2 = 5$$

$$a_6 = a_{6-1} + a_{6-2} = a_5 + a_4 = 5 + 3 = 8$$

Now, $\dfrac{a_{n+1}}{a_n}$

For $n = 1$, $\dfrac{a_{1+1}}{a_1} = \dfrac{a_2}{a_1} = \dfrac{1}{1} = 1$

For $n = 2$, $\dfrac{a_{2+1}}{a_2} = \dfrac{a_3}{a_2} = \dfrac{2}{1} = 2$

For $n = 3$, $\dfrac{a_{3+1}}{a_3} = \dfrac{a_4}{a_3} = \dfrac{3}{2}$

For $n = 4$, $\dfrac{a_{4+1}}{a_4} = \dfrac{a_5}{a_4} = \dfrac{5}{3}$

For $n = 5$, $\dfrac{a_{5+1}}{a_5} = \dfrac{a_6}{a_5} = \dfrac{8}{5}$