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NCERT Discrete 10.5.2 -15

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Question: For what value of n, are the nth terms of two A.Ps: 63, 65, 67,... and 3, 10, 17,... equal? **Solution**:

A sequence is said to be in Arithmetic Progression when it is in the form of

$$a, a + d, a + 2d, a + 3d, ...$$

where a is first term and d is common difference. When there are n terms, the sequence becomes

$$a, a + d, a + 2d, a + 3d, \dots, a + (n - 1)d.$$

 $T_n = a + (n - 1)d.$

which is nth term. In the given question, there are two sequences.

for the sequence (??), let x(n) be *nth* term,

$$a = 63$$

$$a + d = 65$$

$$d = 2$$

$$x(n) = 63 + (n - 1) \times 2$$

$$x(n) = 61 + 2n$$
(3)

for sequence (??), let y(n) be nth term,

$$a = 3$$

$$a + d = 10$$

$$d = 7$$

$$y(n) = 3 + (n - 1) \times 7$$

$$y(n) = 7n - 4$$
(4)

given, x(n) = y(n)

$$\therefore 61 + 2n = 7n - 4$$

$$5n = 65$$

$$n = 13$$

$$So, x(n) = 61 + 2 \times 13 = 87 \text{ and}$$

$$y(n) = 7 \times 13 - 4 = 87$$
(5)

: 13th terms of given two APs are equal.

To find X(z) and Y(z) (i.e. the 'z' transforms):

$$X(z) = \sum_{n = -\infty}^{\infty} x(n) \times z^{-n}$$
 (7)

and
$$Y(z) = \sum_{n=-\infty}^{\infty} y(n) \times z^{-n}$$
 (8)

i.e.
$$X(z) = \sum_{n=1}^{\infty} (61 + 2n) \times z^{-n}$$

when |z| > 1 this can be resolved to:

$$X(z) = \frac{61}{z - 1} + \frac{2(2z - 1)}{(z - 1)^2}$$
 (9)

and
$$Y(z) = \sum_{n=1}^{\infty} (-4 + 7n) \times z^{-n}$$

when |z| > 1 this can be resolved to:

$$Y(z) = \frac{-4}{z - 1} + \frac{7(2z - 1)}{(z - 1)^2}$$
 (10)