NCERT Mathematics 10.5.2 Q10

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Question: The 17th term of an AP exceeds its 10th term by 7.Find the common difference.

Solution:

Parameter	Value
First term of AP	x(0)
Common difference of AP	d
x(16) - x(9)	7

Using the formula for the nth term of an AP ($x(n) = x(0) + (n)d$), where ($x(n)$) represents the $(n+1)$th term of an arithmetic progression (AP)

$$x(16) = x(0) + 16d \tag{1}$$
$$x(9) = x(0) + 9d \tag{2}$$
$$(x(0) + 16d) - (x(0) + 9d) = 7 \tag{3}$$
$$7d = 7 \tag{4}$$
$$d = 1 \tag{5}$$

Now,

$$y(n) = x(n) \cdot u(n) = (x(0) + nd)u(n) \tag{6}$$

The z-transform of $y(n)$ is given by

$$Y(z) = \sum_{n=-\infty}^{\infty} f(n)z^{-n} \tag{7}$$
$$Y(z) = \sum_{n=-\infty}^{\infty} (x(0) + nd)u(n)z^{-n} \tag{8}$$
$$Y(z) = \sum_{n=0}^{\infty} (x(0) + nd)z^{-n} \tag{9}$$
$$Y(z) = x(0) \cdot \frac{1}{1 - z^{-1}} + d \cdot \frac{z^{-1}}{(1 - z^{-1})^2}; \quad |z| > 1 \tag{10}$$