The first and last term of AP are a and l respectively. If S is the sum of all the terms of the AP and the common difference is given by (l^2-a^2)/k-(l+a) , then k = ?

Solution

Let the common difference and number of terms of AP be d and n respectively.

Last term of AP = $n^{th}$of the AP, a_n

$\rightarrow a_n = /(Given)$

$\rightarrow a + (n-1)d = l \ \rightarrow n = \frac{l-a}{d} + 1$ … (1)

Sum of n terms of $A.P. = S(Given)$

$$\frac{n}{2}[2a + (n-1)d] = S$$

$$\rightarrow \frac{1}{2}\left(\frac{l-a}{d} + 1\right)\left[2a + \left(\frac{l-a}{d} + 1 - 1\right)d\right] = S \quad \text{(Using (1))}$$

$$\rightarrow \frac{1}{2}\left(\frac{l-a}{d} + 1\right)[2a + (l-a)] = S$$

$$\rightarrow \frac{1}{2}\left(\frac{l-a}{d} + 1\right)(a + l) = S$$

$$\rightarrow \frac{l-a}{d} + 1 = \frac{2S}{l+a}$$

$$\rightarrow \frac{l-a}{d} = \frac{2S}{l+a} - 1 = \frac{2S - (l+a)}{l+a}$$

$$\rightarrow d = \frac{(l+a)(l-a)}{2S - (l+a)}$$

Comparing with $d = \frac{l^2-a^2}{k-(l+a)}$, we get $k = 2S$

Thus, the value of k is $2S$.

Answer: the value of k is $2S$.