11.9.5-13

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question:

$$\frac{a+bx}{a-bx}=\frac{b+cx}{b-cx}=\frac{c+dx}{c-dx} \tag{1}$$

then show that a,b,c,d are in G.P

solution:
let,

$$\frac{b}{a}=\frac{c}{b}=\frac{d}{c}=r \tag{2}$$

parameter	description	value
$x(0)$	first term	a
$x(1)$	second term	b
$x(2)$	third term	c
$x(3)$	fourth term	d
r	common ratio	$\frac{b}{a}$
n	no of terms	4
$x(n)$	$n/^{th}$ term	$x(0)\,r^n$

TABLE 0: input parameters

$$\frac{a+bx}{a-bx}=\frac{b+cx}{b-cx} \tag{3}$$

$$\frac{a+arx}{a-arx}=\frac{ar+ar^2x}{ar-ar^2x} \tag{4}$$

$$\frac{1+rx}{1-rx}=\frac{1+rx}{1-rx} \tag{5}$$

LHS=RHS So a,b,c are in G.P

$$\frac{b+cx}{b-cx}=\frac{c+dx}{c-dx} \tag{6}$$

$$\frac{ar+ar^2x}{ar-ar^2x}=\frac{ar^2+ar^3x}{ar^2-ar^3x} \tag{7}$$

$$\frac{1+rx}{1-rx}=\frac{1+rx}{1-rx} \tag{8}$$

LHS=RHS So b,c,d are in G.P
As proved above a,b,c are in G.P and b,c,d are also in G.P. So, a,b,c,d are in G.P.

Applying z-transform

$$X(z)=\frac{a^2}{a-bz^{-1}} \quad |z|>\left|\frac{b}{a}\right| \tag{9}$$