Discrete Assignment

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Problem Statement

Find the value of n so that $\frac{a^{n+1}+b^{n+1}}{a^n+b^n}$ may be the geometric mean between a and b.

1 Solution

Parameter	Value	Description
x(0)	a	First term
x(2)	b	Third term
x(1)	$\sqrt{ab}$	Second term
r	-	Common ratio
n	-	Given variable

Table 1: Input parameters table

Consider a GP as in Table 1

$$\therefore \frac{(x(0))^{n+1} + (x(2))^{n+1}}{(x(0))^n + (x(2))^n} = x(1) \tag{1}$$

$$\implies \frac{(x(0))^{n+1} + (x(0)r^2)^{n+1}}{(x(0))^n + (x(0)r^2)^n} = x(0)r \tag{2}$$

$$\implies \frac{(x(0))^{n+1}(r^{2n+2} + 1)}{(x(0))^n(r^{2n} + 1)} = x(0)r \tag{3}$$

$$\implies r^{2n+2} + 1 = r^{2n+1} + r \tag{4}$$

$$\implies r^{2n+2}(r - 1) = r - 1 \tag{5}$$

$$\implies r^{2n+1} = r^0 \tag{6}$$

$$\implies n + \frac{1}{2} = 0 \tag{7}$$

$$\implies n = -\frac{1}{2} \tag{8}$$