

# Untitled

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**Proposition:** The sequence  $c/2^n$  is bounded from above by the sequence  $p(1-p)^n$  (where  $n \geq 0$  is an integer) when  $c$  is 0.4 and  $p$  is 0.49.

*Proof:* This proof relies on finding the values of  $p$  that satisfy the following inequality:

$$C/2^{(n+b)r} \leq p(1-p)^n, \tag{ineq}$$

where  $n > 0$  and  $b > 0$  are integers, and  $c > 0$  and  $r > 0$  are real numbers. Taking the logarithm of both sides, rewrite them to:

$$\ln c + \ln 1/2((n+b)r) \leq \ln p + \ln 1-pn.$$

Now observe that both functions are linear in  $n$ . Now consider—

$$g(n, p) = \ln c + \ln 1/2((n+b)r) - \ln p - \ln 1-pn.$$

Proving the statement thus boils down to finding out the areas where  $h(p)$ , the function that solves the equation  $g(n, p) = 0$  for  $n$ , is 0 or less.  $h(p)$  is:

$$h(p) = \frac{-br \ln 2 + \ln c - \ln p}{r \ln 2 + \ln 1-p}.$$

All values of  $p$  for which  $-\infty < h(p) \leq 0$  will satisfy (ineq). Given  $b = 0$ ,  $r = 1$ ,  $c = 0.4$ , and  $p = 0.49$ ,  $h(p)$  is less than 0, which completes the proof.