Re: General solution to equation

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- *From*: grove.matthew@xxxxxxxxx
- *Date*: Sun, 08 Jul 2007 09:01:24 −0700

On Jul 7, 7:43 pm, Raymond Manzoni <raym...@xxxxxxx> wrote:

> grove.matt...@xxxxxxxxx a écrit :
>
>> I need to solve the following equation for n, and I'm having a lot of trouble.
>>
>> (s*(1+t)^n−s)*(1−z) = (s*(1+x)^n−(s+(s*d*(1−(1+x)^n)/−x)))*(1−c)+ (s*d*(1−(1+x)^n)/−x)
>>
>> Any help finding a general solution for n would be much appreciated. It would even be helpful if someone could tell me that it's not possible to find a general solution so I stop banging my head against the wall. Thanks in advance.
>
> The 's' factor appears everywhere and may be removed.
>
> Let's note L= 1−z and R= (c−1) (1−d/x) + d/x then your equation is simply (if L not 0 that is z not 1) :
> ((1+t)^n − 1) = R/L ((1+x)^n − 1)
>
> I'll define a function of n (with r= R/L) :
> f(n)= ((1+t)^n − 1) − r ((1+x)^n − 1)
>
> I'll suppose that t and x are different and not −1 and that you are searching a real positive solution for n
>
> A simple solution of f(n)= 0 is of course n=0
>
> Let's study the behavior of f(n) for positive values of n.
>
> The derivative of f(n) is
> f'(n)= ln(1+t) (1+t)^n − r ln(1+x) (1+x)^n

> f'(n)= 0 iff ln(1+t)/ln(1+x) = r ((1+x)/(1+t))^n
> that is n0= ln(ln(1+t)/ln(1+x)/r)/ln((1+x)/(1+t)) verifies f'(n0)=0
> n0 may be complex, real and negative or real and positive.
>
> Since f is smooth, f(0)= 0 and since limit_{n−>+oo} f(n)= +/− oo you may obtain a positive solution for f(n)= 0 only in the last case (n0 positive real).
>
> In this case you may solve f(n)= 0 by iterations for example using Newton's method :
>
> Start with a 'large enough' value of n (say 2 n0) and compute
> g(n)= n − f(n)/f'(n)= n − (((1+t)^n − 1) − r ((1+x)^n − 1))/(ln(1+t) (1+t)^n − r ln(1+x) (1+x)^n)
> replace n by g(n) and continue until required precision
>
> Should this method be unstable for your t, x, r values then try one
> of the methods proposed here :http://en.wikipedia.org/wiki/Root−finding_algorithm
>
> Hoping it helped,
> Raymond

Thanks to both of you. This is very helpful.

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