Numerical Analysis Questions & Answers

Question by Student 201527119

Sorry, I missed k in left.

$k * k^{\sum_{m=0}^{n-1} p^{m-1}} = k^{1+\sum_{m=0}^{n-1} p^{m-1}}$

Hm, but if that is true, then I don't understand how you obtain the following on the denominator on the LHS:

$$\frac{k^{2^n} * \epsilon_0^{2^n}}{k * k^{p^n-1} * \epsilon_0^{p^n}} = \frac{k^{2^n} * \epsilon_0^{2^n}}{k^{p^n} * \epsilon_0^{p^n}}$$

Please fix this and rewrite your proof better below. And please never use the newline command in your posts (two blackslashes). This is not necessary and is a bad habit.

Question by Student 201727142

Hello, professor. I can't understand that the bisection method in Assignment 2 #1. If the significant number is 4, should I round to the fourth decimal places? or round down to the fourth decimal place? And do I have to count 1 when I get the x_{mid} *in the initial range(*$x_{min} = \frac{\pi}{2} \leqq x \leqq x_{max} = \frac{\pi*3}{2}$*)?*

Obtaining convergence to 4 significant numbers means that iterating more won't change the first 4 significant numbers. Only one question per post please. 1 point bonus.

Question by Student 201527119

$\epsilon_{(n)(Newton)} = k^{2^n-1}\epsilon_0^{2n}$

$\epsilon_{(n)(secant)} = k^{\sum_{m=0}^{n-1} p^{m-1}}\epsilon_0^{p^n}$

$$\frac{\epsilon_{(n)(Newton)}}{\epsilon_{(n)(secant)}} = \frac{k^{2^n-1}\epsilon_0^{2n}}{k^{\sum_{m=0}^{n-1} p^{m-1}}\epsilon_0^{p^n}} = \frac{\frac{k^{2^n}\epsilon_0^{2n}}{k}}{k^{\sum_{m=0}^{n-1} p^{m-1}}\epsilon_0^{p^n}} = \frac{k^{2^n}\epsilon_0^{2n}}{k^1 k^{\sum_{m=0}^{n-1} p^{m-1}}\epsilon_0^{p^n}} = \frac{k^{2^n}\epsilon_0^{2n}}{k^{1+\sum_{m=0}^{n-1} p^{m-1}}\epsilon_0^{p^n}}$$

$(k^a k^b = k^{a+b})$

In denominator,

$k^{\sum_{m=0}^{n-1} p^{m-1}}\epsilon_0^{p^n} = k^{1+p^{-1}+p^0+p^1+\ldots+p^{n-2}}\epsilon_0^{p^n}$

$$p^{-1}+p^{0}+p^{1}+\ldots+p^{n-2}=\frac{\frac{p^{n}-1}{p}}{p-1}=\frac{p^{n}-1}{p^{2}-p}$$

$$and, p^{2}=p+1$$

$$so, \frac{p^{n}-1}{p^{2}-p}=p^{n}-1$$

$$k^{\sum_{m=0}^{n-1} p^{m-1}} \epsilon_{0}^{p^{n}}=k^{1+p^{-1}+p^{0}+p^{1}+\ldots+p^{n-2}} \epsilon_{0}^{p^{n}}=k^{1+p^{n}-1} \epsilon_{0}^{p^{n}}=k^{p^{n}} \epsilon_{0}^{p^{n}}$$

$$\frac{\epsilon(n)(Newton)}{\epsilon(n)(secant)}=\frac{k^{2n} \epsilon_{0}^{2n}}{k^{p^{n}} \epsilon_{0}^{p^{n}}}=\frac{(k\epsilon_{0})^{2^{n}}}{(k\epsilon_{0})^{p^{n}}}=(k\epsilon_{0})^{2^{n}-p^{n}}$$

$$So, p=1.618, k=|\frac{f"(r)}{2f'(r)}|$$

$$\frac{\epsilon(n)(Newton)}{\epsilon(n)(secant)}=(|\frac{f"(r)}{2f'(r)}|\epsilon_{0})^{2^{n}-1.618^{n}}$$

I think this is much better than before one.

There is still the same problem with your proof. You claim that

$$\frac{\epsilon(n)(Newton)}{\epsilon(n)(secant)}=\frac{k^{2^{n}-1} \epsilon_{0}^{2n}}{k^{\sum_{m=0}^{n-1} p^{m-1}} \epsilon_{0}^{p^{n}}}=\frac{\frac{k^{2^{n}} \epsilon_{0}^{2n}}{k}}{k^{\sum_{m=0}^{n-1} p^{m-1}} \epsilon_{0}^{p^{n}}}=\frac{k^{2^{n}} \epsilon_{0}^{2n}}{k^{1} k^{\sum_{m=0}^{n-1} p^{m-1}} \epsilon_{0}^{p^{n}}}=\frac{k^{2^{n}} \epsilon_{0}^{2n}}{k^{1+\sum_{m=0}^{n-1} p^{m-1}} \epsilon_{0}^{p^{n}}}$$

and that

$$k^{\sum_{m=0}^{n-1} p^{m-1}} \epsilon_{0}^{p^{n}}=k^{1+p^{-1}+p^{0}+p^{1}+\ldots+p^{n-2}} \epsilon_{0}^{p^{n}}=k^{1+p^{n}-1} \epsilon_{0}^{p^{n}}=k^{p^{n}} \epsilon_{0}^{p^{n}}$$

But if you substitute the latter in the former, you will not get

$$\frac{\epsilon(n)(Newton)}{\epsilon(n)(secant)}=\frac{k^{2n} \epsilon_{0}^{2n}}{k^{p^{n}} \epsilon_{0}^{p^{n}}}=\frac{(k\epsilon_{0})^{2^{n}}}{(k\epsilon_{0})^{p^{n}}}=(k\epsilon_{0})^{2^{n}-p^{n}}$$

Thus your proof is wrong. I gave you 3 chances already, and you didn't succeed. I can not give you one more chance. 1 point bonus for the effort. Let others now try.

Question by Student 201727142

Hello, professor. I'm so sorry to have asked a lot of questions. But I still don't understand the second question. And do I have to count 1 when I get the x_{mid} in the initial range($x_{min}=\frac{\pi}{2} \leqq x \leqq x_{max}=\frac{\pi*3}{2}$)?

I don't understand your question. Please formulate this better.

Question by Student 201427128

Dear professor, I have question about A2#Q6(a).

before that, when you solved problem using eq.Newton-Raphson by hand in the class.

$x_{n+1} = x_n - \frac{f(x_n)(x_n - x_{n-1})}{x_n - x_{n-1}}$

$f(x) = x^2 - 2$

you guessed $x_0 = 1,\ \ x_{-1} = 0.9$ *and found* $x_1 = 1.526$

And with many iterations, can get a more accurate x.

I used this idea to solve A2#Q6(a).

$x_{n+1} = x_n - 0.05\frac{f(x_n)}{f'(x_n)} - 0.95\frac{f(x_n)(x_{n-1} - x_{n-2})}{f(x_{n-1}) - f(x_{n-2})}$

given initial condition $x_0 = 2.8$

I guessed $x_1 = 3.0,\ \ x_2 = 3.2$

And I got the answers(=5 iterations) on the site.

but now I have question that if I guess more bigger x1 x2 , I get another iteration number

Is there a more accurate way to guess?

I'm not sure what you mean. The number of iterations depends on the initial guess. If the initial guess is the root, then the number of iterations is 1. I'll give you 0.5 point for the effort.

Question by Student 201427128

professor, I'm sorry to repeat the same question.

A2#6(a) ask about the number of iteration up to 4 significant digits.

the number of iteration will different if the initial guess is different.

I think it's possible that each person has a different answer.

Is there a proper way to set the initial guess?

I see what you mean. True, the number of iterations depends not only on the initial guess, but also on the values given to the previous guesses for the root (i.e. x_{-1} and x_{-2}). This may affect slightly the number of iterations needed to reach convergence. But for fastest convergence generally choose values for x_{-1} and x_{-2} that are very close to x_0. But even if you choose values for x_{-1} and x_{-2} that are not very close to x_0, I won't take away points. When correcting the exams, I will look at the logic, not the answers only. Good question: 1.0 bonus point more.

Lastly, please stop using the double backslash character when writing your posts (the "\\"). This makes your post very hard to read. In English, simply write what you want to say within one paragraph (one paragraph = one idea = one question). Don't break lines.