Math151 at the University of Tennessee, Knoxville - Chat for October 12, 2015 with the course instructor, Louis Gross.

I will be online starting at 7:30PM and will be happy to answer questions regarding any aspect of the course, assignments, etc. You can type in this document to ask questions.

When you ask a question, please do not use your name because this document will be saved and publicly posted after we close it. I will be on-line at least until 8:30PM but will stay on longer if there are still questions. Note that I do not know the identity of anyone posting questions - each participant shows up as "Anonymous" animal.

I am online now if there are questions. Lou

So I am very confused with chapter 5. Can you please explain step by step how to do the exercises, such as 5.3, 5.7, 5.9, 5.11, & 5.13?

OK - let's start with one of the 5.3 problems suppose (a)
It is

$$x_{n+1} = .3x_n$$

and so we know that the solution to this (it is what we called a geometric sequence) is

$$x_n = .3^n x_0$$

and we are also told that

$$x_0 = 10$$

so this means that

$$x_n = .3^n 10$$

so for example for n= 3

$$x_3 = .3^3 10 = .27$$

sorry - I am trying to use a formatting program to do this and then insert the equation into the document - it isn't going quick

OK? Then we are asked to find

how do you know to use 3? And do you just plug it in for n?

The n=3 was just an example. If you wanted to find x_4 then you'd just plug in 4 for n so it would be

$x_4 = .3^4 10$

which is .081

Is this OK?

The next step is finding the $\lim_{n\to\infty} x_n$

but what happens in this case is that each time period you multiply by .3 so that each time step the answer for x_n

gets closer and closer to 0

Shall I go on to a different problem in 5.3?

Ok I understand it more now. So, how do you know when it is geometric or arithmetic?

Anytime you have something that is multiplicative in a difference equation it is geometric and when it is added then it is arithmetic so that

$x_{n+1} = bx_n$

multiplies by the number b each time step so the solution is a geometric sequence

$x_n = b^n x_0$

But if the equation is

$x_{n+1} = b + x_n$

then each time step you are adding b
so the solution is

$x_n = bn + x_0$

Alright that makes sense. We are suppose to memorize the solutions for each type of sequence right?

Yes you can memorize it, but it is also very logical - for the geometric sequence each time step you are multiplying by a fixed number (b in the above case) so after n time steps you are multiplying the initial value x_0 by b^n and similarly in the arithmetic case each time step you are

adding the constant b so after n time steps you have added bn to what you had to start. Does this make sense?
Yes, it does. Could you do e on 5.3?

Alright - let's do a problem with a slightly more complicated situation

$$x_{n+1} = 3x_n + 5$$

which is 5.3 e

so there are two ways to think about this - one is to memorize the solution
which is on page 94

in this case the a in the general solution is 3 (it is what is being multiplied by each time step and the b is 5 which is what is added each time step.
so using the formula, we get

$$x_n = c3^n + 5/(1-2)$$

or

$$x_n = c3^n - 5$$

Where did you get the 2 from? Sorry - it is a 3
Shouldn't it be (1-3) since the equation says it is (1-a) and a is 3 in this particular problem?
yes you are correct I mistyped

$$x_n = c3^n + 5/(1-3)$$

is the correct answer

$$x_n = c3^n - 5/2$$

OK I used the formula for the solution on Page 94 - I'll rewrite it:

for the equation

$$x_{n+1} = ax_n + b$$

the solution is

$$x_n = ca^n + b/(1-a)$$

But there is another way to think about this. Then we essentially are adding the "general solution" to the geometric equation
which is in this case

$x_n = c3^n$

and then add to this a “particular solution” and the easiest way to do this is to assume the solution is $x_n = K$

so that we plug in K for x_n and x_{n+1}
so that
K =3K + 5
which gives us
K=-5/2 which means to get the overall solution we add the general and the particular solution to get
$x_n = c3^n - 5/2$

but we are also told that

$x_0 = 10$

so we can find the value of c by plugging in n = 0 and this value to get

10 = c -5/2

so c = 12.5

and the overall solution with the initial condition is

$x_n = 12.5 3^n - 5/2$

this is called the solution to the linear difference equation with the initial condition $x_0 = 10$

Alright it all makes more sense now, I have a clear understanding. Thank you.

Do you want me to do one of the other problems such as 5.7?

Yes please.

OK so we are told that 10% of the drug is eliminated each hour. So we will measure time (what we call n in this) in hours. So
x_n
is the amount of drug in the body in milligrams after n hours. So if we want how much is left after 1 hour we know that 90% of the drug still remains. If we start(as we are told) with 180 mg at time n=0 then after 1 hour we have .9(180) = 162 mg left.

We want to find the equation for x_{n+1} and this is

$$x_{n+1} = .9x_n$$

so that is part (a)
and the general equations solution is

$$x_n = .9^n x_0$$

but we also know that

$$x_0 = 180$$

so the complete answer is

$$x_n = .9^n 180$$

and we can check this by plugging in n=1 to see that we get
.9(180) = 162

and that is all we are asked for in 5.7

I'm getting tired - anything else for now?

That is it, thank you.

OK I'm going offline