

Solutions to Attendance Quiz for Lecture 4 of Dr. Z.'s Dynamical Models in Biology class

Use Maple to find the following numbers:

1. $a(200)$, if $a(n)$ is the sequence satisfying the recurrence equation with the given initial conditions:

$$a(n) - 3a(n-1) + 3a(n-2) - a(n-3) = 0 \quad , \quad a(0) = 0 \quad , \quad a(1) = 1 \quad , \quad a(2) = 4 \quad .$$

Sol. to 1: The Maple command is

`rsolve(a(n)-3*a(n-1)+3*a(n-2)-a(n-3)=0, a(0)=0, a(1)=1, a(2)=4,a(n));`

and you get

$$2(n+1)\left(\frac{n}{2}+1\right) - 3n - 2$$

You first need to simplify it so you type:

`expand(%);`

getting n^2 , so

Ans. to 1: $a(200) = (200)^2 = 40000$

2. $y(2.1)$ (in decimals) if $y(x)$ is the solution of the differential equation

$$y^{(4)}(x) - 16y(x) = 0 \quad , \quad y(0) = 1 \quad , \quad y'(0) = 1 \quad , \quad y''(0) = 1 \quad , \quad y'''(0) = 1 \quad .$$

Sol. to 2: The Maple command is

`dsolve(diff(y(x),x,x,x,x)-16*y(x),y(0)=1, D(y)(0)=1, D(D(y))(0)=1, D(D(D(y)))(0)=1, y(x));`

getting

$$y(x) = \frac{5e^{-2x}}{32} + \frac{15e^{2x}}{32} + \frac{3\sin(2x)}{16} + \frac{3\cos(2x)}{8}$$

Then to get the value at $x = 2.1$ you do

`evalf(subs(x=2.1,op(2,%)));` .

Ans. to 2: $y(2.1) = 30.91429247$.

3. The $(1,2)$ entry of the matrix A^{10} if

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix}$$

Sol. to 3: You first have to type:

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with(linalg);
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You enter the matrix as follows:

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A:=matrix([[1,2],[3,1]]);
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then you type

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evalm(A^10)[1,2];
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getting:

Ans. to 3: $(A^{10})_{1,2} = 97364$.