1/1 + 1 = 0

 $\int_{0}^{1} \frac{1}{2} \int_{0}^{1} \frac{1}{2} \int_{0}^{1}$ 

$$\lambda_{1}(X) = 2IN(X) - COZ(X)$$

$$\lambda_{1}(X) = COZ(X) - 2IN(X)$$

$$\lambda_{1}(X) = COZ(X) + 2IN(X) - COZ(X) + 2IN(X) + COZ(X) = 0$$

$$\lambda_{1}(X) = 2IN(X) - COZ(X) + 2IN(X) + COZ(X) = 0$$

$$\lambda_{1}(X) = 2IN(X) - COZ(X) + 2IN(X) + COZ(X) = 0$$

HW4: Dyn Mod In Bio

Yz(t) is not a sol'n

2. Verify that 
$$y_1(t)=t^2$$
 satisfies the differential equation 
$$y'(t)^2-4y(t)=0 \quad .$$

Would you expect the function  $y_2(t) = 2y_1(t) = 2t^2$  to also be a solution? (after all it is a constant

Would you expect the function 
$$y_2(t) = 2y_1(t) = 2t^2$$
 to also be a solution? (after all it is a constant multiple of  $y_1(t)$ ). Explain. Verify that indeed  $y_2(t)$  is **not** a solution.

Verify it is  $y_1(t) = y_2(t) = y_1(t)$ 

$$\frac{\text{Verify it is a sol'n}}{\text{V'(t)}^2 - 4\text{V(t)}} = 0$$

$$\frac{\text{Verify it is a sol'n}}{\text{V'(t)}^2 - 4\text{V(t)}} = 0$$

$$\frac{\text{V(t)}^2 - 4\text{V(t)}}{\text{Verify is it a sol'n}^2}$$

$$\frac{\text{Verify it is it a sol'n}}{\text{Verify is it a sol'n}^2}$$

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3. Give an example of a second-order linear recurrence equation, with two specific sequences that are solutions and verify that their sum also satisfies that same recurrence equation.

call the two solins: 
$$U_n = I^n = I$$
 and  $V_n = (-2)^n$ 

Verify Un is a sol'n:  

$$0n^{2}-U_{N-1}+2U_{N-2}=-1+2=1=U_{N}$$

$$\iint_{N} = -V_{n-1} + 2V_{n-2} = -(-2)^{n-1} + 2(-2)^{n-2} \\
= (-2)^{n-2} (-(-2)^{1} + 2) \\
= (-2)^{n-2} (2+2)$$

$$= 4(-2)^{n-2} = (-2)^n = V_n$$

Wn= 
$$Mn + Vn = 1 + (2)^n$$
  
USING linearity  $\rightarrow -Wn-1 + 2Wn-2 = -(Un-1 + Vn-1) + 2(Un-2 + Vn-2)$   
=  $-Un-1 + 2Un-2 + Vn-1 + 2Vn-2$   
=  $Un + Vn$   
=  $Wn \checkmark$ 

4. Consider the non-linear recurrence

$$a(n) = a(n-1)^2$$
 ,  $n > 0$  .

Check that both sequences

Check O2(N)=32n

doesn't hold.

$$a_3(n) := a_1(n) + a_2$$

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CNECK 
$$(N) = 2^{2^n}$$

$$a_3(n) := a_1(n) + a_2(n)$$

$$= 2^n$$

 $Q_1(N) + Q_2(N) = Q_3(N)$ , extra term  $\frac{1}{1}$  that isn't generally = 0

CNECK 
$$(I_1(N) = 2^{2^n})$$
  
 $(I_1(N) = I_2(N-1)^2 = (2^{2^{n-1}})^2 = 2^{2 \cdot 2^{n-1}} = 2^{2^n} = a_1(N)$ 

$$a_3(n) := a_1(n) + a_2(n)$$

$$a_3(n) := a_1(n) + a_2(n) =$$

$$a_3(n) := a_1(n) + a_2(n) =$$

 $\Omega(N) = \Omega(N-1)^2 = (3^{2^{n-1}})^2 = 3^{2 \cdot 2^{n-1}} = 3^{2^n} = \Omega_2(N)$ 

 $Q_3(N-1)^2 = (Q_1(N-1) + Q_2(N-1))^2 = Q_1(N-1)^2 + 2Q_1(N-1)Q_2(N-1).$ 

for example: N=0  $a_1(0)=2$ ,  $a_2(0)=3 \rightarrow a_3(0)=5$ the recurrence predicts  $a_3(1)=5^2=25$ , but  $a_1(1)+a_2(1)=2^2+3^2=15+25$ 

The failure is blu the recurrence is non-linear, so superposition

$$(n) + a_2(n) = 2^{2^n} +$$

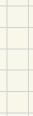
$$a_3(n) := a_1(n) + a_2(n) = 2^{2^n} + 3^{2^n}$$

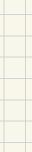
quence 
$$2^n + 2^n$$

$$a_1(n) := 2^{2^n}$$
 ,  $a_2(n) := 3^{2^n}$  ,









- 5. Write the Maple commands to solve each of the following problems, and give the Maple output.
- a. Solve the Initial Value Problem Differential Equation

$$y''(x) + y(x) = 0$$
 ,  $y(0) = 1$  ,  $y'(0) = 1$  .

$$y^*(x) + y(x) = 0$$
 ,  $y(0) = 1$  ,  $y'(0) = 1$ 

input: 
$$dsolve(\{diff(y(x), x$2\} + y(x) = 0, y(0) = 1, D(y)(0) = 1\}, y(x));$$
  
output:  $y(x) = sin(x) + cos(x)$ 

. **b** Solve the Initial Value Problem Difference Equation

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

What: 
$$V = \sqrt{\frac{1}{2} \sqrt{\frac{3}{5}}} \left( \sqrt{\frac{1}{5}} + \sqrt{\frac{3}{5}} \sqrt{\frac{1}{5}} \right) + \sqrt{\frac{3}{5}} \sqrt{\frac{1}{2}} \left( \sqrt{\frac{3}{2}} + \sqrt{\frac{5}{2}} \right)^{n} + \sqrt{\frac{3}{5}} \sqrt{\frac{3}{5}} + \sqrt{\frac{5}{2}} \sqrt{\frac{5}{2}} - \sqrt{\frac{5}{5}} \sqrt{\frac{2}{5}} - \sqrt{\frac{5}{5}} \sqrt{\frac{5}{5}} - \sqrt{\frac{5}{5}}} - \sqrt{\frac{5}{$$

 $\begin{bmatrix} 3 & 4 \\ 2 & 4 \end{bmatrix}$ 

$$m_0 t$$
: A: = matrix ([[3,4],[2,4]]);

Output: 
$$A := \begin{bmatrix} 3 & 4 \\ 2 & 4 \end{bmatrix}$$

