① e^t, e^{2t} $\qquad$ $r^2-3r+2=0$

$4e^{2t}-3\,2e^{2t}+2e^{2t}=0$ $\qquad$ $e^t-3e^t+2e^t=0$

$y' = e^t + 2e^{2t}$ $\qquad$ $(e^t + 4e^{2t}) - 3(e^t+2e^{2t}) + (2e^t + e^t) = 0$

$y'' = e^t + 4e^{2t}$

② $y'(t)^2 - 4y(t) = 0$

$y_1(t) = t^2$ yes as $(2t) \to 4t^2$ thus $y_2(t) = 2y_1(t) = 2t^2$ isn't true since non-liner
$(4t) \to 8t^2$ $\qquad$ $4t^2$ can't make it true
$= 8t^2 = 4t^2$ $\qquad$ $2t^2$ is not a super position for the non-linear

③ $a(n) - 5a(n-1) + 6a(n-2) = 0$

$2^n, 3^n$

$2^n = 2^n - 5(2^{n-1}) + 6(2^{n-2}) = 2^n - 5/2 \cdot 2^n - 6/4 \cdot 2^n = 0$

$3^n = 3^n - 5(3^{n-1}) + 6(3^{n-2}) = 3^n - 5/3 \cdot 3^n + 6/3 \cdot 3^{n-2} = 0$

④ $a(n-1)^2$ $\quad n \geq 1$

$(a_1(n-1) = 2^{2^{(n-1)}})^2 = a(n-1)^2 = 2^{(2\cdot 2^{(n-1)})} = 2^{2^n} = a_1(n)$

$(a_2(n-1) = 3^{2^{(n-1)}})^2 = a_2(n-1)^2 = 3^{(2\cdot 2^{(n-1)})} = 3^{2^n} = a_2(n)$ $\quad\downarrow$ ye step value

it isn't automatically a solution since its a non-linear occurence

$(a_3(n-1))^2 = (2^{2^{n-1}} + 3^{2^{n-1}})^2$ $\quad$ prob wouldn't be $a_1 + a_2$

```
> dsolve( {diff(y(x), x, x) + y(x) = 0, y(0) = 1, D(y)(0) = 1}, y(x));
```

$$y(x) = \cos(x) + \sin(x)$$

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

$$\left(\frac{1}{2} - \frac{3\sqrt{5}}{10}\right)\left(-\frac{\sqrt{5}}{2} + \frac{3}{2}\right)^n + \left(\frac{3\sqrt{5}}{10} + \frac{1}{2}\right)\left(\frac{3}{2} + \frac{\sqrt{5}}{2}\right)^n - \frac{\left(\sqrt{5}+1\right)\sqrt{5}\left(-\frac{2}{-3-\sqrt{5}}\right)^n}{5\left(-3-\sqrt{5}\right)} - \frac{\left(\sqrt{5}-1\right)\sqrt{5}\left(-\frac{2}{\sqrt{5}-3}\right)^n}{5\left(\sqrt{5}-3\right)} - n - 1$$

```
> with(LinearAlgebra) :
  A := Matrix([[3, 4], [2, 4]]);
  Eigenvalues(A);
  Eigenvectors(A);
```

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

$$\begin{bmatrix} \frac{7}{2} + \frac{\sqrt{33}}{2} \\ \frac{7}{2} - \frac{\sqrt{33}}{2} \end{bmatrix}$$

$$\begin{bmatrix} \frac{7}{2} + \frac{\sqrt{33}}{2} \\ \frac{7}{2} - \frac{\sqrt{33}}{2} \end{bmatrix}, \begin{bmatrix} \frac{4}{\frac{1}{2} + \frac{\sqrt{33}}{2}} & \frac{4}{\frac{1}{2} - \frac{\sqrt{33}}{2}} \\ 1 & 1 \end{bmatrix}$$