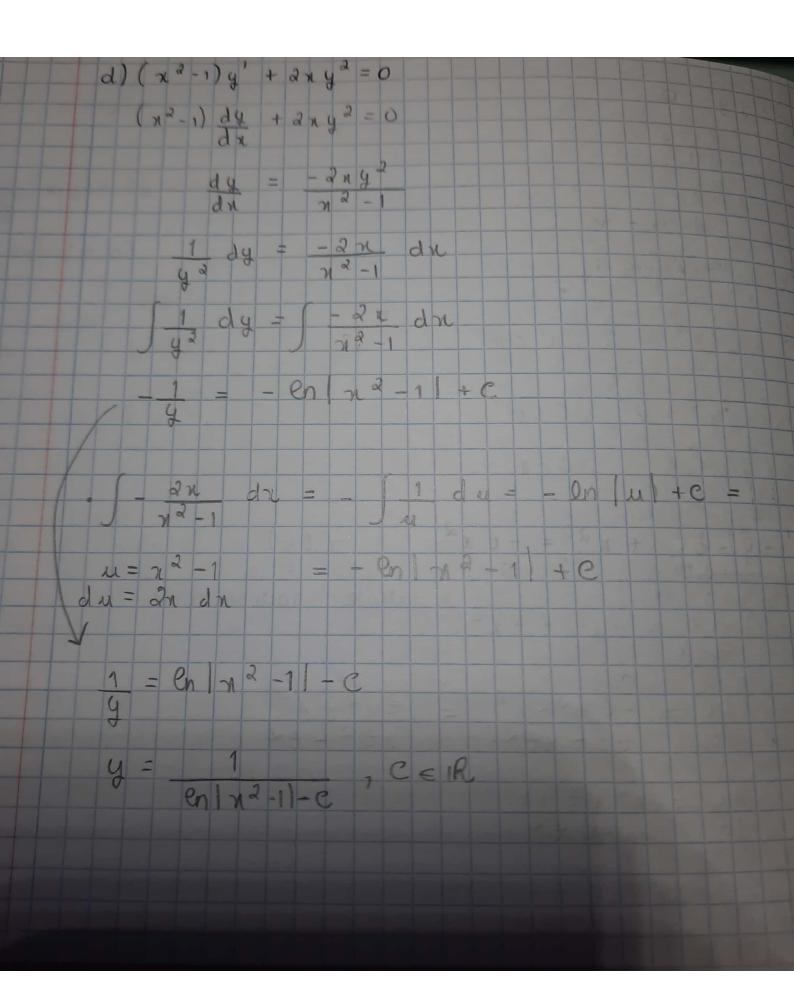
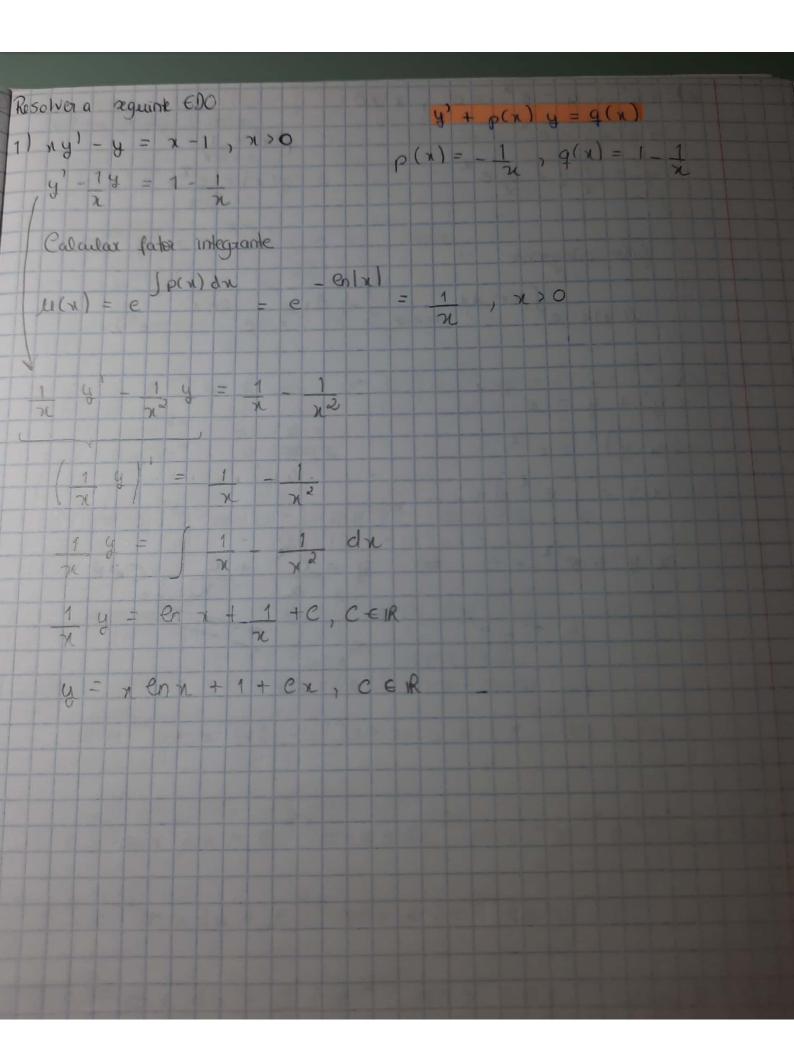
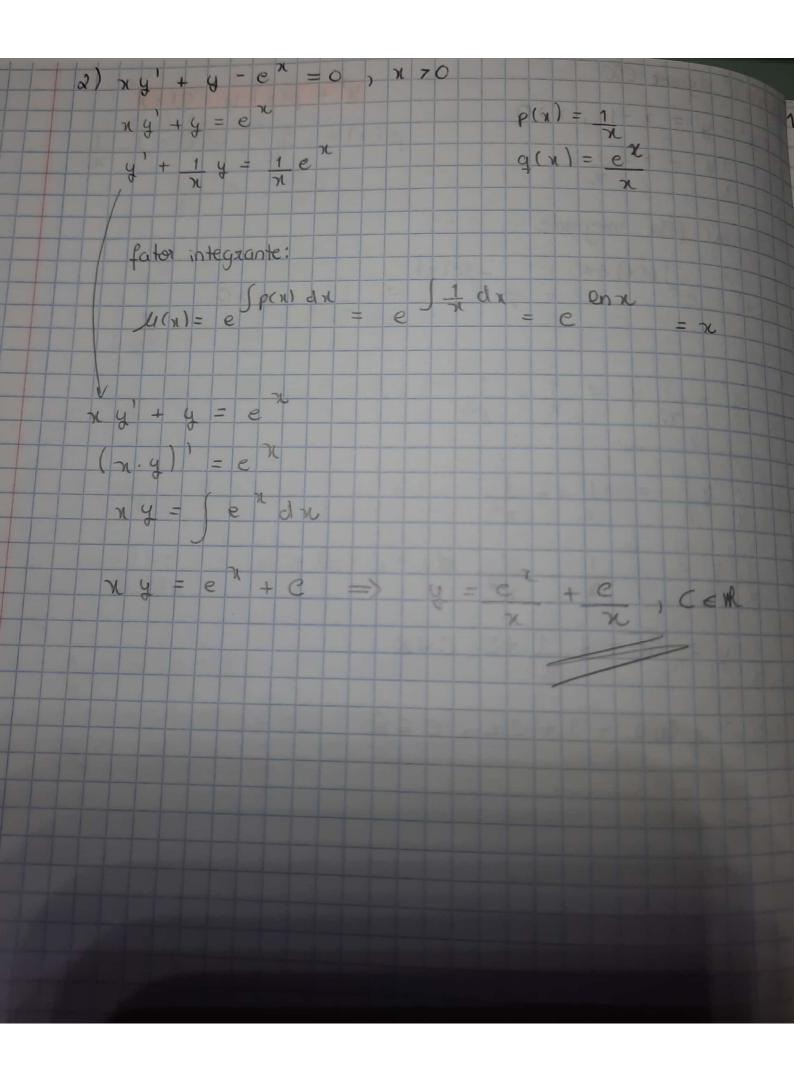
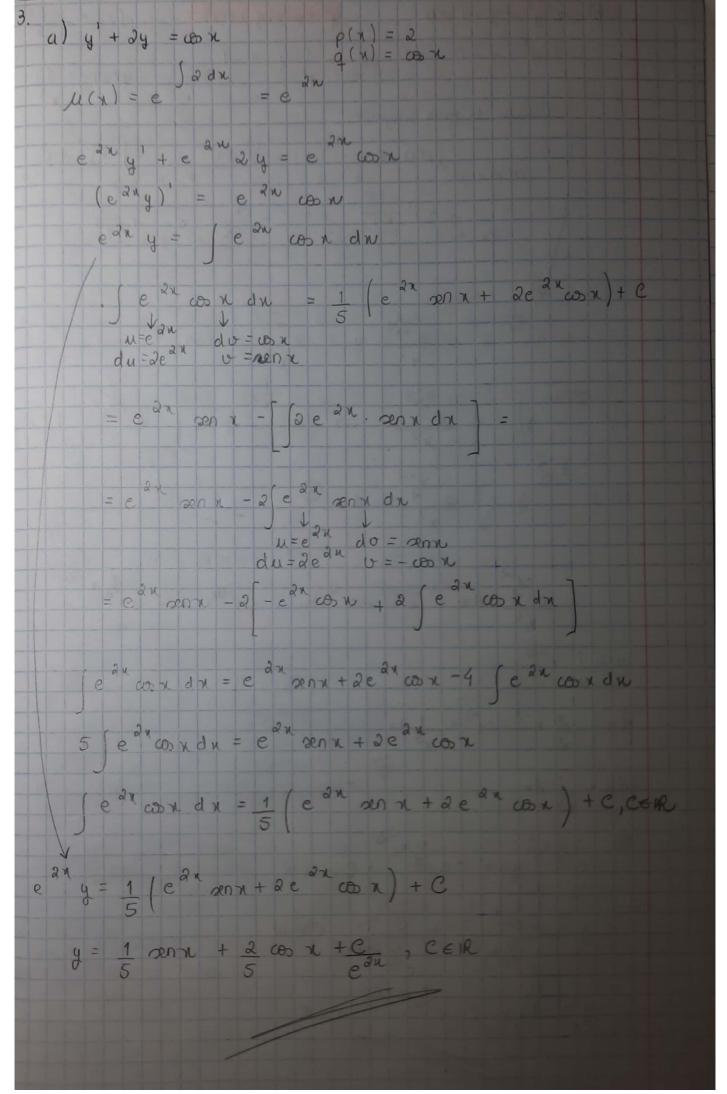


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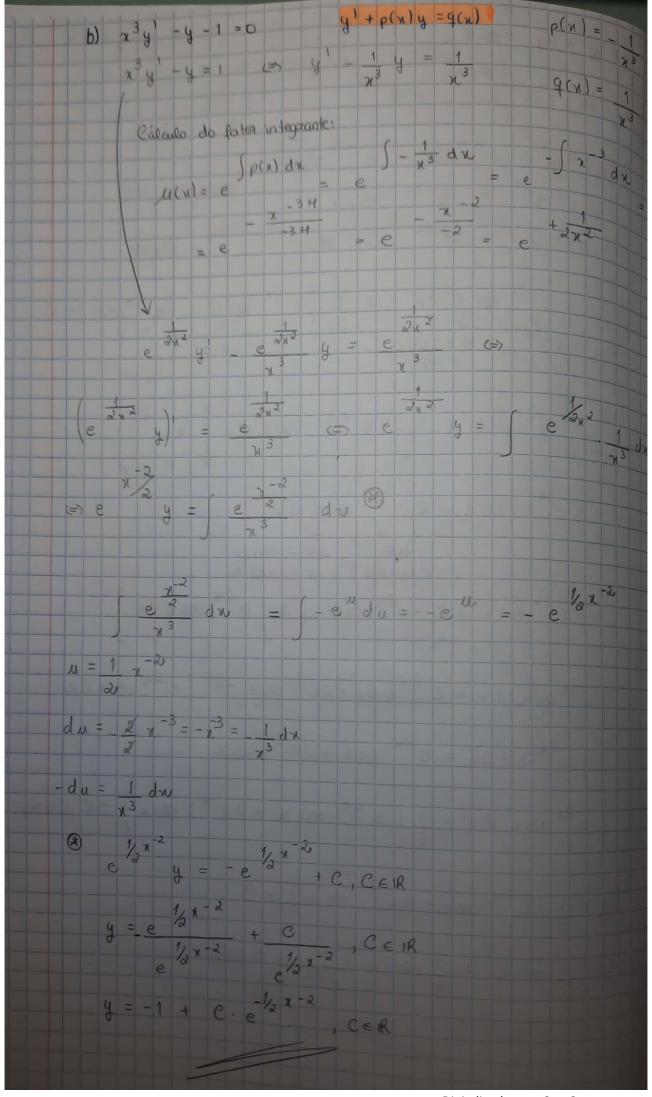




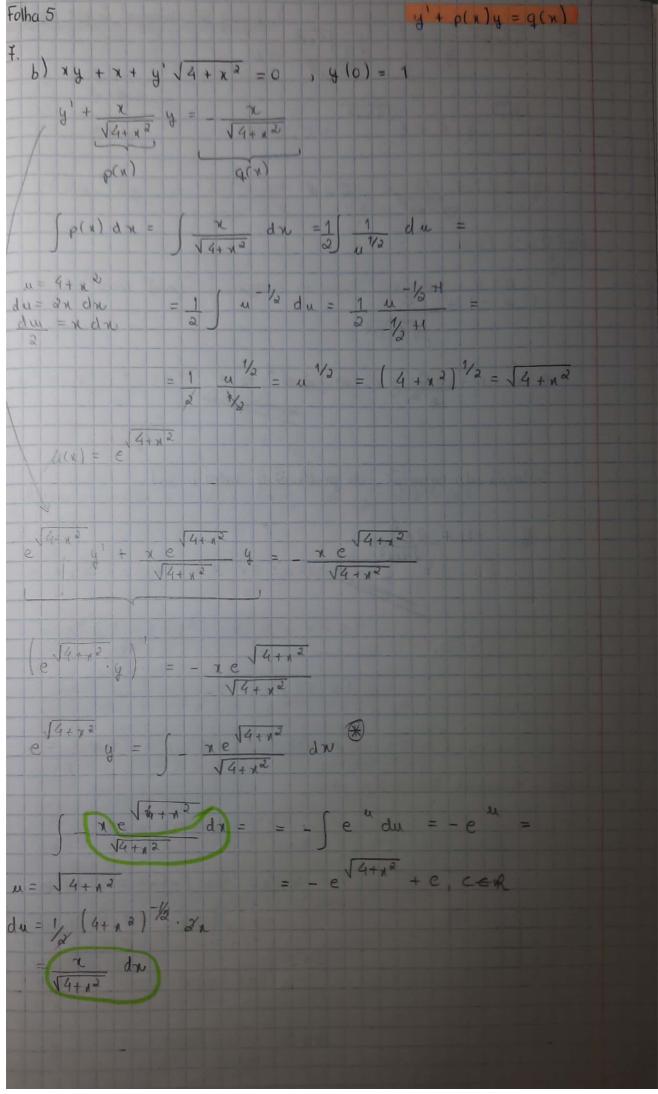




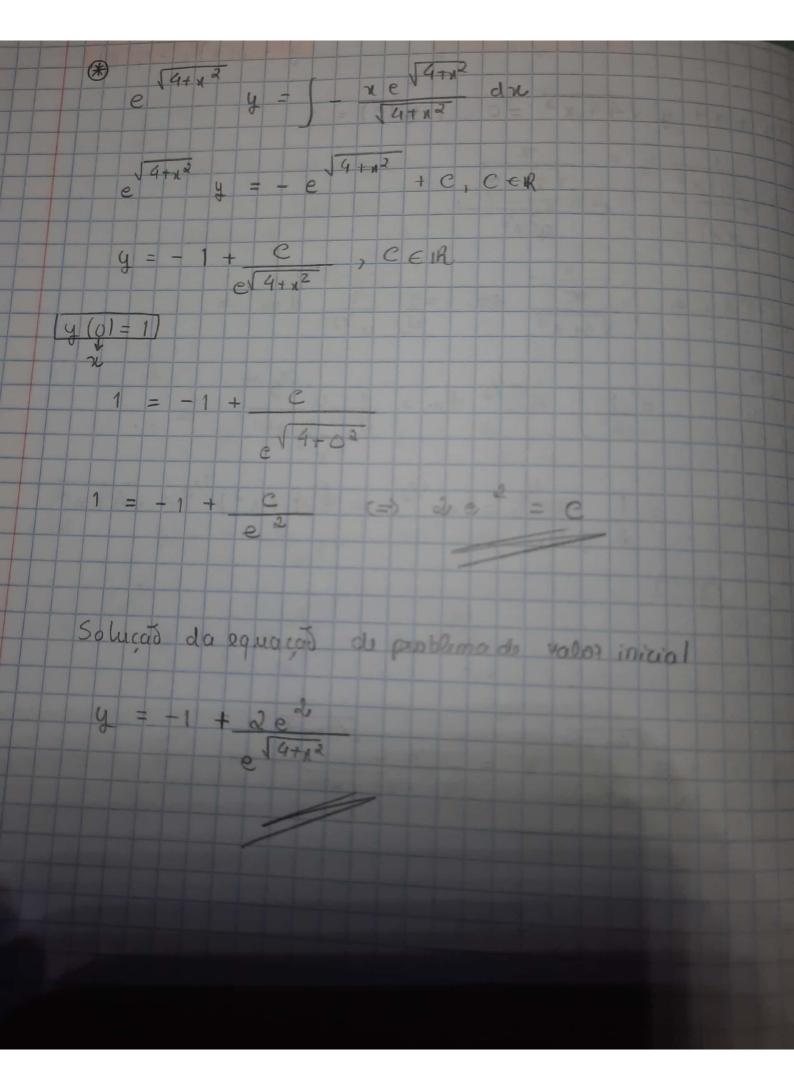
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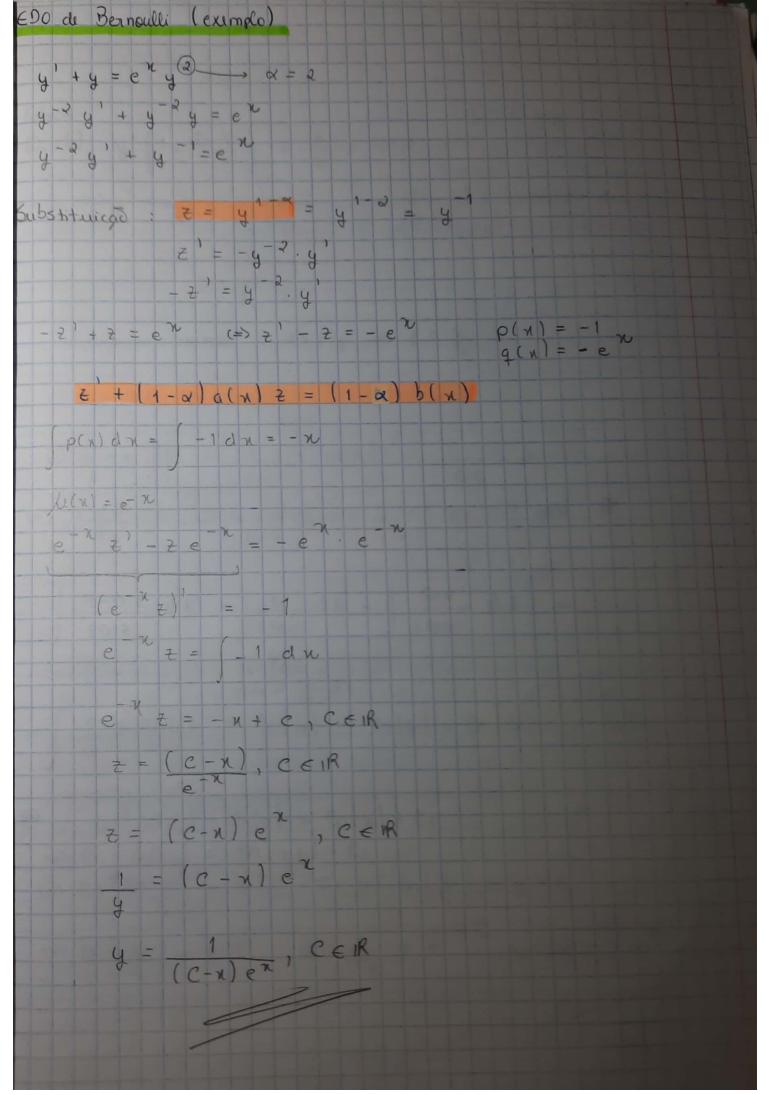


$\begin{cases} y' = y - x \\ y + x \\ y' = x \\ y' + x \\ y' = x^2 + x^2 + y^2 \\ y' = x^2 + x^2 + y^2 \\ y' = x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 + x^2 + x^2 + x^2 + x^2 + x^2 \\ y' = x^2 + x^2 $	Exemplo solução homogénea de gran O
$\begin{cases} (\lambda x, \lambda y) = \lambda y + \lambda x = \chi(y + x) = \frac{y - x}{y + x} \\ = \chi(y + x) = \frac{y - x}{y + x} \\ = \chi(x, y), \lambda \neq 0 \end{cases}$ $\therefore f \in \text{una funça homogenea de gran 0 } \text{empre que } \lambda \neq 0$ $y' = \chi^2 + \chi^2 + y^2 \qquad \text{f $\bar{\epsilon}$ homogenea de gran $\bar{\epsilon}$ to } \\ \chi^2 \qquad \qquad $	
$f(\lambda x, \lambda y) = \lambda y + \lambda x = \lambda((y + x)) = f(x, y), \lambda \neq 0$ $\therefore f \in \text{uno funcial homogenea de gran 0} \text{rempre que } \lambda \neq 0$ $y' = \chi^2 + \chi y + y^2 \qquad \text{f e homogenea de gran veco}$ $\chi^2 \qquad \qquad \lambda = \frac{y}{\chi}$ $\text{Astical medança de variavel } \{x = y = \} y' = 2 + \chi^2$ $= \chi^2 \left(1 + 2 + 2^2\right) = 1 + 2 + 2^2$	P(xiy)
$y' = \chi^2 + \chi^2 + y^2$ $\frac{1}{2} = \frac{1}{2} $ $\frac{1}{2} = \frac{1}{2} + \chi^2 + $	$\{(\lambda_x, \lambda_y) = \lambda_y + \lambda_x = \lambda(y + x) = y + x$
Action mudança de variavel $z = y$ => $y^{1} = z + xz^{1}$ $z + xz^{1} = x^{2} + x \cdot xz + (zx)^{2} = x^{2}$ $z + xz^{1} = x^{2} + z^{2}$ $z + xz^{1} = x^{2} + z^{2}$ $z + xz^{2} = x^{2} + z^{2}$	i. « é uma funçai homogènea de grau 0 rempre que 2 ≠0
Addicat mudança de variável $e = y = y = z + xz^{2}$ $= x^{2} + xz^{2} = x^{2} + x \cdot xz^{2} + (zx)^{2} = 1 + z + z^{2}$ $= x^{2} (1+z+z^{2}) = 1+z+z^{2}$ $= x^{2} (1+z+z^{2}) = 1+z+z^{2}$ $= x^{2} (1+z)$ $= x^{2} (1+z+z^{2}) = 1+z^{2}$ $= x^{2} (1+z)$ $= x^{2} (1+z+z^{2}) = 1+z^{2}$ $= x^{2} (1+z)$	y' = x2 + xy + y2 & é homogénea de gran tero
$\frac{1}{2} + \chi \frac{1}{2} = \chi^2 + \chi \cdot \chi \frac{1}{2} + (\frac{1}{2}\chi)^2 = \frac{1}{2}$ $= \chi^2 \left(\frac{1}{2} + \frac{1}{2} + \frac{1}{2}\chi^2 \right) = \frac{1}{2} + \frac{1}{2} + \frac{1}{2}\chi^2$ $= \frac{1}{2} + \chi \frac{1}{2} + \frac{1}{2} + \frac{1}{2}\chi^2 = \frac{1}{2} + \frac{1}{2}\chi^2$ $= \frac{1}{2} + \chi \frac{1}{2} + \frac{1}{2}\chi^2 = \frac{1}{2} + \frac{1}{2}\chi^2$ $= \frac{1}{2} + \chi \frac{1}{2} + \frac{1}{2}\chi^2 = \frac{1}{2} + \frac{1}{2}\chi^2$ $= \frac{1}{2} + \chi \frac{1}{2} + \frac{1}{2}\chi^2 = \frac{1}{2} + \frac{1}{2}\chi^2$ $= \frac{1}{2} + \chi \frac{1}{2} + \frac{1}{2}\chi^2 = \frac{1}{2} + \frac{1}{2}\chi^2$ $= \frac{1}{2} + \chi \frac{1}{2} + \frac{1}{2}\chi^2 = \frac{1}{2} + \frac{1}{2}\chi^2 = \frac{1}{2} + \frac{1}{2}\chi^2$ $= \frac{1}{2} + \chi \frac{1}{2} + \frac{1}{2}\chi^2 = \frac{1}{2}\chi^$	
$= \chi^{2}(1+z+z^{2}) = 1+z+z^{2}$ $= \chi^{2}(1+z+z+z^{2}) = 1+z+z^{2}$ $= \chi^{2}(1+z+z+z^{2}) = 1+z+z^{2}$ $= \chi^{2}(1+z+z+z^{2}) = 1+z+z^{2}$ $= \chi^{2}(1+z+z+z^{2}) = 1+z+z+z^{2}$ $= \chi^{2}(1+z+z+z+z+z+z+z+z+z+z+z+z+z+z+z+z+z+z+z$	Aplicar mudança de variavel z x = y => y = z + x z
2 + 2 + 2 = 1 + 2 + 2 $2 + 2 + 2 = 1 + 2 + 2 $ $2 + 2 + 2 = 1 + 2 + 2 $ $2 + 2 + 2 = 1 + 2 + 2 $ $2 + 2 + 2 = 1 + 2 + 2 = 1 + 2 + 2 = 1 + 2 + 2 = 1 + 2 = 2 =$	$\frac{1}{2} + \chi \frac{1}{2} = \chi^2 + \chi \cdot \chi^2 + (\pm \chi)^2 = \frac{1}{2}$
$z + nz' = 1 + z + z^2$ (=) $z dz = 1 + z^2$ dx $eq. diferencián divariántes agaráncias$	$= \chi^{\alpha}(1+z+z^{\alpha}) = 1+z+z^{\alpha}$
eq. diferencial divariantes reparaveis	₹(1, ₹)
	$z + nz' = 1 + z + z^2$ (=) $z dz = 1 + z^2$ dx $eq. diferencial divariants aparaments$
	
ouction t = en(x) + e, c \in R	ouction = en(x) + e, c \in R
$\operatorname{axctan}\left(\frac{4}{x}\right) = \operatorname{en}\left[x\right] + c$	$axctan\left(\frac{4}{x}\right) = en x + c$
$\frac{4}{x} = \tan \left(e_n(x) + c \right)$	The state of the s
y = x tan (en/x) +c), c = iR	y = x +an (en/x) +c), c €1R

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3. a) $(n^2 + y^2) y' = ny$ homogenea du gran o $y' = ny$ $n^2 + y^2$ $e^{(n)}y$	41
	187
	4
l'é homogenea de gran 0 - vamos prover une	
$f(\lambda x, \lambda y) = \frac{\lambda x \lambda y}{(\lambda x)^2 + (\lambda y)^2} = \frac{\lambda^2 x y}{\lambda^2 x^2 + \lambda^2 y^2} = \frac{\lambda^2 x y}{\lambda^2 x^2 + \lambda^2 y^2}$	
$= \frac{\lambda^2 \lambda y}{\lambda^2 (\lambda^2 + y^2)} = \frac{\lambda^2 (\lambda^2 + y^2)}{\lambda^2 (\lambda^2 + y^2)} $	
$\exists x = \langle y \rangle \rightarrow xubstituição $	
$\frac{1}{2} + \chi^{2} = \chi^{2} + \frac{1}{2} = \chi^{2} + \frac{1}{2} = \frac{1}{2}$ $\chi^{2} + \chi^{2} + \chi^{2$	
$\mathcal{E}(1, \pm)$	
1+22 dx 1+22	
(=) $x d = 2 - 2(1 + 2^2)$ (=) $x d = -2^3$ $d = 1 + 2^2$ $d = 1 + 2^2$	
$\int \frac{1+z^2}{z^3} dz = \int \left(\frac{1}{z^3} + \frac{1}{z}\right) dz = \int \left(\frac{z^{-3}}{z^3} + \frac{1}{z}\right) dz = \int \left(\frac{z^{-3}}{z^3} + \frac{1}{z^3}\right) dz = \int \left(\frac{z^{-3}}{z^3}$	Ħ
$= \frac{2}{4} + \ln z + e, C \in \mathbb{R}$	
* * * * * * * * * * * * * * * * * * * 	
$= \frac{1}{2 \pm 2} + en \left[\frac{1}{2} \right] + C$	
1 - en z = en x + c, C ∈ IR	
$\frac{1}{2t^2} = \frac{\ln nt + C}{ay^2} = \frac{1}{ay^2} = \frac{\ln y + C}{ay^2} = \frac{1}{ay^2} =$	
2t2	
y = 0 é uma solução singular da equação inicial	

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```
Folha 5.
folha 5.

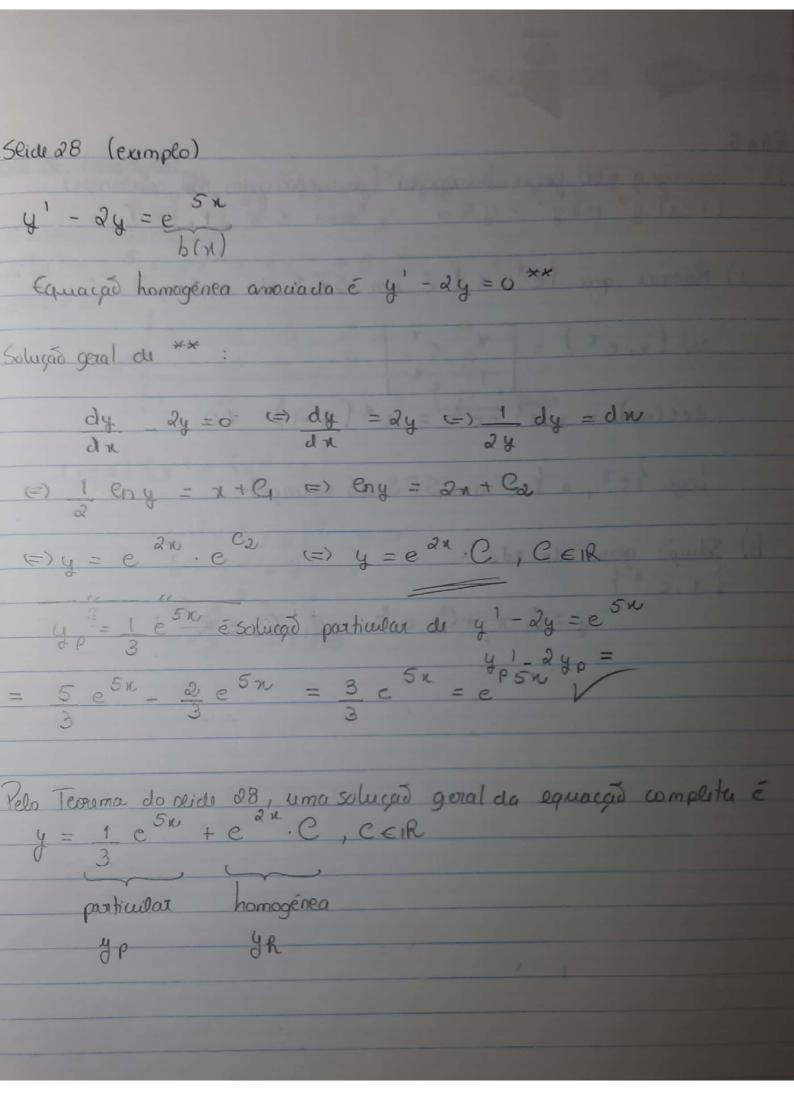
10. b) y'\left(1-\frac{4}{x}\right) = \frac{4}{x}, x>0

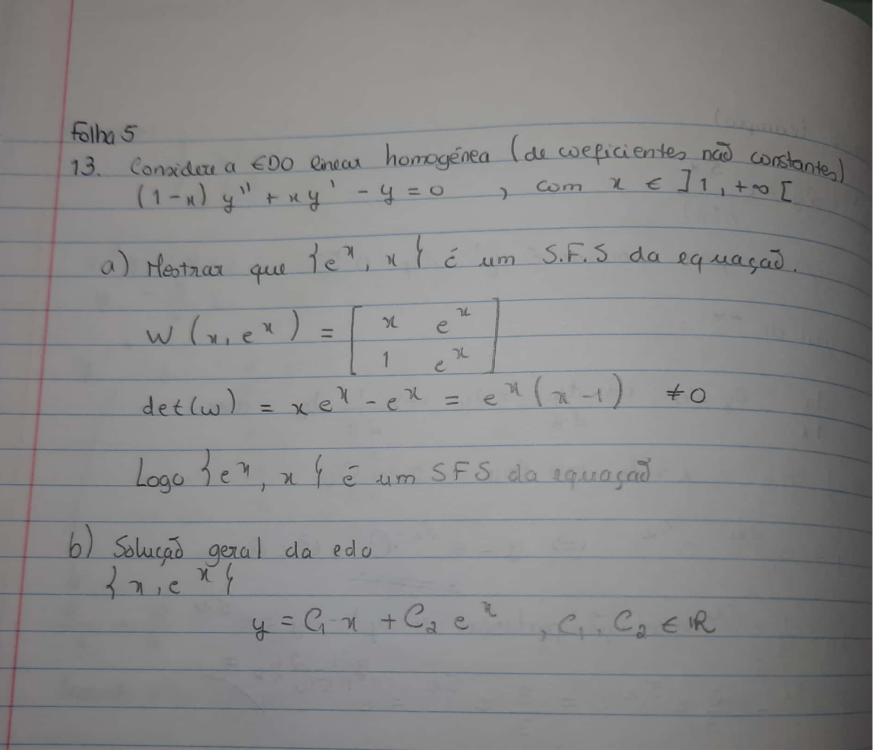
Pauvai:
                                                                                                                                                                                                                                                                                                                                                                              y'= &(n,y)
                                            \langle z \rangle y' = \frac{4}{\pi} \cdot \frac{1}{1 - \ln 4} \left\{ (\pi_1 y) \in \text{homogenea du gran o} \right\} \left\{ (\pi_1 y) \in \text{homogenea du gran o} \right\}
                                                                                                                                               f(n,y)
                                    Aplicando o metodo: tx=y => == 4
                           \frac{1}{2} + x d = \frac{2}{2} \implies \frac{2}{2} + x d = \frac{2}{2}
\frac{1}{2} + x d = \frac{2}{2} \implies \frac{2}{2} + x d = \frac{2}{2}
\frac{1}{2} + x d = \frac{2}{2} \implies \frac{2}{2} + x d = \frac{2}{2}
\frac{1}{2} + x d = \frac{2}{2} \implies \frac{2}{2} + x d = \frac{2}{2}
     (=) 1 dt = 2 en 2 - x+x (=) 1-en 2 dt = 1 dx €

dx 1-en 2 7 en 2 x
                                                                                                                                                               1-en =
                                                \frac{1-\text{RnZ}}{2\text{RnZ}} dZ = \begin{cases} 1 & dZ - \int \frac{\text{RnZ}}{2\text{RnZ}} dZ \\ \frac{1}{2\text{RnZ}} dZ - \int \frac{\text{RnZ}}{2\text{RnZ}} - \int \frac{\text{RnZ}}{2\text{RnZ}} dZ - \int \frac{\text{RnZ}}{2\text{RnZ}} - \int \frac{\text{RnZ}}{2\text{RnZ}} dZ - \int \frac{\text{RnZ}}{2\text{RnZ}} - \int \frac{\text{RnZ}} - \int \frac{\text{RnZ}}{2\text{RnZ}} - \int \frac{\text{RnZ}}{2\text{RnZ}} - \int \frac{\text{RnZ
                                               1 = en |21 = en |u1 - en |21 = en |en |u1 - en |2
            integrando.
   (a) e_{n} |e_{n}|_{z}| - e_{n}|_{z}| = e_{n}|_{x}|_{z} + e_{1}
(b) e_{n} |e_{n}|_{z}| = e_{n}|_{x}|_{z} + e_{1}
(c) e_{n} |e_{n}|_{x}|_{z} = e_{n}|_{y}|_{z} + e_{1}
(d) e_{n} |e_{n}|_{x}|_{z} = e_{n}|_{y}|_{z} + e_{1}
(e) e_{n} |e_{n}|_{x}|_{z} = e_{n}|_{y}|_{z} + e_{1}
             (=) en x = 4.6 (=) 4 = 6 (=) 4 = 16 (CE)
```

Exercises
$$\begin{cases} x^2y^1 - 3xy = 3y^4 \\ y(1) = \frac{1}{2}x \\ y^2 - 3xy = 3\frac{1}{2}x \\ y^2 - 3y = 3\frac$$

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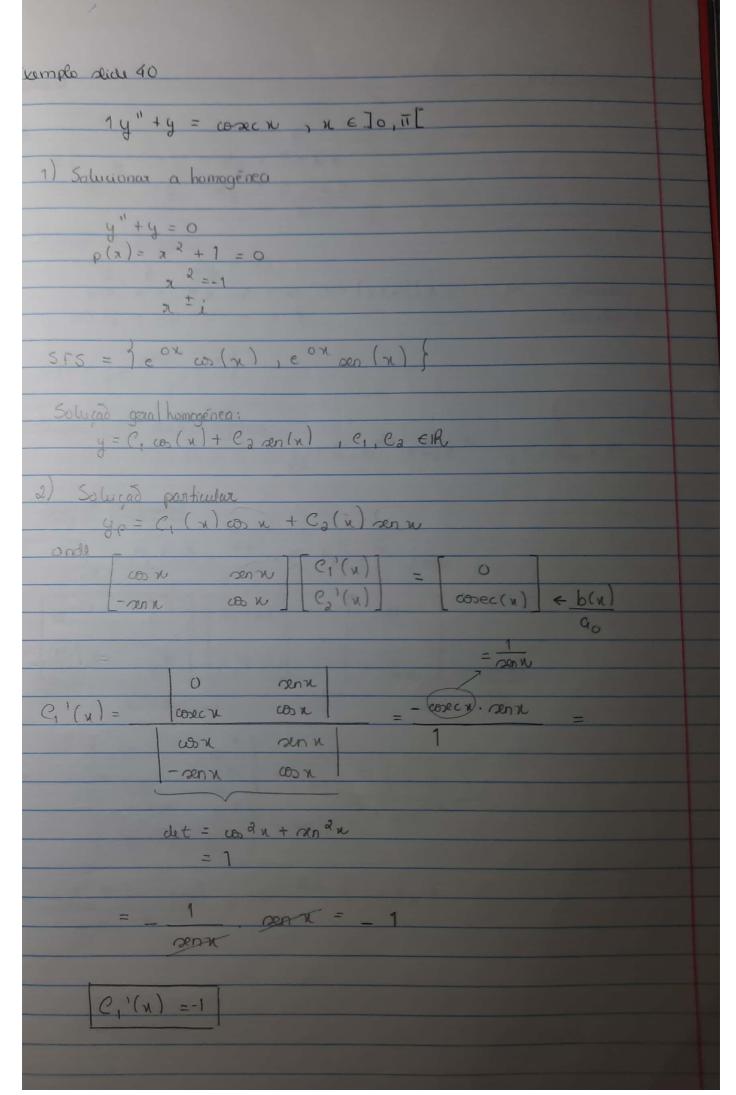


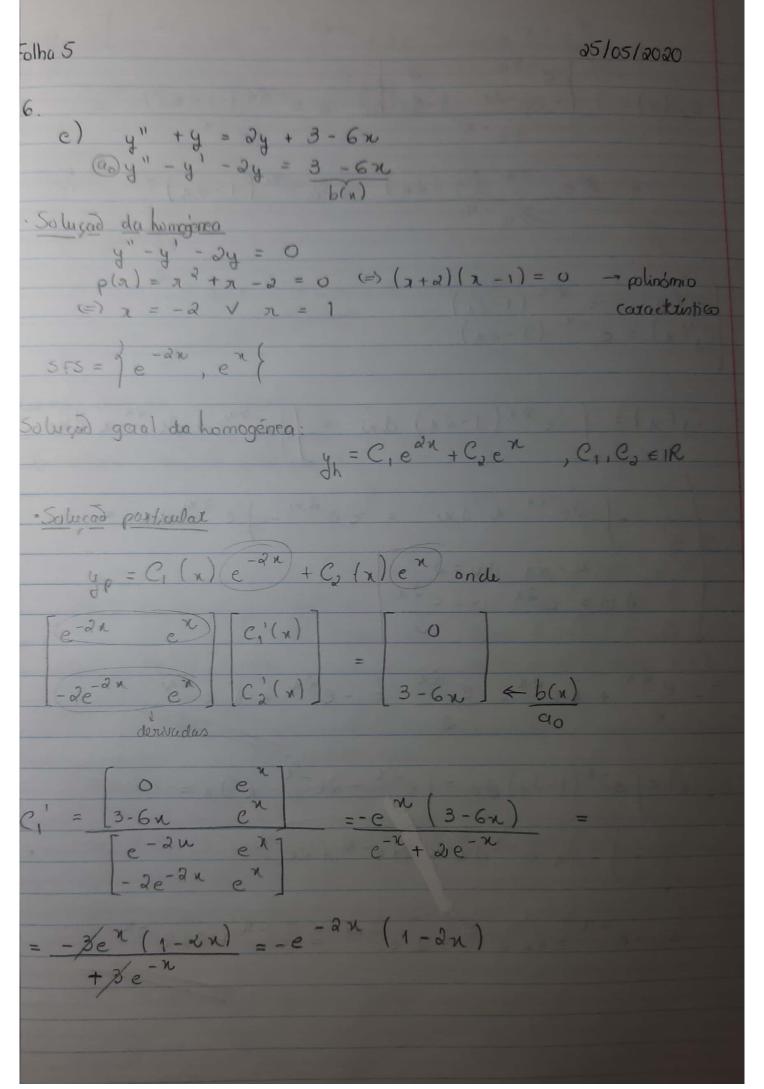
Science (example) $y^{(5)} + 2y^{(4)} + 4y^{(3)} + 8y^{(2)} + 4y' + 8y = 0$ Polinomia cara eterística:
$y^{(5)} + 2y^{(4)} + 4y^{(3)} + 8y^{(2)} + 4y' + 8y = 0$
Polinómio cara eterístico:
p(x)=x5+2x4+4x3+822+4x+8
p(x) = 0
1 2 4 8 4 8
-2 -2 0 -8 0 -8
1 0 4 0 4 0 7 xesto
$(x+a)(x^4+4x^2+4)$
$(=)(\pi^2+2)^2=0$
(=) 72+2=0
(=) 2 2 = -2
(=) ス = ± i (2)

ixample:

1) $2y^{(5)} - 8y^{(4)} + 8y^{(4)} = 0$ equação linear homogénia de ordem 5 polinómio Caractaistin 3=0 V 22-42+4=0 2=0 V (2-2) =0 7=0 V 7=2 SFS = den, nen, neer, ear, rear (= 91, x, x2, e ax, near 6 Solução geral da equação Solução geral da EDO: homogénea C1 + C2 x + C3 x2 + C4 e2x + C5 xe2x, C1, C3, C3, C4, C5 €1 2 = -2 + 122 - 4x1x5 2) y" + 2y' +5y = 0 = -0+ 14-20 p(x) = x2 + 2x + 5 = 0 $x_1 = -1 + 2i$, $x_2 = -1 - 2i$ = - 2 = 1-16 $SFS = \begin{cases} e^{-n} \cos(2n), e^{-n} \cos(2n) \end{cases}$ = -2 ± 42 = - 1 ± 2i Solução geral da EDO: Cie colan) + Cae renlan, Ci, Coeire

Folha 5 14. e) y"+4y = 0 $p(x) = x^2 + 4 = 0$ 21 = ± 2i $a_1 = 2i$, $a_2 = -2i$ SFS= q exx cos (Bx); exx con (Bx) Sio kima fundamental de solución = 1 e x cos (ax), e x sen (ax) } = $\frac{1}{3}$ cos (2x), sen (2x)Solução geral: Goodon) + Ca sen (an), G, Cz ER





$$C_{3}(x) = \begin{vmatrix} e^{-3x} & 3-6x \\ -3e^{-3x} & 3-6x \end{vmatrix} = e^{-3x} (3-6x)$$

$$= 3e^{-3x} (1-3x)$$

$$= 3e^{-3x} (1-3x)$$

$$= 3e^{-3x} (1-3x)$$

$$= e^{-3x} dx = x$$

$$= -e^{-3x} + x e^{-3x} - e^{-3x} + x e^{-3x}$$

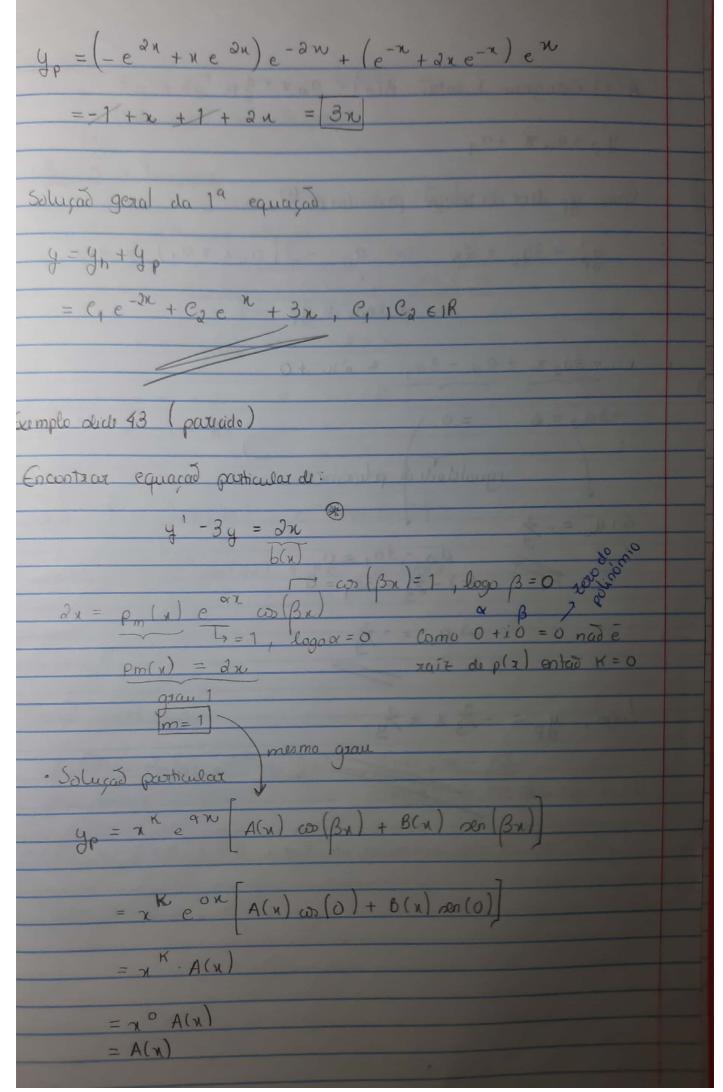
$$= -e^{-3x} + x e^{-3x} - e^{-3x} + x e^{-3x}$$

$$= -e^{-3x} + x e^{-3x} - e^{-3x} + x e^{-3x}$$

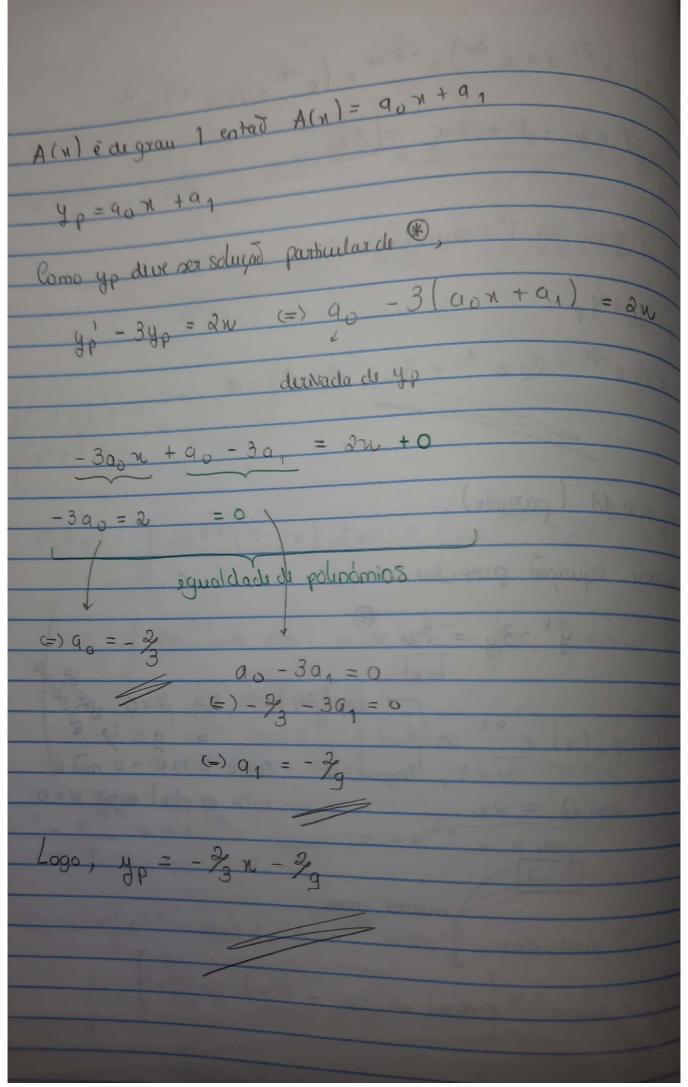
$$= -e^{-3x} + x e^{-3x} - e^{-3x} + x e^{-3x}$$

$$= -e^{-3x} + x e^{-3x} + x e^{-3x}$$

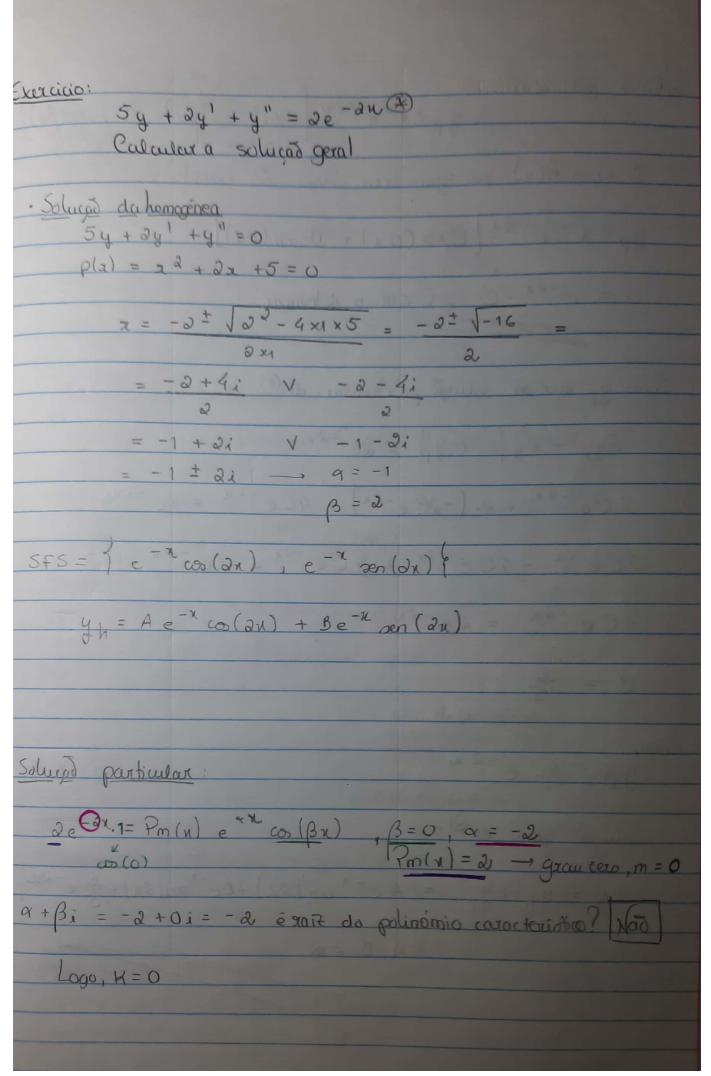
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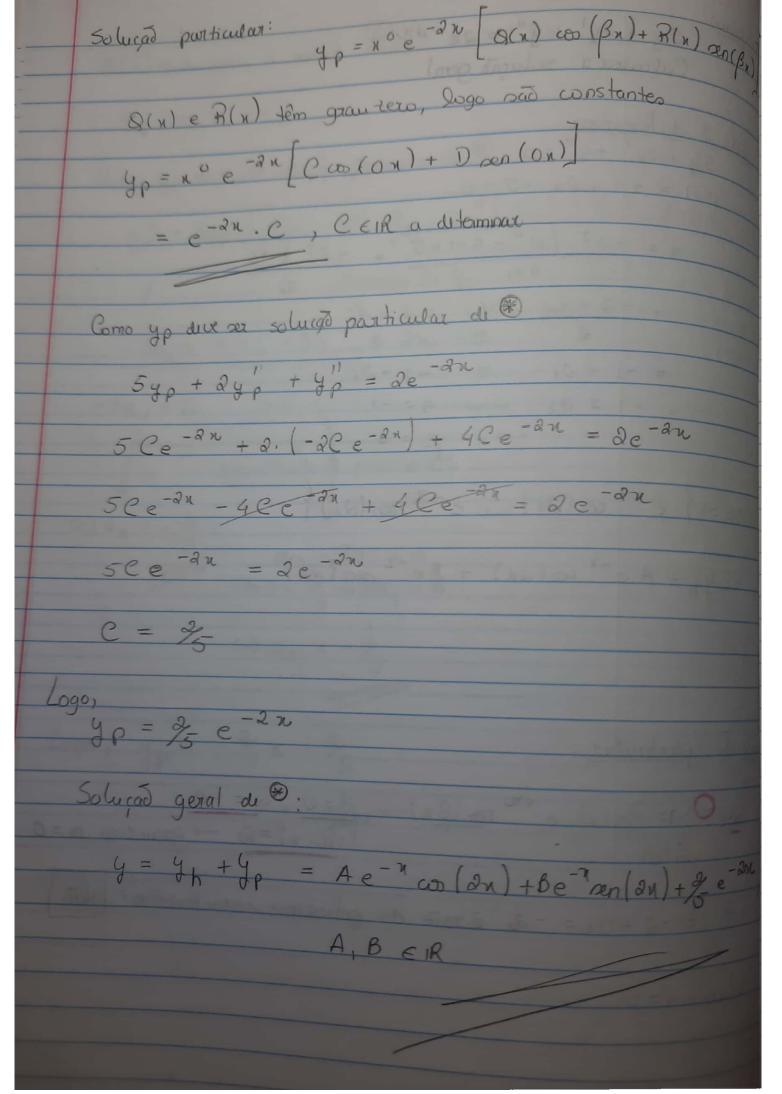


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