1) $\frac{dP}{dt} = kP$

$\int \frac{dP}{P} = \int k\,dt$

$\ln P = kt + C$

$P = ae^{kt}$

$t = 6 \quad P = 56 \ldots \qquad t = 12 \quad P = 111$

$56 = a\,(e^{6})^{k} \ldots 1 \qquad 111 = a\,(e^{12})^{k}$

$a(e^{6})^{k} - 56 = a(e^{12})^{k} - 111$

$a((e^{12})^{k} - (e^{6})^{k}) = 55 \quad \ldots \alpha$

B) $\frac{111}{e^{12k}} = \frac{56}{e^{6k}}$

$\frac{111}{56} = e^{6k}$

$k = 0.114$

en α

$a(3.93 - 1.98) = 55$

$a = 28.21$

- Estubieron Presentes

$t = 0$

$P = 28.21\,e^{k(0)}$

$P = 28.21$ bacterias

2)

$$y'' + 4y' + 4y = 0$$

$$r^2 + 4r + 4 = 0$$

$$\frac{-4 \pm \sqrt{16 - 4(4)(1)}}{2}$$

$$x_1 = -2$$

$$x_2 = -2$$

$$y_{(x)} = C_1 e^{-2x} + C_2 x e^{-2x}$$

$x = 0$

$$C_1 = 1 \qquad e^{-2x} + C_2 x e^{-2x}$$

$\longrightarrow y'(0) = 2$

$$y'_{(x)} = -2e^{-2x} + C_2(x \cdot -2e^{-2x} + e^{-2x})$$

$x = 0$

$$2 = -2 + C_2(1)$$

$$C_2 = 4$$

a) $x = 1{,}79$

$$y_{(x)} = e^{-2x} + 4x e^{-2x}$$

$$y_{(x)} = 0.23$$

3)

$$\left(10x^3y^4 + e^{-y} + 3\,\text{sen}(4x+3y)\right)\frac{dy}{dx} =$$

$$-\left(6x^2y^5 + 4\,\text{sen}(4x+3y) + 2\right)$$

$$\underbrace{\left(10x^3y^4+e^{-y} + 3\,\text{sen}(4x+3y)\right)}_{M}dy + \underbrace{\left(6x^2y^5+4\,\text{sen}(4x+3y)+2\right)}_{N}dx = 0$$

$$\frac{\partial M}{\partial x} = 30x^2y^4 + e^{-y} + 12\cos(4x+3y)$$

$$=$$

$$\frac{\partial N}{\partial y} = 30y^4x^2 + 12\cos(4x+3y)$$

las Derivadas parciales son iguales
por ende cumple con el criterio

∴ Es exacta.

$$M = 10x^3y^4 + e^{-y} + 3\operatorname{sen}(4x+3y) = \frac{\partial F}{\partial y}$$

Integramos M

$$10x^3\int y^4 dy + \int e^{-y} dy + 3\int \operatorname{sen}(4x+3y)$$

$$10x^3 \frac{y^5}{5} + -e^{-y} + \operatorname{sen}(4x)\operatorname{sen}(3y) - (\cos(4x)\cos(3y) + C_1$$

$$N = 6x^2y^5 + 4\operatorname{sen}(4x+3y) + 2 = \frac{\partial F}{\partial x}$$

Integramos N

$$6y^5\int x^2 dx + 4\int \operatorname{sen}(4x+3y)\,dx + 2\int dx$$

$$6y^5 \cdot \frac{x^3}{3} + \operatorname{sen}(3y)\operatorname{sen}(4x) - \cos(3y)\cos(4x) + 2x + C_2$$

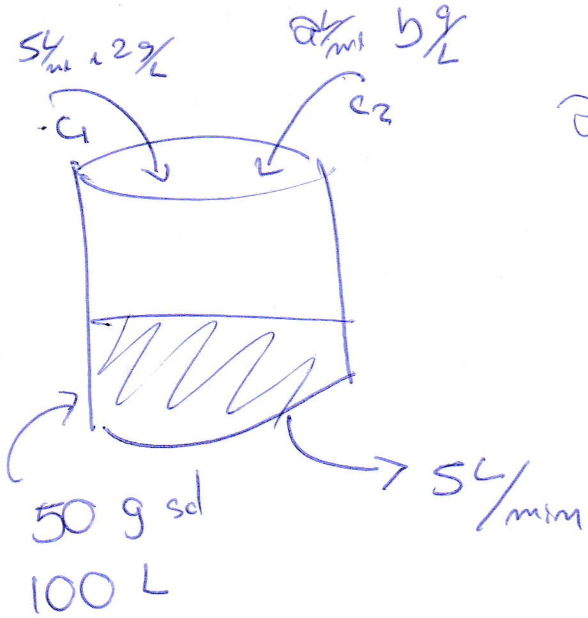
$$\rightsquigarrow F(x,y) = 6y^5\frac{x^3}{3} + \operatorname{sen}(3y)\operatorname{sen}(4x) - \cos(3y)\cos(4x) +$$

$$2x +$$

$$10x^3\frac{y^5}{5} + (-e^{-y}) + \operatorname{sen}(4x)\operatorname{sen}(3y) -$$

$$\cos(4x)\cos(3y) + C$$

a)



$a = 8$

$b = 0$

$$\frac{dS}{dt} = 10\,g/min + \cancel{ab} - 5\left(\frac{S}{100+(5+a-5)t}\right)$$

$$\frac{dS}{dt} = 10 + ab - \frac{5S}{100+8t}$$

$$\frac{dS}{dt} + \frac{5S}{100+8t} = 10$$

$$\mu = e^{5\int 1/100+8t\,dt}$$

$$\mu = \left(e^{Ln(100+8t)}\right)^{5/8}$$

$$\mu = (100+8t)^{5/8}$$

$$(100+8t)^{5/8} S = \int (100+8t)^{5/8} \cdot 10\,dt$$

$$S = 10 \int \underbrace{(100+8t)}_{u}{}^{5/8} dt$$

$u = 100+8t$

$du = 8dt$

$dt = \frac{du}{8}$

$$S = \frac{\frac{10}{13}(100+8t)^{13/8}}{\cancel{(100+8t)^{5/8}}} + \frac{C}{(100+8t)^{5/8}}$$

$$\Rightarrow S = \frac{10}{13}(100+8t) + C \cdot (100+8t)^{-5/8}$$

4)

$$S = \frac{10}{13}(100+8\tau) + C(100+8\tau)^{-5/8}$$

$\tau = 0$

$S = 50$

$$\hookrightarrow 50 = \frac{1000}{13} + C(100)^{-5/8}$$

$$C = -478.76$$

$$S = \frac{10}{13}(100+8\tau) - 478.76(100+8\tau)^{-5/8}$$

1) $S = 3$

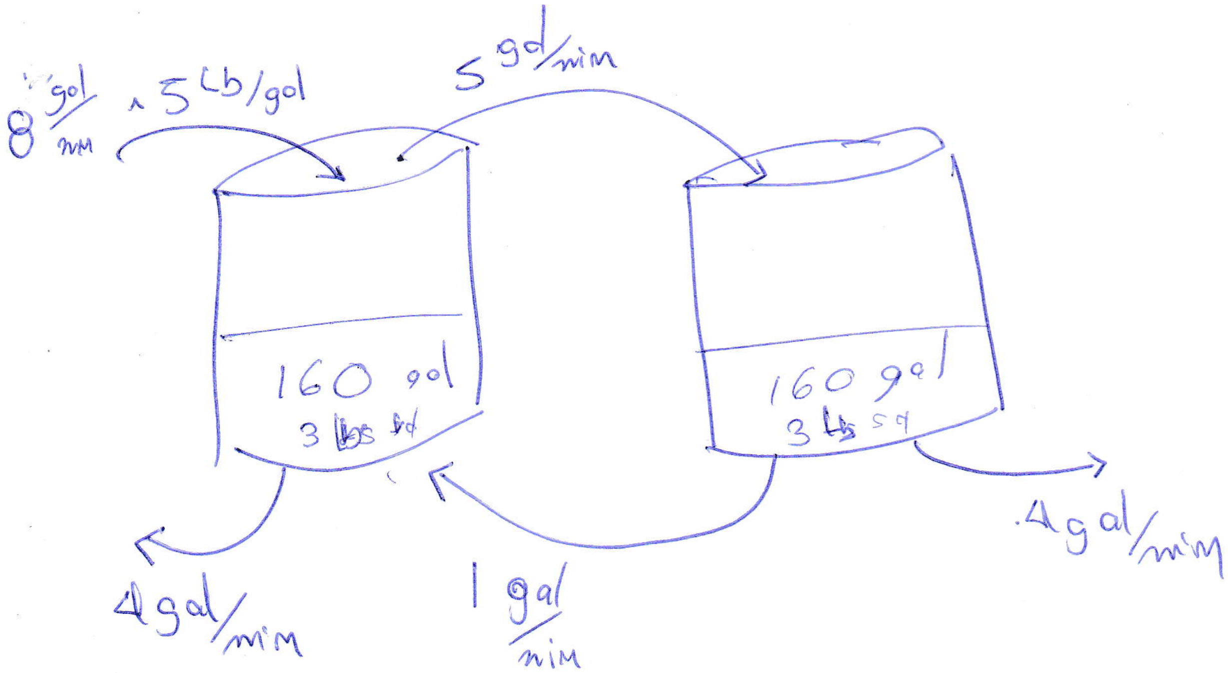
$$3 = \frac{10}{13}(100+8\tau) - 478.76(100+8\tau)^{-5/8}$$

$\tau =$

4) $V = 100 + 8t$

la funcion del volumen es lineal
siempre va a crecer el volumen del agua

5)



$$\frac{dx_1}{dt} = 40\,\frac{Lb}{min} + x_2\,\frac{Lb}{min} - \frac{9\,gal/min \times x_1\,Lb}{160 + (6-9)t}$$

$$\frac{dx_1}{dt} = 40 + x_2 - \frac{9x_1}{160-3t}$$

$$\frac{dx_2}{dt} = 5x_1\,\frac{lb}{min} - \frac{5x_2}{160}\,\frac{lb}{min}$$

$$\frac{dx_2}{dt} = 5x_1 - \frac{5x_2}{160}$$

$$\left(Dx_1 = 40 + x_2 - \frac{9x_1}{160-3t} \right) D$$

$$Dx_2 = 5x_1 - \frac{5x_2}{160}$$

$$\cancel{\frac{15}{60} Dx_1 + Dx_2}$$

$$D^2x_1 = 4 + Dx_2 - \frac{9\cancel{D}x_1}{(100-3t)}$$