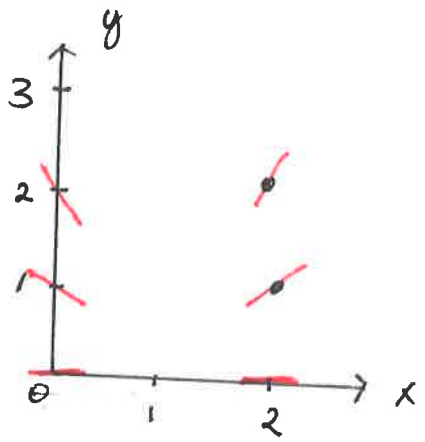
DE Exit Slip #2.

#1. $\frac{dy}{dx} = \frac{y^2}{x-1}$

a.

x	0	e	0	2	0	2
y	0	0	1	1	2	2
$\frac{dy}{dx}$	0	0	-1	1	-4	4



b. $f(2) = 3 \Rightarrow \frac{dy}{dx} = \frac{9}{1} = 9$.

$y - 3 = 9(x-2)$

c. $\int \frac{1}{y^2} dy = \int \frac{1}{x-1} dx$

$\Rightarrow \frac{-1}{y} = \ln(x-1) + C$ ← $f(2) = 3$

$-\frac{1}{3} = C$

$\Rightarrow \frac{-1}{y} = \ln(x-1) - \frac{1}{3} \Rightarrow y = \frac{-1}{\ln(x-1) - \frac{1}{3}} = \frac{-3}{3\ln(x-1) - 1}$

#2. $\frac{dN}{dt} = (7-t)e^{t-6}$

a.

$\Rightarrow \int dN = \int (7-t)e^{t-6} dt = \int 7 \cdot e^{t-6} dt - \int t e^{t-6} dt$.

$N = 7e^{t-6} - [te^{t-6} - e^{t-6}] + C$ ⇓ $7 \cdot e^{t-6}$

$= 8e^{t-6} - te^{t-6} + C$

$t=6$, $N=2$ → $2 = 8 - 6 + C$

$C = 0$

$N = 8e^{t-6} - te^{t-6}$

$u = t$ $dv = e^{t-6} dt$

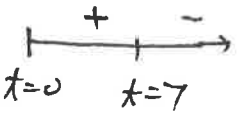
$du = dt$ $v = e^{t-6}$

$\Rightarrow te^{t-6} - \int e^{t-6} dt$.

$= te^{t-6} - e^{t-6}$.

b. Solve $\frac{dN}{dt} = 0$ for Max.

$(7-t)e^{t-6} = 0 \Rightarrow \boxed{t = 7 \text{ hrs}}$ ⇐ Max



c. $0 = 8e^{t-6} - te^{t-6}$

$= e^{t-6}(8-t) = 0 \Rightarrow \boxed{t = 8 \text{ hrs}}$

d. $\frac{dN}{dt} = (7-t)e^{t-6}$

$\Rightarrow \frac{d^2N}{dt^2} = 0 \Rightarrow -e^{t-6} + (7-t)e^{t-6} = 0$

$e^{t-6}[7-t-1] = 0$

$e^{t-6}[6-t] = 0 \Rightarrow \boxed{t = 6 \text{ hrs}}$

#3. $\frac{dy}{dx} = \sqrt{y}(3+x^2)$

$\int \frac{dy}{\sqrt{y}} = \int (3+x^2)\,dx$

2. $y^{\frac{1}{2}} = 3x + \frac{1}{3}x^3 + C$ ⇐ $y = 16,\ x = 3$

$(16)^{\frac{1}{2}} = 3 \cdot 3 + \frac{1}{3} \cdot 3^3 + C$

$C = -10$

$\boxed{y = \left(3x + \frac{1}{3}x^3 - 10\right)^2}$

#4. $\frac{dy}{dx} = \frac{\cot y}{x}$

$$\frac{dy}{\cot y} = \frac{1}{x}\,dx$$

$\Rightarrow \tan y\,dy = \frac{1}{x}\,dx$

$\Rightarrow -\ln|\cos y| = \ln x + C$.

$\Rightarrow \ln x + \ln|\cos y| = D$. $(-C = D)$

$\Rightarrow \ln x \cdot \cos y = D$

$\Rightarrow x \cdot \cos y = e^D \quad (e^D = C)$

$\Rightarrow x\cos y = C \quad \Leftarrow y = \frac{4\pi}{3},\ x = 6$

$6 \cdot \cos\left(\frac{4\pi}{3}\right) = C$

$C = 6\left(-\frac{1}{2}\right) = -3$.

$\therefore \boxed{x\cos y = -3}$

$$\int \tan y\,dy = \int \frac{\sin y}{\cos y}\,dy = -\ln|\cos y|$$

$u = \cos y$

$du = -\sin y\,dy$