< Sec 1.1 >

2. 2^{nd} order linear ODE

4. 2^{nd} order linear PDE

12 2^{nd} order nonlinear ODE

14. $\frac{dx}{dt} = k x^4$

where k is a proportionality

< Sec 1.2 >

10. $y - \ln y = x^2 + 1$

$\therefore \frac{dy}{dx} - \frac{1}{y}\frac{dy}{dx} = 2x$

$\underbrace{\left(1 - \frac{1}{y}\right)}_{\frac{y-1}{y}} \frac{dy}{dx} = 2x$ $\quad \therefore \frac{dy}{dx} = \frac{2xy}{y-1}$

$\therefore$ Yes !

19. $\underbrace{\underbrace{\left(\frac{dy}{dx}\right)^2 + y^2}_{\geq 0} + 3}_{\geq 3} \geq 3$

$\therefore \left(\frac{dy}{dx}\right)^2 + y^2 + 3 = 0$

has no real-valued solution.

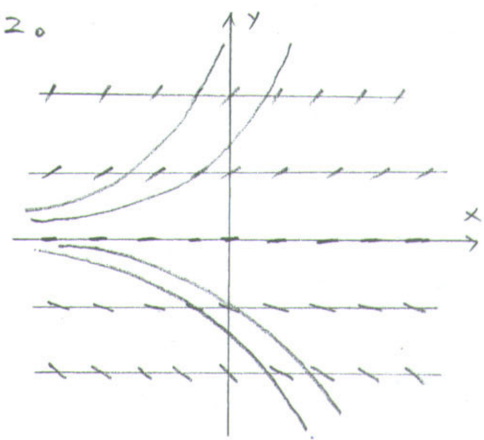
27. $\begin{cases} \frac{dy}{dx} = \frac{x}{y} \\ y(1) = 0 \rightarrow (x_0, y_0) = (1, 0) \end{cases}$

$\left.\begin{array}{l} f(x,y) = \frac{x}{y} \\ \frac{\partial f}{\partial y} = -\frac{x}{y^2} \end{array}\right\}$ discontinuous (not even defined) at $y = 0$

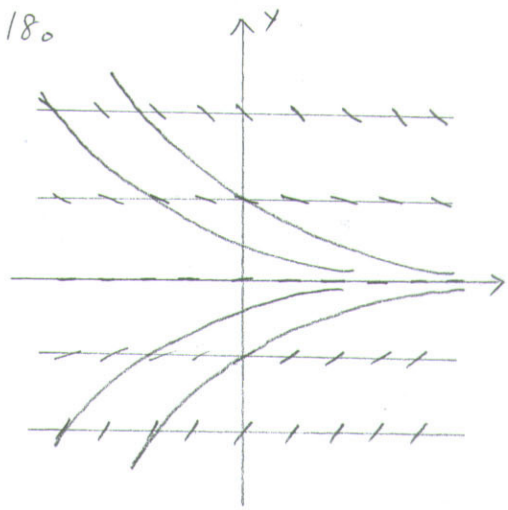
On every rectangle containing the point $(1,0)$, f & $\frac{\partial f}{\partial y}$ are discontinuous. Thus, we can not use Thm 1.

< Sec 1.3 >

12.



18.



For all $\alpha \in \mathbb{R}$, the solution to the IVP $\left[\begin{array}{l} \frac{dy}{dx} = -y \\ y(0) = \alpha \end{array}\right.$,

$\lim_{x \to \infty} y(x) = 0$