1. Draw the direction field for the following ODEs and determine the $t \to \infty$ behavior

$$y' = 4 - y$$
$$y' = y + 2$$
$$y' = (y + 1)(y - 2)$$

2. Classify the following differential equations by order and linearity

$$y^{(100)} + y' = 6$$
$$y''' + t^2 y'' + t^4 y' - \cos ty = \sqrt{t}$$
$$y' = y + \sin y$$

3. Check if the given functions $\varphi(t)$ are solutions to the corresponding ODEs

$$\varphi(t) = \tan t, \, y' = 1 + y^2$$
$$\varphi(t) = e^t + e^{-2t}, \, y'' + y' - 2y = 0$$
$$\varphi(t) = 1/t, \, t^2 y'' - 2y = 0$$
$$\varphi(t) = \sin 2t, \, y'' + y = \sin 2t$$

4. (no need to write) Review the techniques of integration and make sure you are comfortable to $u$-substitution, integrating by parts and integration of $\cos^2 x, \sin^2 x$.