1. (Solution to extra problem 1) The solution of $y'(t) = y(1 - y)$ with $y(0) = y_0$ behaves in the following way.

   (i) If $y_0 > 1$ then $\lim_{t \to \infty} y(t) = 1$.
   (ii) If $y_0 = 1$ then $y(t) = 1$.
   (iii) If $0 < y_0 < 1$ then $\lim_{t \to \infty} y(t) = 1$.
   (vi) If $y_0 < 0$ then $\lim_{t \to \infty} y(t) = 1$.

2. Draw the directional field for the differential equation $y'(t) = y(y - 2)$ at the following points $(0, 1), (1,1), (2,1), (1, 2), (2,2), (3,2)$ on the t-y plane.

   Solution: Please see figure 1.

3. Draw the directional field for the differential equation $y'(t) = (t+1)(y-2)$ at the following points $(0, 1), (1,1), (2,1), (1, 2), (2,2), (3,2)$ on the t-y plane.

   Solution: Please see figure 2.

4. (Problem 5 from sec1.3) $\frac{d^2y}{dt^2} + \sin(t + y) = \sin(t)$ is a second order O.D.E.

5. (Problem 6 from sec1.3) $\frac{d^3y}{dt^3} + t \frac{dy}{dt} + \cos^2(t)y = t^3$ is a third order O.D.E.

6. (Problem 9 from sec1.3) $ty'(t) - y = t^2$ is a first order O.D.E.

7. (Problem 12 from sec1.3) $t^2y''(t) + 5ty' + 4y = 0$ is a second order O.D.E.