

due January 26, 2015 at the beginning of class

Topics covered : equations  $y' = ay + b$ , where  $a$  and  $b$  are constant, and separable equations (corresponds to sections 1.2, 2.2 in the textbook). *You do not need to use calculator for this assignment.*

1. Assume that the velocity  $v$  of the falling object satisfies the following differential equation:

$$v'(t) = 4.9 - \frac{v}{40} \quad (1)$$

- (a) Find a number  $v_e$  such that  $v(t) \equiv v_e$  is a solution of equation (1) (in other words find the equilibrium solution of (1)).
- (b) Solve the equation (1) with initial condition  $v(0) = 0$ . What is the limit of this solution when  $t \rightarrow +\infty$ ? How this limiting velocity is related to your answer in the item (a)?
- (c) Find the time that must elapse for the object to reach 30% of the limiting velocity found in the item (b).
- (d) How far does the object fall in the time found in the item (c).
2. Solve the following differential equations (find the general solutions):

- (a)  $y' = e^{x+y}$ ;
- (b)  $(x^2 - 1)y' + 2xy^2 = 0$ .