Excercise 8

1. Read through helps and examples of functions `DSolve` `NDSolve`.

2. Solve differential equations both analytically and numerically, define some boundary conditions and plot the solution function (or real-part of it, if solution is a complex function)

   a)
   $$y'(x) = 6y(x)$$

   b)
   $$y'(x) + 3y(x) = 4$$

   c)
   $$4y''(x) - 3y'(x) + 5y(x) = 2$$

3. The trajectory of thrown ball could be solved parametrically from equations:
   $$y''(t) = -g$$
   $$x'(t) = v_{0x}$$
   Solve differential equations and identify intial locations and velocities from the solution. Define following initial conditions and calculate the distance and maximum height of the throw. $g = 9.81$, $v_{0x} = 10$, $v_{0y} = 20$, $y_0 = x_0 = 0$.

4. Let's add air resistance ($k = 0.1$) to the previous excercise. The equations of motion are now:
   $$F_y = my''(t) = mg - ky'(t)$$
   $$F_x = mx''(t) = -kx'(t)$$
   Again, solve and plot the trajectory of the ball ($m = 1$ kg) and find the maximum height and distance of the throw. If you drop the ball to the infinitely deep shaft, what would be its terminal velocity?