1. In this problem, you will implement gradient descent to find the minima of a function. The function that we are looking at is $f(x) = x^2 + 3x - 30$

   - Plot the function between $x = -10, 10$ and determine where the minima is using either the minimize command or by converting the problem to a roots problem and solving it.
   - Define a function `f` which takes one argument: x The function returns $x^2+3x-30$.
   - Define a function `gradMinimize` which takes two arguments: α, x_0 where α is the learning rate and x_0 is the initial guess. This function returns the minima of `f` using gradient descent. Inside this function, you need to create a loop which implements the gradient descent algorithm: $x_{i+1} = x_i - \alpha f'(x_i)$. You can create this loop using the `while` function in python. The loop should end when either one of the two conditions are satisfied: a. $|x_{i+1} - x_i|$ <`tol` or b. the number of iterations>`N`. Here `tol` is some small number you choose (such as 10^{-6}) and it indicates that the solution is not changing much with more iterations. Here `N` is some integer that you choose and it indicates how many maximum iterations the loop should run for - it should not run forever.
   - Use `gradMinimize` to find the minima of $f(x)$ and make sure that you get the same answer as that found in the first part of this question. You can try different values of α and x_0 and you can even plot how the solution converges by saving $f(x_i)$ inside the loop into an evolving vector and then plotting it as a function of iteration number after the problem is solved.

2. Use `gradMinimize` to find all the roots of $y = f(x) = x^2 - 10x + 12$. As discussed in class, you can do this by minimizing $[f(x)]^2$. Verify that the roots are indeed correct.

3. Create a function `gradMinimize2var` to find the minima of $f(x, y) = (x-1)^2+y^2$ using the gradient descent algorithm: $(x_{i+1}, y_{i+1}) = (x_i, y_i) - \alpha \nabla f(x_i, y_i)$. Here, $\nabla f(x_i, y_i) = \nabla f(x, y)|_{(x_i, y_i)}$ is the gradient of the function $(\partial f/\partial x, \partial f/\partial y)$ evaluated at (x_i, y_i). This function will take inputs α and the initial guess (x_0, y_0) (you can pass this as a vector in the function). And it will return (x_{min}, y_{min}) as the minima of the function.