1. Consider the ODE

$$y' + y = 2\sin(x) \tag{1}$$

a) Find constants A and B such that $y_*(x) = A\cos(x) + B\sin(x)$ is a solution of the differential equation. Don't use the method of integrating factors. Just substitute and solve for A and B

b) The equation

$$y' + y = 0$$

is called the associated homogenous equation. (A linear equation $y' + P(x)y = Q(x)$ is homogeneous if $Q(x) = 0$). Find the general solution of the associated homogeneous equation.

c) Every solution of equation (1) can be written as a sum of your solution from part a) with a solution of the associated homogeneous equation. Use this fact to find the solution of equation (1) solving the initial condition $y(0) = 1$

2. Consider the initial value problem

$$\begin{aligned} y' &= -\frac{e^{2y} + 2x}{2e^{2y}x - 2} \\ y(0) &= -3 \end{aligned}$$

a) Write this differential equation in differential form.

b) Find the solution of this initial value problem in implicit form.

c) Use the Octave program `levelcurve` to produce a plot of your solution.

d) Find the value of $y(1)$ to 8 significant figures.