MA322: Scientific Computing
Lab Assignment 7

Name : Nayanika Ghosh
Roll : 200123036

Q.1) The given initial value problem : -

$x' = x + e^t + tx$

$x(1) = 2$

The given interval = [1, 3]

The formula for the **third-order Taylor's method** : -

$x(t + h) = x(t) + hx'(t) + \frac{h^2}{2!} x''(t) + \frac{h^3}{3!} x'''(t)$

The formula for the **implicit Euler's method** : -

$x_n = x_{n-1} + hf(x_n , t_n)$

where $x' = f(x,t)$

The following is the output : -

```
Taylor's Method of Order 3 :
x(1.0) = 2.000000
x(1.1) = 2.771346
x(1.2) = 3.787224
x(1.3) = 5.132577
x(1.4) = 6.924749
x(1.5) = 9.327011
x(1.6) = 12.568191
x(1.7) = 16.971382
x(1.8) = 22.996219
x(1.9) = 31.301584
x(2.0) = 42.839317
x(2.1) = 58.995273
x(2.2) = 81.803276
x(2.3) = 114.272063
x(2.4) = 160.888739
x(2.5) = 228.399986
x(2.6) = 327.033714
x(2.7) = 472.424410
x(2.8) = 688.671499
x(2.9) = 1013.236064
x(3.0) = 1504.843734
```

```
Implicit Euler's Method :
x(1.0) = 2.000000
x(1.1) = 2.911920
x(1.2) = 4.158886
x(1.3) = 5.877683
x(1.4) = 8.267373
x(1.5) = 11.620722
x(1.6) = 16.373007
x(1.7) = 23.178633
x(1.8) = 33.032775
x(1.9) = 47.466710
x(2.0) = 68.865165
x(2.1) = 100.988090
x(2.2) = 149.839105
x(2.3) = 225.129139
x(2.4) = 342.774935
x(2.5) = 529.220283
x(2.6) = 829.010401
x(2.7) = 1318.251388
x(2.8) = 2128.864279
x(2.9) = 3492.920809
x(3.0) = 5824.882270
```