

## 數值方法作業五

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Question1\_a:

```
PS C:\Users\User\Desktop\F54091196_numerical_hw5> python
96_numerical_hw5\question1_a.py"
    t    Euler y    Exact y    Error
    1.00    0.00000    0.00000    0.00000
    1.10    0.10000    0.10516    0.00516
    1.20    0.20992    0.22124    0.01133
    1.30    0.33047    0.34912    0.01865
    1.40    0.46235    0.48968    0.02733
    1.50    0.60629    0.64388    0.03759
    1.60    0.76304    0.81275    0.04971
    1.70    0.93348    0.99749    0.06402
    1.80    1.11854    1.19944    0.08090
    1.90    1.31929    1.42012    0.10082
    2.00    1.53694    1.66128    0.12434
PS C:\Users\User\Desktop\F54091196_numerical_hw5>
```

Question1\_b:

```
PS C:\Users\User\Desktop\F54091196_numerical_hw5>
96_numerical_hw5\question1_b.py"
    t    Taylor y    Exact y    Error
    1.0000000 0.0000000    0.00000    0.0000000
    1.1000000 0.1050000    0.10516    0.0001598
    1.2000000 0.2209192    0.22124    0.0003236
    1.3000000 0.3486124    0.34912    0.0005087
    1.4000000 0.4889538    0.48968    0.0007279
    1.5000000 0.6428828    0.64388    0.0009925
    1.6000000 0.8114382    0.81275    0.0013146
    1.7000000 0.9957867    0.99749    0.0017074
    1.8000000 1.1972517    1.19944    0.0021869
    1.9000000 1.4173435    1.42012    0.0027723
    2.0000000 1.6577947    1.66128    0.0034871
PS C:\Users\User\Desktop\F54091196_numerical_hw5>
```

## Question2:

Step size $h = 0.1$							
t	u1 (RK4)	u1 (Exact)	Error u1		u2 (RK4)	u2 (Exact)	Error u2
0.00	1.33333	1.33333	0.00000e+00		0.66667	0.66667	1.11022e-16
0.10	-3.05244	1.79306	4.84550e+00		8.98931	-1.03200	1.00213e+01
0.20	-23.84779	1.42390	2.52717e+01		51.19270	-0.87468	5.20674e+01
0.30	-130.16520	1.13158	1.31297e+02		269.26919	-0.72500	2.69994e+02
0.40	-680.23149	0.90941	6.81141e+02		1399.36858	-0.60821	1.39998e+03
0.50	-3531.29959	0.73879	3.53204e+03		7258.24184	-0.51566	7.25876e+03
0.60	-18312.79505	0.60571	1.83134e+04		37634.95548	-0.44041	3.76354e+04
0.70	-94951.33191	0.49986	9.49518e+04		195131.87174	-0.37740	1.95132e+05
0.80	-492306.46564	0.41367	4.92307e+05		1011721.87208	-0.32295	1.01172e+06
0.90	-2552513.62387	0.34161	2.55251e+06		5245578.82659	-0.27441	5.24558e+06
1.00	-13234278.78917	0.27967	1.32343e+07		27197287.20659	-0.22989	2.71973e+07

Step size $h = 0.05$							
t	u1 (RK4)	u1 (Exact)	Error u1		u2 (RK4)	u2 (Exact)	Error u2
0.00	1.33333	1.33333	0.00000e+00		0.66667	0.66667	1.11022e-16
0.05	1.72188	1.91206	1.90178e-01		-0.49960	-0.90908	4.09477e-01
0.10	1.72692	1.79306	6.61475e-02		-0.83260	-1.03200	1.99405e-01
0.15	1.61716	1.60197	1.51939e-02		-0.89037	-0.96146	7.10857e-02
0.20	1.48169	1.42390	5.77849e-02		-0.86104	-0.87468	1.36389e-02
0.25	1.34895	1.26765	8.12994e-02		-0.80750	-0.79522	1.22838e-02
0.30	1.22706	1.13158	9.54868e-02		-0.75034	-0.72500	2.53421e-02
0.35	1.11748	1.01300	1.04480e-01		-0.69589	-0.66306	3.28263e-02
0.40	1.01953	0.90941	1.10117e-01		-0.64573	-0.60821	3.75176e-02
0.45	0.93198	0.81863	1.13347e-01		-0.59993	-0.55939	4.05450e-02
0.50	0.85354	0.73879	1.14753e-01		-0.55809	-0.51566	4.24348e-02
0.55	0.78302	0.66827	1.14743e-01		-0.51971	-0.47622	4.34815e-02
0.60	0.71934	0.60571	1.13627e-01		-0.48429	-0.44041	4.38795e-02
0.65	0.66156	0.54991	1.11651e-01		-0.45141	-0.40764	4.37717e-02
0.70	0.60887	0.49986	1.09007e-01		-0.42067	-0.37740	4.32688e-02
0.75	0.56055	0.45469	1.05852e-01		-0.39175	-0.34930	4.24586e-02
0.80	0.51598	0.41367	1.02309e-01		-0.36436	-0.32295	4.14112e-02
0.85	0.47463	0.37616	9.84749e-02		-0.33826	-0.29808	4.01825e-02
0.90	0.43604	0.34161	9.44283e-02		-0.31323	-0.27441	3.88173e-02
0.95	0.39981	0.30958	9.02293e-02		-0.28909	-0.25174	3.73506e-02
1.00	0.36560	0.27967	8.59249e-02		-0.26570	-0.22989	3.58102e-02