Numerical Methods - HW5

Q1: Single ODE

t	Euler	Taylor 2nd	Exact
1.0	0.000000	0.000000	0.000000
1.1	0.100000	0.100000	0.095600
1.2	0.200000	0.201165	0.184369
1.3	0.300000	0.303208	0.268555
1.4	0.400000	0.405927	0.349773
1.5	0.500000	0.509176	0.429250
1.6	0.600000	0.612844	0.507970
1.7	0.700000	0.716852	0.586761
1.8	0.800000	0.821136	0.666355
1.9	0.900000	0.925647	0.747429
2.0	1.000000	1.030349	0.830641

Q2: System of Two ODEs

Step size h = 0.05

t	u1 (RK4)	u1 (Exact)	u2 (RK4)	u2 (Exact)
0.00	1.333333	1.000000	0.666667	1.000000
0.05	1.711583	1.221830	-0.239051	0.775670
0.10	1.867822	1.329253	-0.683829	0.660756
0.15	1.911634	1.367159	-0.893120	0.610383
0.20	1.899022	1.363579	-0.982254	0.596554
0.25	1.858578	1.335880	-1.010219	0.601945
0.30	1.804871	1.294701	-1.007169	0.615972
0.35	1.745300	1.246458	-0.988511	0.632287
0.40	1.683598	1.194931	-0.962105	0.647191
0.45	1.621624	1.142265	-0.931956	0.658629
0.50	1.560285	1.089604	-0.900092	0.665561
0.55	1.500001	1.037491	-0.867537	0.667558
0.60	1.440948	0.986118	-0.834802	0.664553

0.65 1.383181 0.935478 -0.802134 0.656690

0.70 1.326692 0.885462 -0.769653 0.644222

0.75 1.271450 0.835917 -0.737409 0.627461

0.80 1.217410 0.786678 -0.705423 0.606735

0.85 1.164523 0.737589 -0.673701 0.582378

0.90 1.112744 0.688512 -0.642242 0.554708

0.95 1.062028 0.639334 -0.611045 0.524032

1.00 1.012336 0.589966 -0.580108 0.490639

Step size h = 0.1

t u1 (RK4) u1 (Exact) u2 (RK4) u2 (Exact)

0.00 1.333333 1.000000 0.666667 1.000000

0.10 1.840786 1.329253 -0.628267 0.660756

0.20 1.884071 1.363579 -0.951529 0.596554

0.30 1.798652 1.294701 -0.994388 0.615972

0.40 1.681283 1.194931 -0.957348 0.647191

0.50 1.559463 1.089604 -0.898403 0.665561

0.60 1.440655 0.986118 -0.834199 0.664553

0.70 1.326579 0.885462 -0.769418 0.644222

0.80 1.217356 0.786678 -0.705312 0.606735

0.90 1.112711 0.688512 -0.642175 0.554708

1.00 1.012312 0.589966 -0.580058 0.490639