P280. #1.

(a) $\hat{y}_{n+1} = y_n + 0.5(te^{3t} - 2y_n)$

$y_{n+1} = y_n + \frac{h}{2}[te^{3t} - 2y_n + (t+h)e^{3(t+h)} - 2\hat{y}_{n+1}]$

n	x_n	y_n	$\hat{y}_{n+1}$	y_{n+1}	(True value
0	0.0	0	0	0.56021	
1	0.5	0.56021	1.12042	5.30149	0.28362
2	1.0	5.30149	10.04277	2.65074	3.21910

P281. #10.

(a). $y_{n+1} = y_n + \frac{h}{6}(k_1 + 2k_2 + 2k_3 + k_4)$

$k_1 = y_n'$

$k_2 = f(t_n + \frac{h}{2}, y_n + \frac{h}{2}k_1)$

$k_3 = f(t + \frac{h}{2}, y_n + \frac{h}{2}k_2)$

$k_4 = f(t+h, y_n + hk_3)$.

t	y_0	True value
0	0	
0.5	0.2970	0.2836
1.0	3.3143	3.21910

P281. #13.

Midpoint method:

$k_1 = -w_i + hi+1$

$k_2 = (\frac{h}{2} - 1)w_i - \frac{h^2}{2}i + hi + 1$

$y_{n+1}^{①} = y_n + hk_2 = (\frac{h^2}{2} - h + 1)y_n + (h^2 - \frac{h^3}{2})i + h$

Modified Euler method:

$k_1 = -y_n + hi+1$.

$k_2 = (\frac{h}{2} - 1)y_n - \frac{h^2}{2}i + hi + 1$

$y_{n+1}^{③} = (\frac{h^2}{2} - h + 1)y_n + [h^2 + (-\frac{h^3}{2})]i + h$.

Heun's method:

$k_1 = -y_n + hi+1$

$k_2 = (\frac{2}{3}h - 1)y_n - \frac{2}{3}h^2 i + hi + 1$.

$y_{n+1}^{②} = (\frac{h^2}{2} - h + 1)y_n + i(h^2 - \frac{h^3}{2}) + h$.

$\therefore \quad y_{n+1}^{①} = y_{n+1}^{②} = y_{n+1}^{③}$

P323. #5.

(a)

n	t	w_t	y_t
0	0	0.000009	0
1	0.1	0.000154	0.000009
2	0.2	0.000834	0.000154
3	0.3	0.002833	0.000834
4	0.4	0.007431	0.002832
5	0.5	0.016585	0.007430
6	0.6		0.016563
7	0.7	0.033003	0.032998
8	0.8	0.060575	0.060562
9	0.9	0.104417	0.104405
10	1.0	0.171347	0.171329

(b)

n	t	w_t	y_t
0	1	1	1
1	1.1	0.990178	0.990179
2	1.2	0.961524	0.961526
3	1.3	0.915455	0.915457
4	1.4	0.853637	0.853640
5	1.5	0.777968	0.777972
6	1.6	0.690562	0.690567
7	1.7	0.593732	0.593738
8	1.8	0.489979	0.489986
9	1.9	0.381980	0.381988
10	2.0	0.272581	0.272589

(c)

n	t	w_t	y_t
0	0	1	1
5	1.0	3.731863	3.731704
10	2.0	11.314626	11.314329
15	3.0	34.045482	34.045172

(d)

n	t	w_t	y_t
0	1	0	0
2	1.2	0.272738	0.272738
4	1.4	0.746988	0.746988
6	1.6	1.516251	1.516265
8	1.8	2.684005	2.684015
10	2.0	4.361573	4.361578

P334. #7.

$\lambda^2+4\lambda-5=0 \quad \therefore \lambda_1=-5, \quad \lambda_2=1. \quad |\lambda_1|>1 \quad \therefore$ unstable.