1. Taylor's method of order two gives the approximations in the following tables.

(a)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 0.50 | 0.12500000 | 0.28361652 |
| 1.00 | 2.02323897 | 3.21909932 |

(b)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 2.50 | 1.75000000 | 1.83333333 |
| 3.00 | 2.42578125 | 2.50000000 |

(c)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 1.25 | 2.78125000 | 2.77892944 |
| 1.50 | 3.61250000 | 3.60819766 |
| 1.75 | 4.48541667 | 4.47932763 |
| 2.00 | 5.39404762 | 5.38629436 |

(d)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 0.25 | 1.34375000 | 1.32914981 |
| 0.50 | 1.77218707 | 1.73048976 |
| 0.75 | 2.11067606 | 2.04147203 |
| 1.00 | 2.20164395 | 2.11797955 |

2. Taylor's method of order two gives the approximations in the following tables.

(a)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 0.50 | 1.2130077 | 1.2140231 |
| 1.00 | 1.4893295 | 1.4898801 |

(b)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 1.50 | 2.3564815 | 2.3541020 |
| 2.00 | 2.7454763 | 2.7416574 |

(c)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 2.25 | 2.2437184 | 2.2441211 |
| 2.50 | 2.5634054 | 2.5644519 |
| 2.75 | 2.9633902 | 2.9651394 |
| 3.00 | 3.4486992 | 3.4512866 |

(d)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 1.25 | 1.4626530 | 1.4031990 |
| 1.50 | 1.0785177 | 1.0164101 |
| 1.75 | 0.79184185 | 0.73800977 |
| 2.00 | 0.574516240 | 0.52968710 |

3. Taylor's method of order four gives the approximations in the following tables.

(a)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 0.50 | 0.25781250 | 0.28361652 |
| 1.00 | 3.05529474 | 3.21909932 |

(b)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 2.50 | 1.81250000 | 1.83333333 |
| 3.00 | 2.48591644 | 2.50000000 |

(c)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 1.25 | 2.77897135 | 2.77892944 |
| 1.50 | 3.60826562 | 3.60819766 |
| 1.75 | 4.47941561 | 4.47932763 |
| 2.00 | 5.38639966 | 5.38629436 |

(d)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 0.25 | 1.32893880 | 1.32914981 |
| 0.50 | 1.72966730 | 1.73048976 |
| 0.75 | 2.03993417 | 2.04147203 |
| 1.00 | 2.11598847 | 2.11797955 |

4. Taylor's method of order four gives the approximations in the following tables.

(a)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 0.50 | 1.2140485 | 1.2140231 |
| 1.00 | 1.4898968 | 1.4898801 |

(b)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 1.50 | 2.3541059 | 2.3541020 |
| 2.00 | 2.7416702 | 2.7416574 |

(c)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 2.25 | 2.2441297 | 2.2441211 |
| 2.50 | 2.5644662 | 2.5644519 |
| 2.75 | 2.9652116 | 2.9651394 |
| 3.00 | 3.4513065 | 3.4512866 |

(d)

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 1.25 | 1.4090648 | 1.4031990 |
| 1.50 | 1.0217897 | 1.0164101 |
| 1.75 | 0.74234451 | 0.73800977 |
| 2.00 | 0.53314083 | 0.52968710 |

5. Taylor's method of order two gives the approximations in the following tables.

(a)

| | Order 2 | | |
|---|---|---|---|
| $i$ | $t_i$ | $w_i$ | $y(t_i)$ |
| 1 | 1.1 | 1.214999 | 1.215886 |
| 2 | 1.2 | 1.465250 | 1.467570 |

(b)

| | Order 2 | | |
|---|---|---|---|
| $i$ | $t_i$ | $w_i$ | $y(t_i)$ |
| 1 | 0.5 | 0.5000000 | 0.5158868 |
| 2 | 1.0 | 1.076858 | 1.091818 |

(c)

| | Order 2 | | |
|---|---|---|---|
| $i$ | $t_i$ | $w_i$ | $y(t_i)$ |
| 1 | 1.5 | −2.000000 | −1.500000 |
| 2 | 2.0 | −1.777776 | −1.333333 |
| 3 | 2.5 | −1.585732 | −1.250000 |
| 4 | 3.0 | −1.458882 | −1.200000 |

(d)

| | Order 2 | | |
|---|---|---|---|
| $i$ | $t_i$ | $w_i$ | $y(t_i)$ |
| 1 | 0.25 | 1.093750 | 1.087088 |
| 2 | 0.50 | 1.312319 | 1.289805 |
| 3 | 0.75 | 1.538468 | 1.513490 |
| 4 | 1.0 | 1.720480 | 1.701870 |

6. Taylor's method of order two gives the approximations in the following tables.

(a)

| $i$ | $t_i$ | $w_i$ |
|---|---|---|
| 2 | 0.2 | 1.3492187 |
| 4 | 0.4 | 1.5546191 |
| 6 | 0.6 | 1.6184028 |
| 8 | 0.8 | 1.5840995 |
| 10 | 1.0 | 1.4976289 |

(b)

| $i$ | $t_i$ | $w_i$ |
|---|---|---|
| 2 | 1.2 | −1.2697379 |
| 4 | 1.4 | −1.1441477 |
| 6 | 1.6 | −1.0485714 |
| 8 | 1.8 | −0.97321601 |
| 10 | 2.0 | −0.91214217 |

(c)

| $i$ | $t_i$ | $w_i$ |
|---|---|---|
| 2 | 1.4 | −1.6024604 |
| 4 | 1.8 | −1.4206863 |
| 6 | 2.2 | −1.3217746 |
| 8 | 2.6 | −1.2601896 |
| 10 | 3.0 | −1.2182831 |

(d)

| $i$ | $t_i$ | $w_i$ |
|---|---|---|
| 2 | 0.2 | 1.0581740 |
| 4 | 0.4 | 1.2044189 |
| 6 | 0.6 | 1.3846529 |
| 8 | 0.8 | 1.5584034 |
| 10 | 1.0 | 1.7043395 |

7. Taylor's method of order four gives the approximations in the following tables.

(a)

| | | Order 4 | |
|---|---|---|---|
| $i$ | $t_i$ | $w_i$ | $y(t_i)$ |
| 1 | 1.1 | 1.215883 | 1.215886 |
| 2 | 1.2 | 1.467561 | 1.467570 |

(b)

| | | Order 4 | |
|---|---|---|---|
| $i$ | $t_i$ | $w_i$ | $y(t_i)$ |
| 1 | 0.5 | 0.5156250 | 0.5158868 |
| 2 | 1.0 | 1.091267 | 1.091818 |

(c)

| | | Order 4 | |
|---|---|---|---|
| $i$ | $t_i$ | $w_i$ | $y(t_i)$ |
| 1 | 1.5 | −2.000000 | −1.500000 |
| 2 | 2.0 | −1.679012 | −1.333333 |
| 3 | 2.5 | −1.484493 | −1.250000 |
| 4 | 3.0 | −1.374440 | −1.200000 |

(d)

| | | Order 4 | |
|---|---|---|---|
| $i$ | $t_i$ | $w_i$ | $y(t_i)$ |
| 1 | 0.25 | 1.086426 | 1.087088 |
| 2 | 0.50 | 1.288245 | 1.289805 |
| 3 | 0.75 | 1.512576 | 1.513490 |
| 4 | 1.0 | 1.701494 | 1.701870 |

8. Taylor's method of order four gives the approximations in the following tables.

(a)

| $i$ | $t_i$ | $w_i$ |
|---|---|---|
| 2 | 0.2 | 1.3461270 |
| 4 | 0.4 | 1.5517144 |
| 6 | 0.6 | 1.6176616 |
| 8 | 0.8 | 1.5853873 |
| 10 | 1.0 | 1.5000175 |

(b)

| $i$ | $t_i$ | $w_i$ |
|---|---|---|
| 2 | 1.2 | −1.2683126 |
| 4 | 1.4 | −1.1422607 |
| 6 | 1.6 | −1.0465749 |
| 8 | 1.8 | −0.97124644 |
| 10 | 2.0 | −0.91025180 |

(c)

| $i$ | $t_i$ | $w_i$ |
|---|---|---|
| 2 | 1.4 | −1.5618034 |
| 4 | 1.8 | −1.3887436 |
| 6 | 2.2 | −1.2971040 |
| 8 | 2.6 | −1.2404156 |
| 10 | 3.0 | −1.2018912 |

(d)

| $i$ | $t_i$ | $w_i$ |
|---|---|---|
| 2 | 0.2 | 1.0571619 |
| 4 | 0.4 | 1.2014475 |
| 6 | 0.6 | 1.3809015 |
| 8 | 0.8 | 1.5550142 |
| 10 | 1.0 | 1.7018616 |

9. (a) Taylor's method of order two gives the results in the following table.

| $i$ | $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|---|
| 1 | 1.1 | 0.3397852 | 0.3459199 |
| 5 | 1.5 | 3.910985 | 3.967666 |
| 6 | 1.6 | 5.643081 | 5.720962 |
| 9 | 1.9 | 14.15268 | 14.32308 |
| 10 | 2.0 | 18.46999 | 18.68310 |

(b) Linear interpolation gives

$$y(1.04) \approx 0.1359139, \quad y(1.55) \approx 4.777033 \quad \text{and} \quad y(1.97) \approx 17.17480.$$

Actual values are

$$y(1.04) = 0.1199875, \quad y(1.55) = 4.788635 \quad \text{and} \quad y(1.97) = 17.27930.$$

(c) Taylor's method of order four gives the results in the following table.

| $i$ | $t_i$ | $w_i$ |
|---|---|---|
| 1 | 1.1 | 0.3459127 |
| 5 | 1.5 | 3.967603 |
| 6 | 1.6 | 5.720875 |
| 9 | 1.9 | 14.32290 |
| 10 | 2.0 | 18.68287 |

(d) Cubic Hermite interpolation gives

$$y(1.04) \approx 0.1199704, \quad y(1.55) \approx 4.788527, \quad \text{and} \quad y(1.97) \approx 17.27904.$$

10. (a) Taylor's method of order two gives the results in the following table.

| $i$ | $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|---|
| 1 | 1.05 | −0.9525000 | −0.9523810 |
| 2 | 1.10 | −0.9093138 | −0.9090909 |
| 11 | 1.55 | −0.6459788 | −0.6451613 |
| 12 | 1.60 | −0.6258649 | −0.6250000 |
| 19 | 1.95 | −0.5139781 | −0.5128205 |
| 20 | 2.00 | −0.5011957 | −0.5000000 |

(b) Linear interpolation gives

$$y(1.052) \approx -0.9507726, \quad y(1.555) \approx -0.6439674, \quad \text{and} \quad y(1.978) \approx -0.5068199.$$

Actual values are

$$y(1.052) = -0.9505703, \quad y(1.555) = -0.6430868, \quad \text{and} \quad y(1.978) = -0.5055612.$$

(c) Taylor's method of order four gives the results in the following table.

| $i$ | $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|---|
| 1 | 1.05 | −0.9523813 | −0.9523810 |
| 2 | 1.10 | −0.9090914 | −0.9090909 |
| 11 | 1.55 | −0.6451629 | −0.6451613 |
| 12 | 1.60 | −0.6250017 | −0.6250000 |
| 19 | 1.95 | −0.5128226 | −0.5128205 |
| 20 | 2.00 | −0.5000022 | −0.5000000 |

(d) Cubic Hermite interpolation gives

$$y(1.052) \approx -0.9505706, \quad y(1.555) \approx -0.6430884, \quad \text{and} \quad y(1.978) \approx -0.5055633.$$

11. (a) The approximations for the velocity are in the following table.

| $i$ | $t_i$ | Order 2 | Order 4 |
|---|---|---|---|
| 2 | 0.2 | 5.86595 | 5.86433 |
| 5 | 0.5 | 2.82145 | 2.81789 |
| 7 | 0.7 | 0.84926 | 0.84455 |
| 10 | 1.0 | −2.08606 | −2.09015 |

(b) The maximum height occurs at approximately 0.8 s.

12. Taylor's method of order two gives the following:

| $t_i$ | $w_i$ | $y(t_i)$ |
|---|---|---|
| 5 | 0.5 | 0.5146389 |
| 10 | 1.0 | 1.249305 |
| 15 | 1.5 | 2.152599 |
| 20 | 2.0 | 2.095185 |