Solve problem 25.9 (5th edition) or 25.5 (6th or 7th editions). Please note that Heun (or predictor-corrector method) without corrector is an Euler method.

In addition, (a) use predictor-corrector method; (b) use 4th order RK method to solve the problem; (c) plot all solutions.

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| --- | --- | --- | --- | --- | --- | --- |
| Iteration | t | **Euler** | **Heuns** | **Ralston Method** | **4th order RK method** | **Mid Point** |
| 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 0.1 | 1 | 1.000049751 | 1.000028046 | 1.000024907 | 1.000012484 |
| 2 | 0.2 | 1.000099501 | 1.000491609 | 1.000413107 | 1.000394738 | 1.000346376 |
| 3 | 0.3 | 1.000883717 | 1.002175279 | 1.002010815 | 1.001966972 | 1.001861229 |
| 4 | 0.4 | 1.003466841 | 1.006429776 | 1.006161599 | 1.006085691 | 1.006056705 |
| 5 | 0.5 | 1.009392712 | 1.014954234 | 1.014586986 | 1.014478096 | 1.014335879 |
| 6 | 0.6 | 1.020515756 | 1.029701416 | 1.029282911 | 1.029147874 | 1.028820511 |
| 7 | 0.7 | 1.038887076 | 1.052774966 | 1.052429763 | 1.052285175 | 1.051624305 |
| 8 | 0.8 | 1.066662856 | 1.086350854 | 1.086327316 | 1.086201494 | 1.084930379 |
| 9 | 0.9 | 1.106038851 | 1.132619742 | 1.133348801 | 1.133283746 | 1.130935699 |
| 10 | 1 | 1.159200632 | 1.193734566 | 1.195895844 | 1.195949081 | 1.191801768 |
| 11 | 1.1 | 1.2282685 | 1.271739498 | 1.276327185 | 1.276572943 | 1.269587002 |
| 12 | 1.2 | 1.315210496 | 1.368454125 | 1.376830442 | 1.377359116 | 1.366133804 |
| 13 | 1.3 | 1.421697753 | 1.485291017 | 1.49920942 | 1.500123864 | 1.482887532 |
| 14 | 1.4 | 1.548884281 | 1.622996941 | 1.644572296 | 1.645979627 | 1.620636489 |
| 15 | 1.5 | 1.697109601 | 1.781328985 | 1.812931502 | 1.81493003 | 1.779183014 |
| 16 | 1.6 | 1.865548369 | 1.958706519 | 2.002764912 | 2.005427665 | 1.956985924 |
| 17 | 1.7 | 2.051864669 | 2.151913824 | 2.210634247 | 2.213992863 | 2.150849752 |
| 18 | 1.8 | 2.251962979 | 2.355956022 | 2.430994819 | 2.435029146 | 2.355766172 |
| 19 | 1.9 | 2.459949065 | 2.56417667 | 2.65633698 | 2.660975139 | 2.565020958 |
| 20 | 2 | 2.668404276 | 2.768713187 | 2.877751354 | 2.882881713 | 2.770648631 |
| 21 | 2.1 | 2.869022099 | 2.961290359 | 3.085902677 | 3.091394221 | 2.964239324 |
| 22 | 2.2 | 3.053558619 | 3.134246915 | 3.272257937 | 3.277981805 | 3.137992233 |
| 23 | 2.3 | 3.214935211 | 3.281591904 | 3.430299726 | 3.436144698 | 3.285805437 |
| 24 | 2.4 | 3.348248597 | 3.39984183 | 3.556424124 | 3.562302794 | 3.404141675 |
| 25 | 2.5 | 3.451435063 | 3.488426528 | 3.650299544 | 3.656147086 | 3.492447442 |
| 26 | 2.6 | 3.525417993 | 3.549565378 | 3.714620281 | 3.720390649 | 3.553022491 |
| 27 | 2.7 | 3.573712762 | 3.587661402 | 3.754357238 | 3.760020894 | 3.590391213 |
| 28 | 2.8 | 3.601610042 | 3.608379518 | 3.775719936 | 3.781264163 | 3.610351883 |
| 29 | 2.9 | 3.615148994 | 3.617624411 | 3.785066452 | 3.790496585 | 3.618929436 |
| 30 | 3 | 3.620099828 | 3.620608522 | 3.78794606 | 3.793285174 | 3.621428261 |

The calculations are in the Excel document attached. The Ralston and the 4th Order RK methods overlap for the period observed. I calculated a Midpoint Method in addition to the work required. The Midpoint and Heuns, predictor-corrector, method overlap the period observed. At t=3, The Euler method is close to the Midpoint and Heuns methods. The Euler method diverts for the Midpoint and Heuns methods in the middle of the period observed.