# Solutions to Homework Assignment 9

**MATH 256-01**
**Section 2.7, Page 103**
**Problems: 1, 3, 4, 5, 7, 11, 13**

I will use the MAPLE code we created in class for most of these exercises. I modified the code a little since the example we did was autonomous, but the exercises are not all autonomous.

1. The actual solution is $2 + t - e^{-t}$ (thanks to MAPLE).

| $h/t$ | 0.1 | 0.2 | 0.3 | 0.4 |
|---|---|---|---|---|
| 0.1 | 1.21 | 1.409 | 1.5981 | 1.77829 |
| 0.05 | 1.202375 | 1.394768438 | 1.578153515 | 1.753408547 |
| 0.025 | 1.198719912 | 1.387931901 | 1.568551695 | 1.741406827 |
| Actual | 1.195162582 | 1.381269247 | 1.559181779 | 1.729679954 |

With $h = 0.025$, we get pretty good agreement even out at $t = 0.4$.

3. The actual solution is $\dfrac{t}{2} + e^{2t}$ (thanks to MAPLE).

| $h/t$ | 0.1 | 0.2 | 0.3 | 0.4 |
|---|---|---|---|---|
| 0.1 | 1.24 | 1.518 | 1.8416 | 2.21992 |
| 0.05 | 1.254750 | 1.552497500 | 1.902271975 | 2.314999089 |
| 0.025 | 1.262812422 | 1.571487250 | 1.935908121 | 2.368088655 |
| Actual | 1.271402758 | 1.591824698 | 1.972118800 | 2.425540928 |

We don't get quite as good agreement on this one as the last, but we should expect that since the solutions diverge.

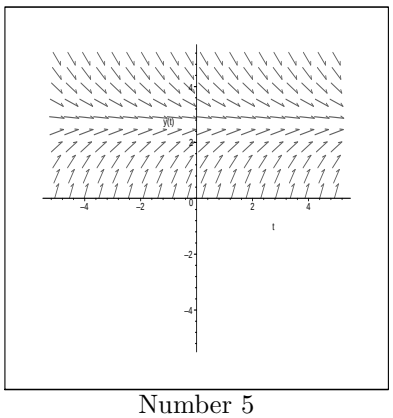
4. The actual solution is $\dfrac{6}{5}\cos(t) + \dfrac{3}{5}\sin(t) - \dfrac{6}{5}e^{-2t}$ (MAPLE again).

| $h/t$ | 0.1 | 0.2 | 0.3 | 0.4 |
|---|---|---|---|---|
| 0.1 | 0.2985012496 | 0.5328209730 | 0.7128577251 | 0.8466044783 |
| 0.05 | 0.2840819099 | 0.5106004292 | 0.6876899980 | 0.8220033637 |
| 0.025 | 0.2775609553 | 0.5004707450 | 0.6761251486 | 0.8106070955 |
| Actual | .2714281443 | .4908974368 | .6651419477 | .7997294411 |

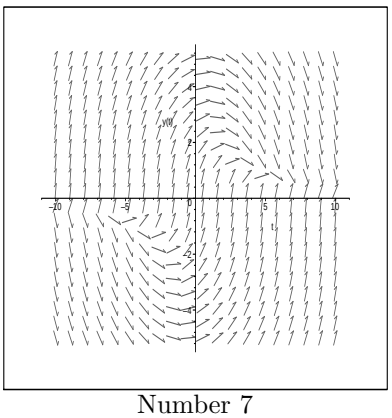
These also give pretty good agreement; again, the solutions are converging.

5. The solutions appear to be converging; see the direction field below.

7. It's a little hard to tell, but the solutions look like they may be converging.



Number 5



Number 7

11.

| $h/t$ | 0.5 | 1 | 1.5 | 2 | 2.5 | 3 |
|---|---|---|---|---|---|---|
| 0.1 | 2.307997864 | 2.490062019 | 2.600226203 | 2.667727873 | 2.709388005 | 2.735209816 |
| 0.05 | 2.301666034 | 2.482626248 | 2.593517108 | 2.662269931 | 2.705188450 | 2.732090083 |
| 0.025 | 2.298637982 | 2.479029576 | 2.590239733 | 2.659579296 | 2.703100022 | 2.730525396 |
| 0.01 | 2.296862589 | 2.476908558 | 2.588297233 | 2.657977087 | 2.701850831 | 2.729585380 |

13.

| $h/t$ | 0.5 | 1 | 1.5 | 2 | 2.5 | 3 |
|---|---|---|---|---|---|---|
| 0.1 | −1.463181004 | −0.3194679500 | 1.072910331 | 1.424868446 | 1.520519626 | 1.484039175 |
| 0.05 | −1.455896942 | −0.2374418800 | 1.064935389 | 1.416320863 | 1.518076105 | 1.487809009 |
| 0.025 | −1.451902134 | −0.1916548220 | 1.062490352 | 1.412939081 | 1.517369070 | 1.489985476 |
| 0.01 | −1.449379294 | −0.1629496898 | 1.061462077 | 1.411179664 | 1.517103086 | 1.491381964 |