MA 341-003 Test 2 Review Questions

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October 26, 2006

1. Homogeneous 2nd order linear equations with constant coefficients: Sec. 4.2 problems 4, 16; sec. 4.3, problems 14, 24.

2. Undetermined coefficients: Sec. 4.4 problems 18 and 32, Sec. 4.5 problems 18 and 28.

3. Variation of parameters: Sec. 4.6 problem 18.

4. Mass-spring systems: Sec. 4.8 problem 2.

5. Definition of Laplace transform: Sec. 7.2 problem 4.

6. Laplace transforms from tables: Sec. 7.3 problems 6 and 10.

7. Inverse Laplace transforms: Sec. 7.4 problems 24 and 26.

8. Solving initial value problems: Sec. 7.5 problem 10.

9. Transforms of discontinuous functions: Sec. 7.6 problem 32.

10. Transforms of delta functions: Use last homework assignment.
Answers:

1. 4.2 problem 4: \(c_1e^{-3t} + c_2te^{-3t}\)
2. 4.2 problem 16: \(\frac{4}{3}e^t - \frac{1}{3}e^{3t}\)
3. 4.3 problem 14: \(c_1e^t \cos 5t + c_2e^t \sin 5t\)
4. 4.3 problem 24: \(\frac{1}{3} \sin 3t + \cos 3t\)
5. 4.4 problem 18: \(y_p = -2t \cos 2t\)
6. 4.4 problem 32: \(t(At^6 + Bt^5 + Ct^4 + Dt^3 + Et^2 + Ft + G)e^{-3t}\)
7. 4.5 problem 18: \(c_1e^{3t} + c_2e^{-t} - t^2 + \frac{4t}{3} + \frac{1}{9}\)
8. 4.5 problem 28: \(\frac{e^{-\frac{4t}{60}}}{12} - \frac{e^t}{10} - \frac{e^{2t}}{6} + \frac{7e^{3t}}{6}\)
9. 4.6 problem 18: \(c_1e^{3t} + c_2te^{3t} + \frac{e^{3t}}{2t}\)
10. 4.8 problem 2: \(y = -\frac{1}{4} \cos 5t - \frac{1}{5} \sin 5t = \frac{\sqrt{41}}{20} \sin (5t + \phi)\) where \(\phi = \arctan \left(\frac{5}{4}\right) - \pi = -2.246\).
   \[
   \text{amplitude} = \frac{\sqrt{41}}{20}, \text{period} = \frac{2\pi}{5}, \text{frequency} = \frac{5}{2\pi}, \text{passes through equilibrium at } t = \frac{\pi - \arctan \left(\frac{5}{4}\right)}{5} = 0.449 \text{ seconds.}
   \]
11. 7.2 problem 4: \(\frac{1}{(s-3)^2}, s > 3\).
12. 7.3 problem 6: \(\frac{2}{(s+2)^2+4} + \frac{2}{(s-3)^3}\)
13. 7.3 problem 10: \(\frac{(s-2)^2-25}{((s-2)^2+25)^2}\)
14. 7.4 problem 24: \(5e^t + 2e^{2t} \cos 3t - 5e^{2t} \sin 3t\)
15. 7.4 problem 26: \(1 - \frac{3}{2}t^2 + 6e^{2t}\)
16. 7.5 problem 10: \(-t - e^{-2t} + 2te^{-2t} + e^{2t}\)
17. 7.6 problem 32: \(\cos t - \sin 2t - (2 \sin t)u(t - 2\pi) + (\sin 2t)u(t - 2\pi)\)