MATE 4072 problems

From the file “homework.html”: “problems ought to be solved as soon as they are posted, as they serve as practice for the regular quiz”.

30/01: 1–5

1. Problem 2 of § 13.2 of Boas.

2. Problem 9 of § 13.2 of Boas.

3. Problem 10 of § 13.2 of Boas.

4. In finding elementary solutions of the steady-state temperature in the semi-infinite rectangular plate, we assumed that the constant of eq. (2.5) (p. 622) is negative. Discuss what we obtain if we assume respectively that the constant is (a) positive or (b) zero.

5. Problem 16 of § 13.2.

3/02: 6–8

6. Problem 7 of § 13.3.

7. Problem 8 of § 13.3.

8. Problem 9 of § 13.3.

11/02: 9–12

9. Problem 5 of § 13.4.

10. Problem 7 of § 13.4.

11. Using the d’Alembert formula, write the equation(s) of the solution u of the one-dimensional wave equation

$$u_{tt} - u_{xx} = 0, \qquad u(0,x) = h(x), \quad u_t(0,x) = 0, \qquad (1)$$

where $h(x) = 1, -1 \le x \le 1, \quad h(x) = 0$ otherwise. Hint: the two cones of influence originating from the points $(t,x) = (0,-1)$, $(t,x) = (0,1)$ divide the half-plane $t \ge 0$ into six regions. The solution will have a different equation in each of these regions. Sketch the graph of $u(t, \cdot)$ at different times. (At time $t = 0$, the graph of u is the same as the graph of h.) At what time does the support of u (set of x-values where $u \ne 0$) split into two intervals?

12. Refer to problem 2 of § 13.4, where you will let $l = 1$, $h = 1/4$, $v = c = 1$. Find initial data $\tilde{f}, \tilde{g}$ such that the d’Alembert solution of corresponding boundariless initial-value problem (with space domain all x, not only $0 \le x \le 1$), restricted to $0 \le x \le 1$, is identical to the solution of the problem with pinned boundary conditions $u(t,0) = u(t,1) = 0$, and plot $\tilde{f}$, $\tilde{g}$. Hint: look for certain periodic functions.
Using the d’Alembert formula, plot the solution $u(t, \cdot)$ at regular time intervals $t = 0, 1/4, 1/2\ldots, 2$, on the interval $-4 \le x \le 4$.

13/02: 13–14

13.

a) Show that any function on the plane given in polar coördinates by $R(r)\Theta(\theta)$, where Θ is 2π periodic, is such that u_r/u is a function of r only. ($u_r = \partial u/\partial r$).

b) Give an example of a function on the plane, expressed in polar coördinates and 2π periodic in θ, which is not of the form $R(r)\Theta(\theta)$.

14. Problem 3 of § 13.6.

26/02: 15–17

15. Problem 5 of § 13.9.

16. Problem 6 of § 13.9.

17. Problem 25 of § 13.10.

10/03: 18–21. Also, problems 11 and 12 were updated.

18. (a)–(d) §14.2: choose three from 1 to 21 (presented as “problem 1”), and one of 22-24, omitting 18.

19. (a)–(c) Choose three from 34–42.

20. (a): problem 46. (b)–(d): choose three from 49–53.

21. (a)–(b) Choose two from 54–63.

2/04: 22–26.

22. (a)–(c) choose three even-numbered from problems 1–12 of §14.3.

23. Problem 14.

24. (a)–(b) choose two of problems 15–20.

25. Problem 21.

26. Choose one of problems 22–24 of §14.3.

7/04: 27–34

27. (a)–(b) Choose two odd-numbered of problems 3–8 of §14.4.

28. Choose one of problems 9–12 of the same section.

29. (a)–(b) Problems 1, 2 of §14.5

30. (a)–(b) Choose two even-numbered problems from 1–9, §14.6.

31. Problem 10.

32. Problem 11.

33. Problem 12.

34. Problem 13 of §14.6.

26/04: 35–40

35. (a)–(b) Choose two even-numbered problems from 1–20, §14.7.

36. Problem 37 of §14.7.

37. (a)–(c) Problem 1 of §15.2; choose three.

38. Problem 13 of §15.2.

39. Problem 17 of §15.2.

40. Problem 19 of §15.2.

2/05: 41–45

41. Problem 10 of §15.3.

42. Problem 14 of §15.3.

43. Problem 18 of §15.3.

44. Problem 19 of §15.3.

45. Problem 20 of §15.3.

5/05: 46–52

46. (a)–(b): problems 6,7 of §15.4.

47. (a)–(b): problems 9,10 of §15.4.

48. Problem 14 of §15.4.

49. Problem 22 of §15.4.

50. (a)–(c): problems 2,6,7 of §15.5.

51. (a)–(b): problems 3,10 of §15.5.

52. (a): problem 16 of §15.5. (b)–(d): 17 of §15.5.

8/05: 53–56

53. Problem 1 of §15.6. Take the motion to be $x = a\sin(\omega t)$.

54. Problem 6 of §15.6. In this problem and problem 56, find the mean of r, but not the standard deviation.

55. Problem 7 of §15.6.

56. Problem 8 of §15.6.

14/05: 57

57. Problems 10, 11, 12 of §15.7.