

# A solutions manual for Topology by James Munkres

December 2017, for no special reason I started studying mathematics and writing a solutions manual for [Topology by James Munkres](#).

## Chapter 1. Set Theory and Logic

1. [Fundamental Concepts](#) *wip*
2. Functions
3. Relations
4. The Integers and the Real Numbers
5. Cartesian Products
6. Finite Sets
7. Countable and Uncountable Sets
8. The Principle of Recursive Definition
9. Infinite Sets and the Axiom of Choice
10. Well-Ordered Sets
11. The Maximum Principle

## Chapter 2. Topological Spaces and Continuous Functions

12. Topological Spaces
13. Basis for a Topology
14. The Order Topology
15. The Product Topology on  $X \times Y$
16. The Subspace Topology
17. Closed Sets and Limit Point
18. Continuous Functions
19. The Product Topology
20. The Metric Topology
21. The Metric Topology (continued)
22. The Quotient Topology

## Chapter 3. Connectedness and Compactness

23. Connected Spaces
24. Connected Subspaces of the Real Line
25. Components and Local Connectedness
26. Compact Spaces
27. Compact Subspaces of the Real Line
28. Limit Point Compactness
29. Local Compactness

## **Chapter 4. Countability and Separation Axioms**

- 30. The Countability Axioms
- 31. The Separation Axioms
- 32. Normal Spaces
- 33. The Urysohn Lemma
- 34. The Urysohn Metrization Theorem
- 35. The Tietze Extension Theorem
- 36. Imbeddings of Manifolds

## **Chapter 5. The Tychonoff Theorem**

- 37. The Tychonoff Theorem
- 38. The Stone-Čech Compactification

## **Chapter 6. Metrization Theorems and Paracompactness**

- 39. Local Finiteness
- 40. The Nagata-Smirnov Metrization Theorem
- 41. Paracompactness
- 42. The Smirnov Metrization Theorem

## **Chapter 7. Complete Metric Spaces and Function Spaces**

- 43. Complete Metric Spaces
- 44. A Space-Filling Curve
- 45. Compactness in Metric Spaces
- 46. Pointwise and Compact Convergence
- 47. Ascoli's Theorem

## **Chapter 8. Baire Spaces and Dimension Theory**

- 48. Baire Spaces
- 49. A Nowhere-Differentiable Function
- 50. Introduction to Dimension Theory

## **Chapter 9. The Fundamental Group**

- 51. Homotopy of Paths
- 52. The Fundamental Group
- 53. Covering Spaces

- 54. The Fundamental Group of the Circle
- 55. Retractions and Fixed Points
- 56. The Fundamental Theorem of Algebra
- 57. The Borsuk-Ulam Theorem
- 58. Deformation Retracts and Homotopy Type
- 59. The Fundamental Group of  $S_n$
- 60. Fundamental Groups of Some Surfaces

## **Chapter 10. Separation Theorems in the Plane**

- 61. The Jordan Separation Theorem
- 62. Invariance of Domain
- 63. The Jordan Curve Theorem
- 64. Imbedding Graphs in the Plane
- 65. The Winding Number of a Simple Closed Curve
- 66. The Cauchy Integral Formula

## **Chapter 11. The Seifert-van Kampen Theorem**

- 67. Direct Sums of Abelian Groups
- 68. Free Products of Groups
- 69. Free Groups
- 70. The Seifert-van Kampen Theorem
- 71. The Fundamental Group of a Wedge of Circles
- 72. Adjoining a Two-cell
- 73. The Fundamental Groups of the Torus and the Dunce Cap

## **Chapter 12. Classification of Surfaces**

- 74. Fundamental Groups of Surfaces
- 75. Homology of Surfaces
- 76. Cutting and Pasting
- 77. The Classification Theorem
- 78. Constructing Compact Surfaces

## **Chapter 13. Classification of Covering Spaces**

- 79. Equivalence of Covering Spaces
- 80. The Universal Covering Space
- 81. Covering Transformations
- 82. Existence of Covering Spaces