# SM223 Calculus III with Optimization

**Course Coordinator:** Assoc. Prof. Marius Ionescu
email: ionescu@usna.edu

Fall 2020–2021

**Textbook:** **Calculus: Early Transcendentals**, 8th edition, James Stewart

| **Syllabus** | | |
|---|---|---|
| Lesson | Section/Topic | Problems |
| 1. | 12.1 Three Dimensions & 12.2 Vectors | 12.1 # 5, 9, 12, 15, 27, 35<br>12.2 # 3, 13, 21, 25, 37 |
| 2. | 12.3 Dot product | # 7, 9, 11, 15, 23 |
| 3. | 12.3 Dot product (cont'd) | # 33, 35, 39, 41, 49, 55 |
| 4. | 12.4 Cross product | # 3, 9, 13, 14, 19 |
| 5. | 12.4 Cross product (cont'd) | # 27, 31, 33, 37 |
| 6. | 12.5 Lines and Planes | # 3, 4, 7, 10, 13 |
| 7. | 12.5 Lines and Planes (cont'd) | # 16, 19, 23, 26, 27 |
| 8. | 12.5 Lines and Planes (cont'd) | # 31, 35, 45, 51, 67 |
| 9. | 12.6 Cylinders and Quadratic Surfaces | # 1, 3, 5, 11, 17 |
| 10. | 12.6 Cylinders and Quadratic Surfaces (cont'd) | # 21–28 |
| 11. | Review | |
| 12. | Test #1 | |
| 13. | 13.1 Vector Functions | # 7, 9, 15, 16, 18 |
| 14. | 13.1 Vector Functions (cont'd) | # 21 – 26 |
| 15. | 13.2 Derivatives and Integrals | # 3, 5, 15, 19, 25, 28, 29, 34 |
| 16. | 13.3 Arc Length (no curvature) | # 1, 3, 5, 9 |
| 17. | 13.4 Motion in Space | # 5, 9, 13, 15, 18 |
| 18. | 13.4 Motion in Space (cont'd) | # 19, 23, 25, 31, 35 |
| 19. | 14.1 Functions of Many Variables | # 1, 3, 7, 24, 25 |
| 20. | 14.1 Functions of Many Variable (cont'd) | # 32, 35, 36, 41, 44 |
| 21. | 14.1 Functions of Many Variables (cont'd) | # 46, 61–66, 68, 69 |
| 22. | 14.3 Partial Derivatives | # 3, 4, 5, 7, 8, 10, 11, 15 |
| 23. | 14.3 Partial Derivatives (cont'd) | # 17, 20, 22, 26, 33 |
| 24. | 14.3 Partial Derivatives (cont'd) | # 34, 41, 53, 56, 64, 66, 74, 82 |
| 25. | 14.4 Tangent Planes and Linear Approximation | # 1, 2, 4, 5, 6 |
| 26. | 14.4 Tangent Planes and Linear Approximation (cont'd) | # 21, 24, 25, 27 |
| 27. | Review | |
| 28. | Test #2 | |
| 29. | 14.5 Chain Rule | # 1, 2, 11, 13, 14, 35 |
| 30. | 14.5 Chain Rule (cont'd) | # 3, 4, 15, 37, 38 |
| 31. | 14.5 Chain Rule (cont'd) | # 5, 6, 39, 40, 41 |

| Syllabus, cont'd | | |
|---|---|---|
| 32. | 14.6 Gradients and Directional Derivatives | # 1, 3, 7, 9, 13, 15 |
| 33. | 14.6 Gradients and Directional Derivatives | # 19, 21, 23, 29, 31 |
| 34. | 14.6 Gradients and Directional Derivatives | # 31, 33, 38, 41, 45, 49, 55 |
| 35. | 14.7 Max/Min Problems | # 3, 5, 6, 11, 41 |
| 36. | 14.7 Max/Min Problems (cont'd) | # 4, 12, 13, 45, 49 |
| 37. | 14.8 Lagrange Multipliers | # 3, 5, 7, 9 |
| 38. | 14.8 Lagrange Multipliers (cont'd) | # 19, 31, 33, 35 |
| 39. | 14.8 Lagrange Multipliers (cont'd) | # 21, 39 |
| 40. | Review | |
| 41. | Test # 3 | |
| 42. | 15.1 Double Integrals over Rectangular Regions | # 1, 5, 7, 15, 17 |
| 43. | 15.1 Double Integrals over Rectangular Regions (cont'd) | # 8, 19, 21, 27, 28 |
| 44. | 15.2 Double Integrals over General Regions | # 1, 7, 13, 15, 17 |
| 45. | 15.2 Double Integrals over General Regions (cont'd) | # 19, 21, 27, 28, 45, 49 |
| 46. | 15.3 Double Integrals in Polar Coordinates | # 5, 7, 8, 9, 10, 11 |
| 47. | 15.3 Double Integrals in Polar Coordinates (cont'd) | # 12, 15, 29, 31, 32 |
| 48. | 15.4 Applications | # 3, 7, 11, 13 |
| 49. | 15.4 Applications (cont'd) | # 27, 28, 29 |
| 50. | 15.6 Triple Integrals | # 4, 5, 13, 14, 19 |
| 51. | 15.6 Triple Integrals (cont'd) | # 27, 28, 33, 35 |
| 52. | 15.7 Triple Integrals in Cylindrical Coordinates | # 1, 3, 9, 17 |
| 53. | 15.7 Triple Integrals in Cylindrical Coordinates (cont'd) | # 18, 23, 24, 29 |
| 54. | 15. 8 Triple Integrals in Spherical Coordinates | # 1,5, 9 |
| 55. | 15.8 Triple Integrals in Spherical Coordinates (cont'd) | # 15, 21, 23 |
| 56. | Review | |
| 57. | Test #4 | |
| 58. | Review | |
| 59. | Review | |
| 60. | Review | |

The final exam will consist of a multiple choice section and a long answer section.

**Course Goals**

Upon successful completion of this course, midshipmen will be able to do the following:

1. Describe basic curves and space motion (including projectile motion) using vector functions and their derivatives and integrals.
2. Draw and interpret level sets and graphs of a real valued function.
3. Use partial derivatives, directional derivatives, and gradient vectors to describe the behavior of a real valued function.
4. Solve extreme value problems by finding and classifying critical points and by the method of Lagrange multipliers.
5. Evaluate double and triple integrals in rectangular and polar coordinates and use integrals to find centers of mass and probabilities.

6. Write well-organized, coherent solutions to applications problems.