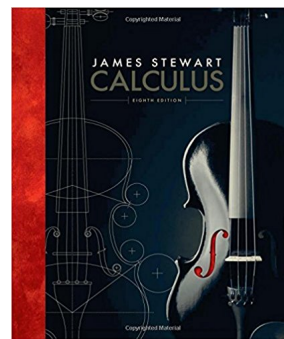## Calculus III with Optimization

**Textbook:** *Calculus: Early Transcendentals,*
   8th edition, by James Stewart
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# SM223 (Fall 2021): Syllabus

| | | | |
|---|---|---|---|
| 1. | Three dimensional space | 12.1 | # 5, 9, 12, 15, 17, 27, 31, 35 |
| 2. | Vectors | 12.2 | # 3, 13, 19, 21, 25, 37 |
| 3. | Dot Product | 12.3 | # 7, 9, 11, 15, 23 |
| 4. | Dot Product | 12.3 | # 33, 35, 39, 41, 49, 55 |
| 5. | Cross Product | 12.4 | # 3, 9, 13, 14, 19 |
| 6. | Cross Product | 12.4 | # 27, 31, 33, 37 |
| 7. | Lines and Planes | 12.5 | # 3, 4, 7, 10, 13 |
| 8. | Lines and Planes | 12.5 | # 16, 19, 23, 26, 27 |
| 9. | Lines and Planes | 12.5 | # 31, 35, 45, 51, 67 |
| 10. | Cylinders and Quadric Surfaces | 12.6 | # 1, 3, 5, 11, 17 |
| 11. | Cylinders and Quadric Surfaces | 12.6 | # 21–28 |
| 12. | Review | | |
| 13. | Test #1 | | |
| 14. | Vector Functions | 13.1 | # 7, 9, 15, 16, 18 |
| 15. | Vector Functions | 13.1 | # 21 – 26 |
| 16. | Derivatives and Integrals | 13.2 | # 3, 5, 15, 19, 25, 28, 29, 34 |
| 17. | Arc Length (no curvature) | 13.3 | # 1, 3, 5, 9 |
| 18. | Motion in Space | 13.4 | # 5, 9, 13, 15, 18 |
| 19. | Motion in Space | 13.4 | # 19, 23, 25, 31, 35 |
| 20. | Functions of Many Variables | 14.1 | # 1, 3, 7, 24, 25 |
| 21. | Functions of Many Variables | 14.1 | # 32, 35, 36, 41, 44 |
| 22. | Functions of Many Variables | 14.1 | # 46, 61–66, 68, 69 |
| 23. | Partial Derivatives | 14.3 | # 3, 4, 5, 7, 8, 10 |
| 24. | Partial Derivatives | 14.3 | # 11, 15, 17, 18, 20 |
| 25. | Partial Derivatives | 14.3 | # 22, 26, 33, 34, 41, 42 |
| 26. | Partial Derivatives | 14.3 | # 53, 56, 64, 66, 74, 82 |
| 27. | Review | | |
| 28. | Test #2 | | |
| 29. | Tangent Planes and Linear Approximation | 14.4 | # 1, 2, 4, 5, 6 |
| 30. | Tangent Planes and Linear Approximation | 14.4 | # 21, 24, 25, 27 |
| 31. | Chain Rule | 14.5 | # 1, 2, 11, 13, 14, 35 |
| 32. | Chain Rule | 14.5 | # 3, 4, 15, 37, 38 |
| 33. | Chain Rule | 14.5 | # 5, 6, 39, 40, 41 |
| 34. | Gradients and Directional Derivative | 14.6 | # 1, 3, 7, 9, 13, 15 |
| 35. | Gradients and Directional Derivative | 14.6 | # 19, 21, 23, 29, 31 |
| 36. | Gradients and Directional Derivative | 14.6 | # 31, 33, 38, 41, 45, 49, 55 |
| 37. | Max-Min | 14.7 | # 3, 5, 6, 11, 41 |
| 38. | Max-Min | 14.7 | # 4, 12, 13, 45, 49 |
| 39. | Lagrange Multipliers | 14.8 | # 3, 5, 7, 9 |
| 40. | Lagrange Multipliers | 14.8 | # 19, 31, 33, 35 |

| 41. | Lagrange Multipliers | 14.8 | # 21, 39, 45 |
|---|---|---|---|
| 42. | Review | | |
| 43. | Test #3 | | |
| 44. | Double Integration over Rectangular Regions | 15.1 | # 1, 5, 7, 15, 17 |
| 45. | Double Integration over Rectangular Regions | 15.1 | # 8, 19, 21, 27, 28 |
| 46. | Double Integration over General Regions | 15.2 | # 1, 7, 13, 15, 17 |
| 47. | Double Integration over General Regions | 15.2 | # 19, 21, 27, 28, 45, 49 |
| 48. | Double Integration over Polar Coordinates | 15.3 | # 5, 7, 8, 9, 10, 11 |
| 49. | Double Integration over Polar Coordinates | 15.3 | # 12, 15, 29, 31, 32 |
| 50. | Applications | 15.4 | # 3, 7, 11, 13 |
| 51. | Application | 15.4 | # 27, 28, 29 |
| 52. | Triple Integrals | 15.6 | # 4, 5, 13, 14, 19 |
| 53. | Triple Integrals | 15.6 | # 27, 28, 33, 35 |
| 54. | Triple Integrals over Cylindrical Coordinates | 15.7 | # 1, 3, 9, 17 |
| 55. | Triple Integrals over Cylindrical Coordinates | 15.7 | # 18, 23, 24, 29 |
| 56. | Triple Integrals over Spherical Coordinates | 15.8 | # 1, 3, 5, 6, 9 |
| 57. | Triple Integrals over Spherical Coordinates | 15.8 | # 17, 19, 21, 25, 30, 41 |
| 58. | Review | | |
| 59. | Test #4 | | |
| 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