## MAC2313 Calculus III Final Examination Topic Outline

- 1. Determine the distance between two points in 3-space
- 2. Determine the equation of a sphere given its center & radius
- 3. Describe a surface from a given equation
- 4. Construct a vector in 2- or 3-space
- 5. Perform operations on vectors utilizing given relationships
- 6. Determine the magnitude of a vector
- 7. Unitize (a.k.a. normalize) a given vector
- 8. Determine the resultant of and/or the angle between two forces/vectors
- 9. Find the dot product of two vectors
- 10. Find the angle between two vectors using the dot product
- 11. Find the direction cosines of given vectors
- 12. Determine the projection of one vector onto another vector
- 13. Determine the vector component of a vector orthogonal to another vector
- 14. Determine the displacement vector
- 15. Determine the work done by a vector force
- 16. Determine the cross product of given vectors
- 17. Determine the area of a parallelogram
- 18. Determine the triple scalar product of three vectors
- 19. Determine the volume of a parallelpiped
- 20. Determine the torque and/or torque vector of a force F about a point P.
- 21. Determine the parametric equation of a line in 2- or 3-space satisfying stated conditions
- 22. Know the definition and significance of skew lines
- 23. Determine the of the equation of a plane given conditions [this includes parametric and symmetric forms]
- 24. Determine the acute angle of intersection between to intersecting planes
- 25. Determine the equation of a line of intersection between two planes
- 26. Determine the distance between a point and a plane
- 27. Identify the type and/or sketch the graph of a given quadric surface
- 28. Convert between rectangular, cylindrical, and spherical coordinates
- 29. Convert a given equation between rectangular, cylindrical, and spherical forms
- 30. Describe the region in 3-space that satisfies given inequalities
- C h a p t e r 1
  - 31. Identify the component form of a vector-valued function
  - 32. Determine the domain of a vector-valued function
  - 33. Determine the continuity and/or differentiability of a vector-valued function
  - 34. Differentiate/integrate vector-valued functions
  - 35. Determine the arc length of a vector-valued function
  - 36. Determine an arc length parameterization of a vector-valued function
  - 37. Find the unit tangent vector, unit normal vector, and the binormal vector
  - 38. Find equations for the rectifying, osculating, & normal planes for a given vector-valued function
  - 39. Find the curvature  $\kappa$  and the radius of curvature  $\rho$
  - 40. Determine the smooth transition between to smooth curves
  - 41. Determine the velocity, acceleration, and speed of a given vector-valued function
  - 42. Determine the distance and displacement over a given interval for a given vector-valued function
  - 43. Determine the tangential scalar component, the normal scalar component, the tangential vector component, and the normal vector component
  - 44. Determine projectile motion
  - 45. Find the position and velocity vectors from given information

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- 46. Sketch level curves/surfaces of given functions
- 47. Evaluate given functions
- 48. Describe the domain of a function f in words
- 49. Determine the limit and continuity of a given function
- 50. Find the partial derivative of a given function
- 51. Find a locally linear approximation to a given function
- 52. Find the total differential of a given function
- 53. Utilize the multi-variate chain rule to find requested derivatives
- 54. Determine if given functions satisfy LaPlace's Equation and/or Cauchy-Riemann Equations
- 55. Solve associated applications to the above
- 56. Determine the directional derivative of a given function
- 57. Find the gradient of a given function
- 58. Determine the tangent plane and/or normal line to a given surface
- 59. Determine the relative maxima/minima of a given function (Second Partials Test)
- 60. Determine the absolute maxima/minima of a given function
- 61. Use the method of Lagrange multipliers to find the relative extrema with a constraint
- 62. Solve associated applications
- 63. Evaluate double integrals in rectangular or polar coordinates
- 64. Find the area of a given function in two variables
- 65. Find the surface area of a parameterized surface using double integrals
- 66. Find the surface area of a function using double integrals (non-parametric form)
- 67. Evaluate triple integrals in rectangular, cylindrical, or spherical coordinates
- 68. Find the volume of a given function in three variables
- 69. Find the mass of a given lamina
- 70. Find the Find the centroid/center of gravity of a given lamina
- 71. Use the Theorem of Pappas to find the volume of a given bounded plane region
- 72. Change the order of integration for a given integral
- 73. Determine the Jacobian for a given function
- 74. Use the Jacobian to change variables in multiple integrals and evaluate
- (75. Find the divergence of a function F
  - 76. Find the curl of a function F
  - 77. Use the del operator ( $\nabla$ ) to find the div of **F** or curl of **F**
  - 78. Use line integrals to find the mass, arc length or area of a given curve
  - 79. Use line integrals to determine the work performed by a given vector field
  - 80. Determine if a given vector field is path independent
  - 81. Determine if a given vector field is conservative
  - 82. If a vector field is conservative, determine the potential function  $\phi$
  - 83. Use Green's Theorem to evaluate a line integral
  - 84. Evaluate surface integrals over a given region
  - 85. Determine the flux, $\Phi$ , of a given vector field across a region
  - 86. Verify the Divergence Theorem by evaluating the surface integral and the triple integral (showing that they are equivalent)
  - 87. Use the Divergence Theorem to find the flux of F across a given surface
  - 88. Determine whether a given vector field is free of sources and/or sinks. Locate any that may exist

Chapter Supplementary Questions

Ch. 12	р. 856	1 - 12, 15, 18 - 19, 23 - 30, 34 - 37
Ch. 13	p. 918	4, 10 – 12, 15 – 20
Ch. 14	p. 1009	1 - 3, 6 - 13, 15 - 26, 30 - 33, 38
Ch. 15	p. 1088	3 - 6, 11 - 36
Ch. 16	p. 1160	4, 8 – 9, 11, 17 – 21, 24 – 27, 29 – 30

And study your take-home and in-class quizzes