Math 2720(Mackey) **Homework** Spring 2009

Guidelines: **Homework is regularly assigned by not collected.** Do it promptly. Keep a separate homework notebook.

Your solutions should always include reasoning. This helps reinforce logical structure, and trains you in critical thinking. Write clearly. Do not put an equals sign between unequal quantities, or quantities you have not yet proved are equal. Use words like "hence", "therefore" to connect statements or equations, and indicate the chain of reasoning. Interpret your answers. Use "we are given", "we want to show that" to distinguish clearly between what is given and what is to be found.

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From Barr, **§1.1, p.8**: 1, 3 – 5, 7, 9 – 11, 13, 15, 16, 19, 20, 22, 23

Additional Problems:

1. Let $P = (2, 3, -5)$ and $Q = (1, -1, 2)$. Give a clear geometric description of each of the following sets of points in $\mathbb{R}^3$. Include an appropriate figure.
   (a) All points in $\mathbb{R}^3$ at a distance of 6 units from P.
   (b) All points in $\mathbb{R}^3$ that are equidistant from P and Q.
   (c) All points in $\mathbb{R}^3$ that are at a distance of 6 units from the z-axis.
2. For each set specified in the previous problem, derive equation(s) that the coordinates of every point in that set must satisfy. Include reasoning and complete sentences!

From Barr, **§1.2** : For the following problems, describe the graph; specify cross-sections when appropriate: 1 – 3, 5, 7, 10, 13acf, 16ab, 20, 21, 23.

Additional Problems:

1. What is meant by a scalar valued function of two variables? Give a precise definition.
2. What are the two ways to visualize a function of two variables? Give clear descriptions.
3. Give an example of a function whose graph is a plane in $\mathbb{R}^3$.
4. Give an example of a function whose graph is a hemisphere in $\mathbb{R}^3$.
5. Suppose that in modeling the concentration of a pollutant leaking from a ship on the sea we make the assumption that the concentration of pollutant is inversely proportional to the distance from the ship. Choose a function that would fit this description. Explain what the variables you introduce stand for.

From Barr, **§1.4**, p.32: 1ab, 2ab, 3, 4, 5ab, 6a - d, 7abef, 8ace, 9abc, 10ab, 11, 12a. For problems 7, 8, a clear and complete description in words is also required. (A clear sketch can sometimes be hard to do by hand.)

Additional Problems:

1. Suppose you want to specify a set consisting of all points in a section of an tangerine. What coordinate system would you choose and how would you specify this set in your chosen coordinate system?

2. A location on the earth can be specified by its latitude and longitude. Clearly describe how to convert this information into spherical coordinates.

3. (Just for fun): Find the spherical coordinates of Kalamazoo MI, and Timbuktu, Mali. Show all your work, neatly and legibly.

From Handout.
§12.3 Countour diagrams, p.625: 1, 3, 5 – 7, 9, 11, 16 – 19, 22.
p.632: 1 - 7, 9, 12 - 15, 24 - 26, 29, 30.

From Barr:
§1.5, p.34: 1, 3, 7, 8b, 9, 13, 21, 23, 27, 28.
§1.6, p.54: 1 – 7, 13, 16.
§1.7, p.65: 1 – 6, 16, 17, 19, 21 – 23, 25, 26, 28, 34a, 37.
§1.8, p.75: 1 – 4, 7 – 11, 13, 17, 18, 24, 27, 29.
§1.9, p.84: 5, 6, 7, 9, 10 – 16, 18. **Warning**: There is error in Problem 10. The graph labeled (4) does not match any of the equations (a) through (f).
§1.10, p. 97: 1 – 3, 5 – 7, 9 – 11, 15, 19, 23, 26 – 28, 31 – 33, 36.

§2.1, p.109: 1abc, 2abc, 3 – 7, 10, 12, 13a, 15, 23a, 24a.
§2.2, p.122: 1 – 9, 12, 13acd, 14, 17 – 19, 28 – 30, 35, 36, 37ac. Know properties in 25 – 27.
15acef, 16. For these problems, do NOT find A^{-1}. Instead reduce the coefficient matrix to upper triangular form, and use back substitution.
§2.3, p.131: 7 – 12, 14ab, 16abde, 17, 19a, 23ab. Know result in 13.
§2.4, p.141: 1, 2, 3, 10, 11ab, 12ab, 13, 14, 15.
From Handout, §12.3 Countour Diagrams: p.625: 1, 3, 5 – 7, 9, 11, 16 – 19, 22.
§2.5: Skip for now. We will return when we have the matrix of partial derivatives (Hessian) and use it to classify critical points.

§3.1: Study solved Examples 3.1.3, 3.1.8, 3.1.9.
p. 160: 3, 5, 9, 10, 11, 15, 16, 21, 23, 24, 27, 30.
Hints: In Problem 23, f is a radial vector field. In Problem 27, f is a linear transformation, use ideas from §2.4
§3.2: Study solved Examples 3.2.4, 3.2.6, 3.2.8, 3.2.9
p.169: 1 – 5, 12, 13, 15, 19, 20, 24, 25.
§3.4: Know Defn 3.4.1 (p.178), understand statement of Clairaut's Theorem (p.182).
Study solved Examples 3.4.2, 3.4.3, 3.4.5, 3.4.6
p.184: 1, 3 – 6, 9 – 11, 15 – 19, 21, 26, 28, 29, 32, 34.

§3.5: Know Defn 3.5.1 (p. 190).
Understand statements of Theorems 3.5.1 (p.191), 3.5.2 (p.194).
Study solved Examples 3.5.1 (p.190), 3.5.3 (p.192), 3.5.4 (p.194) and 3.5.5 (p.196).
p.197: 1 – 5, 7 – 9, 11 – 15, 17 – 19, 27, 28, 30.
§3.6, p.208: 1, 3, 4 – 7, 9, 10, 11, 13, 14, 17, 19, 23, 26, 27, 37, 40.

From Handout.
§14.2, p.694–5: Carefully study Example 4.
§14.2, p.696: 36, 37, 39, 45.
§14.3, p.697–702: Carefully study the text and solved examples!
§14.3, p.702: 1 – 4, 13 – 16, 18, 19.
§14.4, p.709: 1 – 39(odd). These are mostly warm-up exercies to build basic skills.
§14.4, p.710: 41, 43, 46, 47, 49, 50, 52 – 55, 59, 65, 69.
§14.5, p.717: 1 – 21 (odd). These are mostly warm-up exercies to build basic skills.
§14.5, p.717: To be announced.

From Barr:
§4.1, p.220: 1 – 3, 6, 8, 10, 11, 13, 15, 17 – 19, 21, 24, 25, 32 – 34, 36, 37, 39, 40, 43.
§4.2, p.229: 1, 2, 4, 5, 13, 14.
§4.3, p.238: 1 – 5, 8 – 12.
§4.4, p.249: 1 – 6, 11, 15 – 18, 20, 21, 23, 43 – 45.

§5.1, p.279: 1, 3, 5, 8, 10 – 12, 14. More to follow?
§5.2, p.291: 6, 7, 12 – 14, 18, 19. More to follow?
§5.3, p.305: 12 – 15, 17, 19, 23, 24, 27, 28(only set up).

From Handout:
§18.1, p.932: 1 – 17(odd), 21, 45, 46.
§18.2, p.939: 1 – 19(odd), 25, 27, 29, 31.
§18.3, p.946: 1, 2, 9 – 15(odd), 21, 22, 25, 33, 35, 37, 39.
§18.4, p.957: 1 – 17(odd), 20 – 27, 29, 33.
Review Exercises, p.960: 1, 7, 9, 11, 13, 15, 17, 18, 23, 32a, 35, 37, 39.
Check Your Understanding, p. 964: 1, 5, 7, 9, 11, 12, 14, 15, 16, 23, 24, 30, 32, 34, 35, 39, 43.

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