Lumpy Land

You find yourself in a strange undulating landscape given by the function

$$z = f(x, y) = \cos y - \cos x$$

where z is the elevation.

a. Graph the function $z = f(x, y)$
b. Graph the contours of the function $z = f(x, y)$
c. Graph the gradient of the function $z = f(x, y)$
d. Find all maxima, minima and saddle points.
e. What are the level curves for $z = 0$? For $z = 2$?

You are now at the origin and wish to hike to the point $(4\pi, 0, 0)$. You contemplate two rather different routes.

f. Your first route always keeps you on the same elevation. Determine such a route of minimal length. What is the length?
g. You second route always moves along the gradient. Determine such a route of minimal length, assuming you start hiking in the positive x-direction. What is the length? If you cannot find an exact answer, then determine and upper bound and a lower bound between which the actual length must lie.
h. Which route is the shorter – that of part (f) or (g)?

Appropriate pictures should be supplied throughout. Justify your answers.

From the Course Syllabus

PROJECT. You will work on the project in groups of 1–4 students. This project will be a substantial assignment, giving you a chance to earn part of your grade in an environment which simulates the so-called "real world" better than does an in-class exam. It will also give your instructor a chance to base part of your grade on your best work, produced in a setting where time should not be a factor (assuming you start on your project as soon as it is assigned). The results of your work on your project will be presented in a report (one report per group). Each member will also submit a "group evaluation" giving their impression of the relative contribution of each member to the group's effort. These evaluations are due with the project. It is not guaranteed that each member of the group will receive the same grade. **The reports will be graded not only on their mathematical content but also on the quality of the presentation: clarity, neatness, and proper grammar are also important.** Both reports and group evaluations must be typed. The project will be assigned on Monday October 23 and is due on Monday November 6.

We amended the dates. The project will be assigned on Thursday October 26 and is due on Thursday November 9.