

Mathematical Models for Spreading Out

Homework due October 12. The first three questions below are based on the Spreading Out activity published by TIMS.

1. Give a convincing argument that the function taking number of drops to area of the circle is linear. This argument should have NO use of the data we collected.
2. Give a convincing argument that the function taking number of drops to circumference of the circle is approximately \sqrt{d} . This argument should have NO use of the data we collected. It can rely on the result of question 1.
3. Now use the data to estimate the coefficients of the two functions we described above. You may do this by drawing a graph or with the regression function on a calculator. Just explain what you are doing.
4. Let $(a_1, a_2), (b_1, b_2), (c_1, c_2)$ be three pairs of points with a_1, b_1, c_1 distinct. Prove there is a polynomial of degree at most 2 which goes through the three points. (Don't just quote a theorem; prove this case.) (Hint: You need to use a fact about determinants and linear equations taught in Algebra II. You will also have to do a bit of factoring.)
5. State the generalization to n points.
6. Explain in a paragraph or two why these problems form one homework assignment and the moral for high school teaching.

You can find examples of problem 4 (i.e. particular numbers for $(a_1, a_2), (b_1, b_2), (c_1, c_2)$) in most precalculus books. The goal of problems 4 and 5 is that you understand the general case and the connections to modeling.