Project 3 - The Calculus of Pipes Around Corners

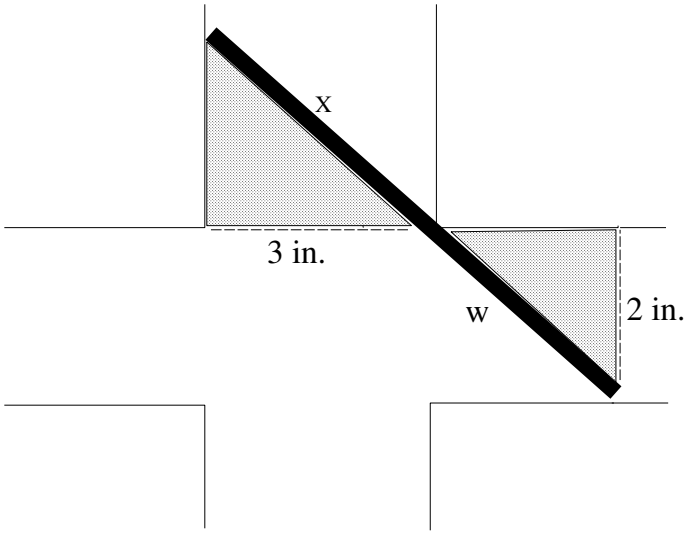
You have probably tried to move large furniture items around corners of doorways and hallways. Sometimes, some strange maneuvering is needed. In this project, you will find the longest pipe that will pass around a corner of two intersecting hallways that are 2 feet and 3 feet wide. You will use the provided scale model simulation platform (2 inch and 3 inches wide) to experimentally determine the longest pipe. Then you will find the answer using . . . **calculus**.

Procedure:

1. Adjust the provided adjustable pipe simulator to the largest possible length that will pass around the corner of the simulation platform. Rest the flat side of the pipe simulator against the corner to minimize error due to the thickness of the pipe simulator. Bend the pipe simulator as little as possible. Measure this length.

2. Use the diagram below to obtain an expression that represents total length *L*.

   Notes: $L = x + w$
   The two triangles shaded are right triangles and similar triangles.
   Side lengths of similar triangles are in direct proportion.
   The Pythagorean theorem applies to right triangles.



OR. . . explain how you obtain an expression for L in some other way. (See problem 51 in Chapter 3 Review Exercises.)

Write-up: (Except for equations, all answers in the write-up must be typed using complete sentences and grammar)

1. *Calculate* the value of L (to the nearest hundredth) that corresponds to the longest pipe that will pass around the corner. This corresponds to the minimum value of L. You may use a mathematical model that is different (like problem 51 in Ch 3 review) than the one suggested but you must, however, *explain* how you obtain the equation that is minimized.

2. What is the percent error in the measured value for the longest pipe?

   (Calculated - Measured)/(Calculated Value) * 100%

3. The calculated value is found by minimizing an equation. How does this provide a maximum pipe length?

4. Discuss the value of using a scale model to analyze a mathematical or design problem.