MathLab
Editing Pythagoras

**Activity:** Applying the distance formula.

**Purpose:** To use the distance formula to find the distance between two points in two-space and to use the ENTRY feature of the calculator to edit the previous entry.

**Background information:** An early mathematician, Pythagoras lived in the sixth century BC and founded a special and somewhat mystical order called the Pythagoreans. Today, however, he is much more renowned for the Pythagorean theorem, which was named after him because of his famous proof. Although this theorem is credited to Pythagoras, there is some evidence that he may have learned it in Babylonia and Egypt, where he spent his youth. Some historians say that in the days of the Egyptian master builders, the ancient engineers would carry rope loops of knots on their belts. By stretching the ropes so that there were intervals of 3, 4, and 5 on each side of the triangle, the engineers could create a 90-degree angle.

**Investigations:**

- Use the Pythagorean theorem to find the distance between the points A = (6, 8) and B = (12, 16). Enter the expression directly into your calculator as follows:
  
  Press 2nd (√), (12 - 6), , (16 - 8), (ENTER)

  You should get 10.

- To repeat the process for another pair of points, you don’t have to re-enter the whole expression. Press 2nd (ENTRY), and the original expression will reappear. Now you can edit the expression using the directional arrows, and the INS (insert) and the DEL (delete) commands. Try editing the command to find the distance between C(9, 13) and D(-4, 5).

- Find the distance between each pair of points.

  a) (0, 0) and (-3, 4)  
  b) (1, 2) and (6, 14)  
  c) (8, 11) and (15, 35)  
  d) (3, 8) and (-5, -7)  
  e) (-2, 3) and (-1, 4)  
  f) (4, 1) and (-1, -3)

- The vertices of a quadrilateral are (4, -3), (7, 10), (-8, 2) and (-1, -5). Find the length of each diagonal.
The points (-6, 2), (5, -1) and (4, 4) form a triangle. Is it a right triangle? Prove that it is or it isn't.

Extensions:

1. In three-dimensional space you can extend the Pythagorean theorem to find the distance between any two points. The distance from the origin in space (0, 0, 0) to point (a, b, c) is given by the equation, distance = \sqrt{a^2 + b^2 + c^2}. What is the length of the segment between each point and the origin?
   
   a) (5, 9, 6)  
   b) (-2, 4, -7)  
   c) (4, -8, 12)

2. To find the distance between any two points in space, you will need to modify the formula used for two points in a plane. The distance formula for space looks like this:

   \[ d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2} \]

   Use this formula to find the distance between each pair of points.

   a) (4, -1, 5) and (7, 3, 7)  
   b) (3, 0, 7) and (-1, 3, 7)

3. Write a calculator program that asks you to input the endpoint values for a segment in three-space and then calculates the length of the segment.