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The Pythagorean Theorem: Prove it!!

$$a^2 + b^2 = c^2$$

The following development of the relationships in a right triangle and the proof of the Pythagorean Theorem that follows were attributed to President James A. Garfield in 1876.

President Garfield's Proof

Complete Steps 1-12 on page 1.3 of the Nspire document *presidentgarfield.tns*. Save this file in your folder under my documents. Save it here so that you have a blank copy in the transfers folder in case you make a mistake that will require you to start over.

Step 1 - Construct A horizontal line. Label the point already on the line point B.

Step 2 – Place a point on the line and label the point C.

Step 3 – Construct a perpendicular line through line BC at point B. Place a point on the perpendicular line and label it point A. Draw a line segment from point C to point A, creating the triangle ABC.

Step 4 – Construct a circle with center at point C and radius AB. Use the compass tool to draw the circle.

Step 5 – Find the intersection of the circle and line BC, label this point D.

Step 6 – Construct a perpendicular line through point D. At this point you will also want to have the students hide the circle as shown in the screen shot.

Step 7 – Construct a Circle with center D and radius BC.

Step 8 – Find the point of intersection of this circle and the vertical line through point D. Label this point E and then hide the circle.

Step 9 – Construct a Line Segment from point E to point D. Also construct a Line Segment from Point E to point C. Also construct a segment from point E to Point A.

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Step 10 - On page 1.5 complete a two column proof showing that segment EC is congruent to Segment AC.

Statements	Reasons

- You may use the table above to help with the proof, but the final proof will be entered on your handheld.

Step 11 – Once you have completed your proof and confirmed that it is correct, measure segments AB, BC, CD, DE, EC, and AC. Measure Angle ECA. It appears to be 90 degrees. Can you prove that this angle must be a right angle?

Statements	Reasons

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- You may use the table above to help with the proof, but the final proof will be entered on your handheld on page 1.6

Step 12 – Use the shapes menu to construct triangles ABC, CDE and ECA. Find the areas of each triangle using the measurement tool and record your answers below.

Triangles	**Areas of Triangles**
ABC	
CDE	
ECA	

Step 13 – Use the polygon tool under the shapes tool to construct the quadrilateral ABDE.

Can you prove that this is a trapezoid? Which sides are the parallel bases of the trapezoid? Which side is the height?

- You may use the table above to help with the proof, but the final proof will be entered on your handheld on page 1.7

Statements	Reasons

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Step 14 – Next you will need to measure the area of the trapezoid ABDE. Does the area of the trapezoid equal the area of the three triangles ABC, CDE, and ECA?

Step 15 – Next you will need to find 5 classmates and compare the areas of their triangles and trapezoids. Is your equation (ABDE = ABC + CDE + ECA) holding? Fill in your measurements for line 1 and then 5 classmates for lines 2-6.

Triangles	**ABC**	**CDE**	**ECA**	**Trapezoid ABDE**
Measurement 1				
Measurement 2				
Measurement 3				
Measurement 4				
Measurement 5				
Measurement 6				

Step 16 – In order to complete the proof, you need to label the diagram on the next page as follows:

AB = DC = x

BC = ED = y

EC = AC = z

You will need to show that $x^2 + y^2 = z^2$

How can you finish up the proof?

(Hint) Go back and figure the areas of the triangles and the trapezoids in terms of x, y, and z. You will need the formulas for each shape. Then use the equation ABDE = ABC + CDE + ECA

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