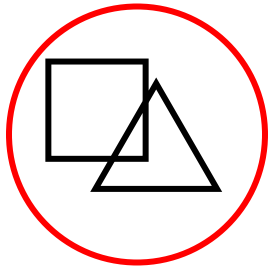
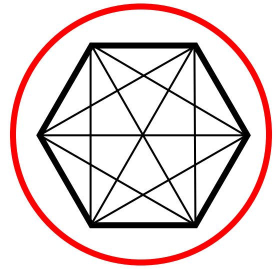
A+ Compass™

The Haberdasher Problem



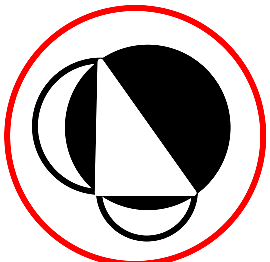


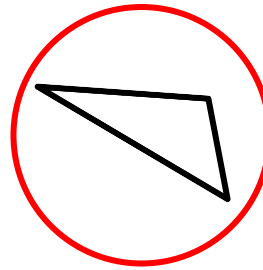
Distinct Diagonals of Regular Polygons

Problems & Puzzles in Plane & Solid Geometry

[click on a link]

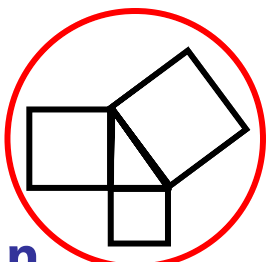
The Pythagorean Set #2

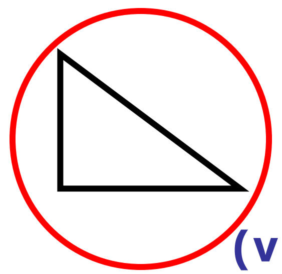




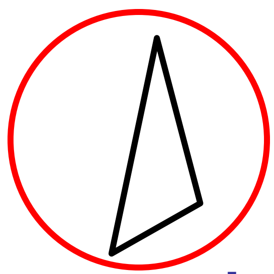
Constructing the Centroid
(with Math-Vu Mirror)

The Pythagorean Set #1





Constructing the Centroid
(verify with A+ Pedestal)



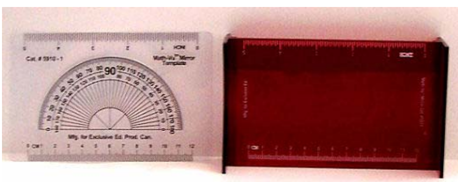
Constructing the Centroid
(by hanging figure)

A+ Compass™

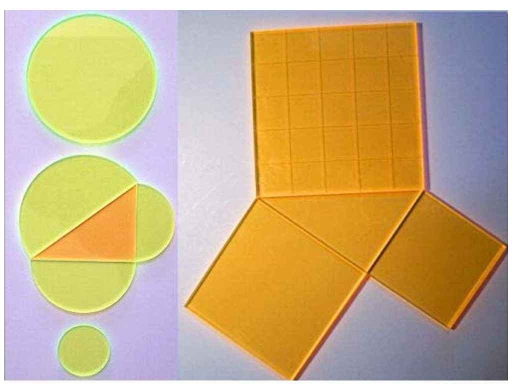
WEBSITE: www.apluscompass.com

RESOURCES:

Math-Vu Mirror



Exploring Right Triangles Set

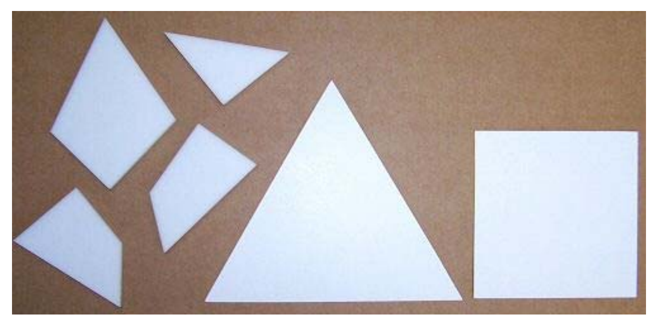


Centroid Set

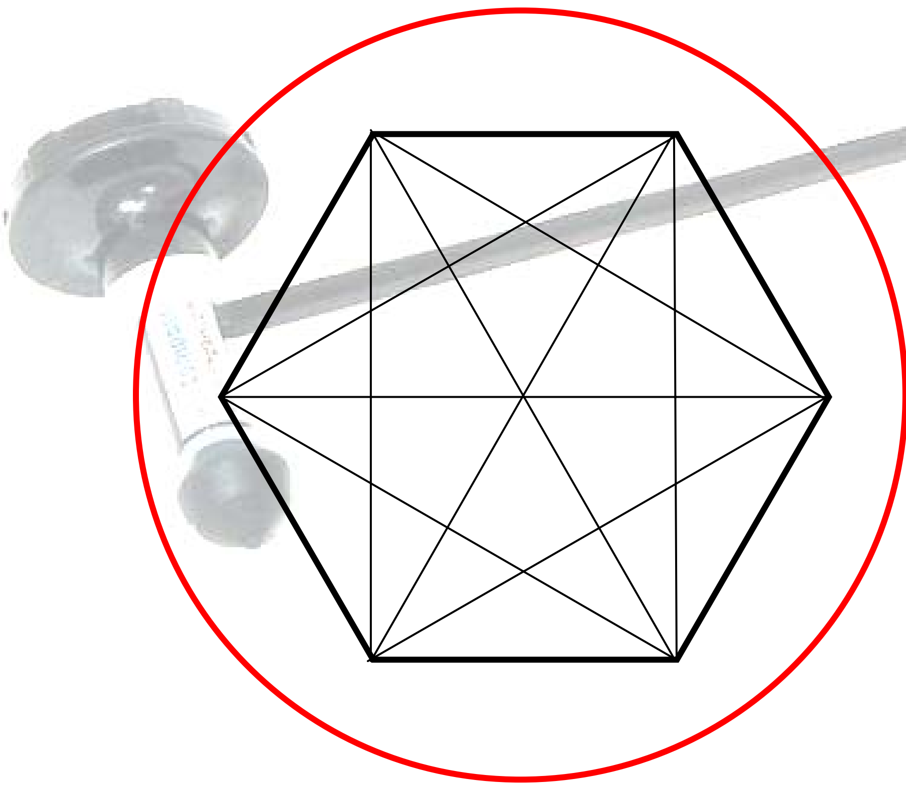
(Pedestal &

A+ Compass™ CD #2

Haberdasher Set



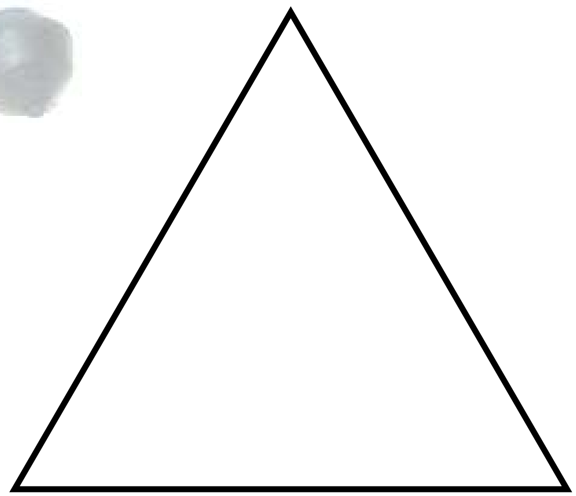
A+ Compass™



Distinct Diagonals of Regular Polygons

[return to start page]

In each of the polygons below, use a straightedge to draw as many distinct diagonals as possible and write that number in the space below each figure.



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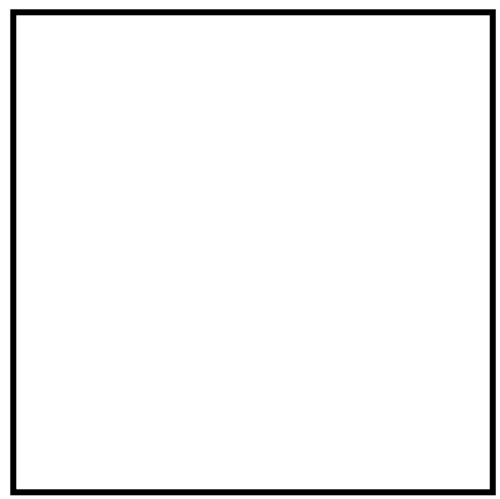

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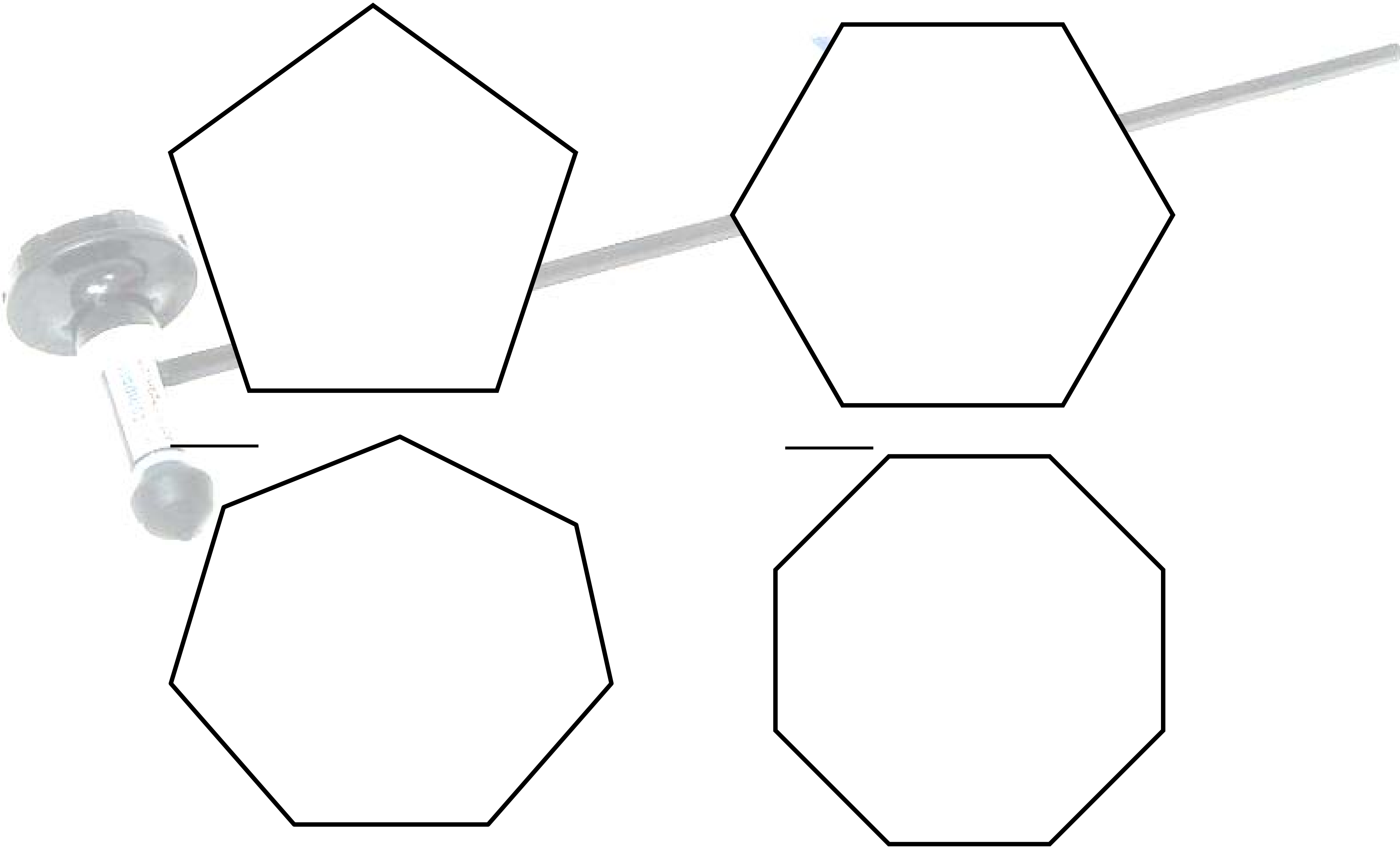
Diagonals of Regular Polygons



______ ______

______ ______

[return to start page]

Predict the number of distinct diagonals in a regular nonagon (9-sided polygon): ______________________

What equation relates the number of diagonals to the number of sides of these regular polygons?

____

Use your TI-83 to find this equation

[return to start page]

How does the number of sides in these regular polygons compare to the number of vertices? ______

____

____

When is the number of diagonals equal to zero? ____

____

____

Why do you need to divide by two in this equation?

____

____

____

[return to start page]

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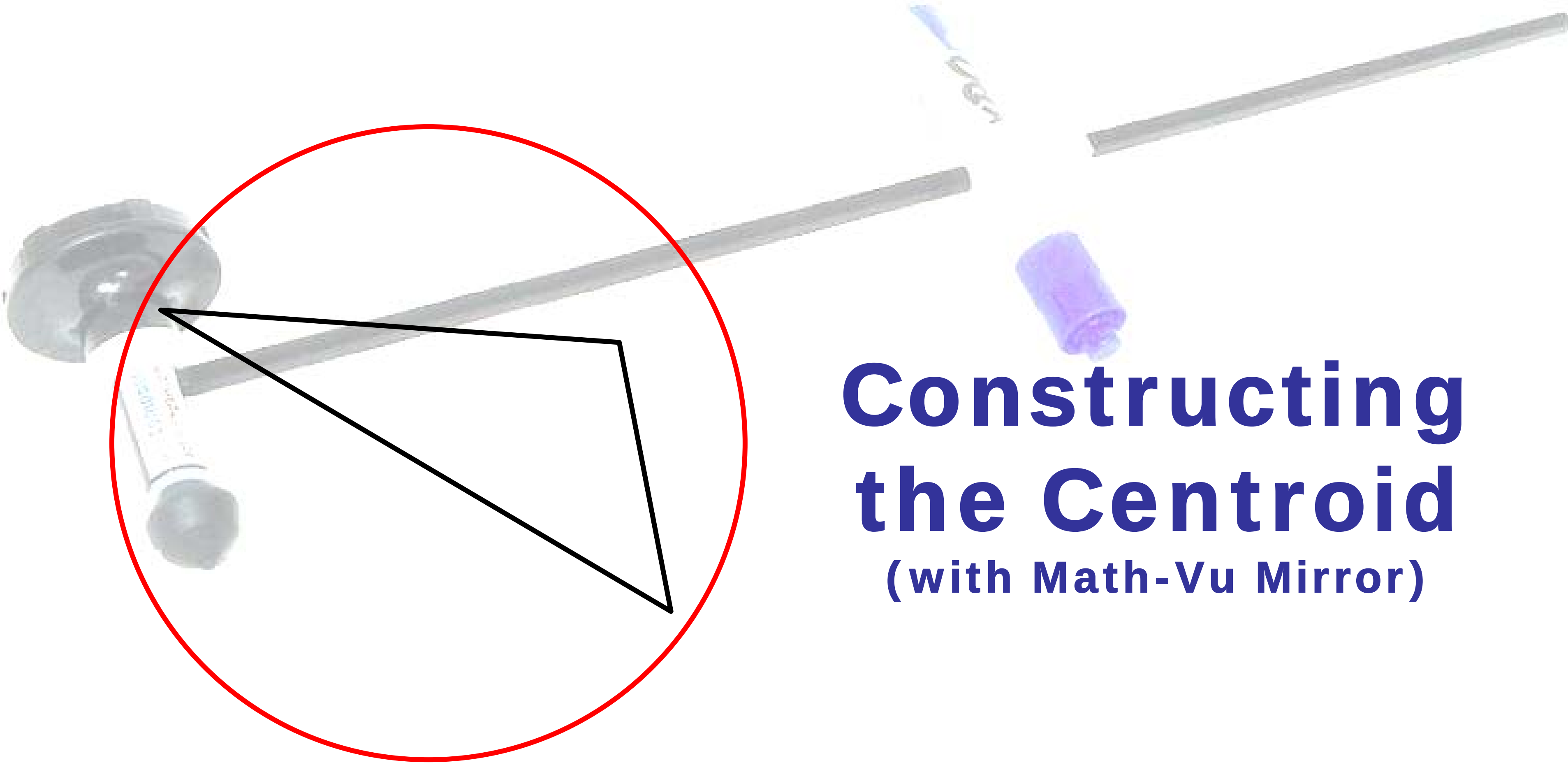
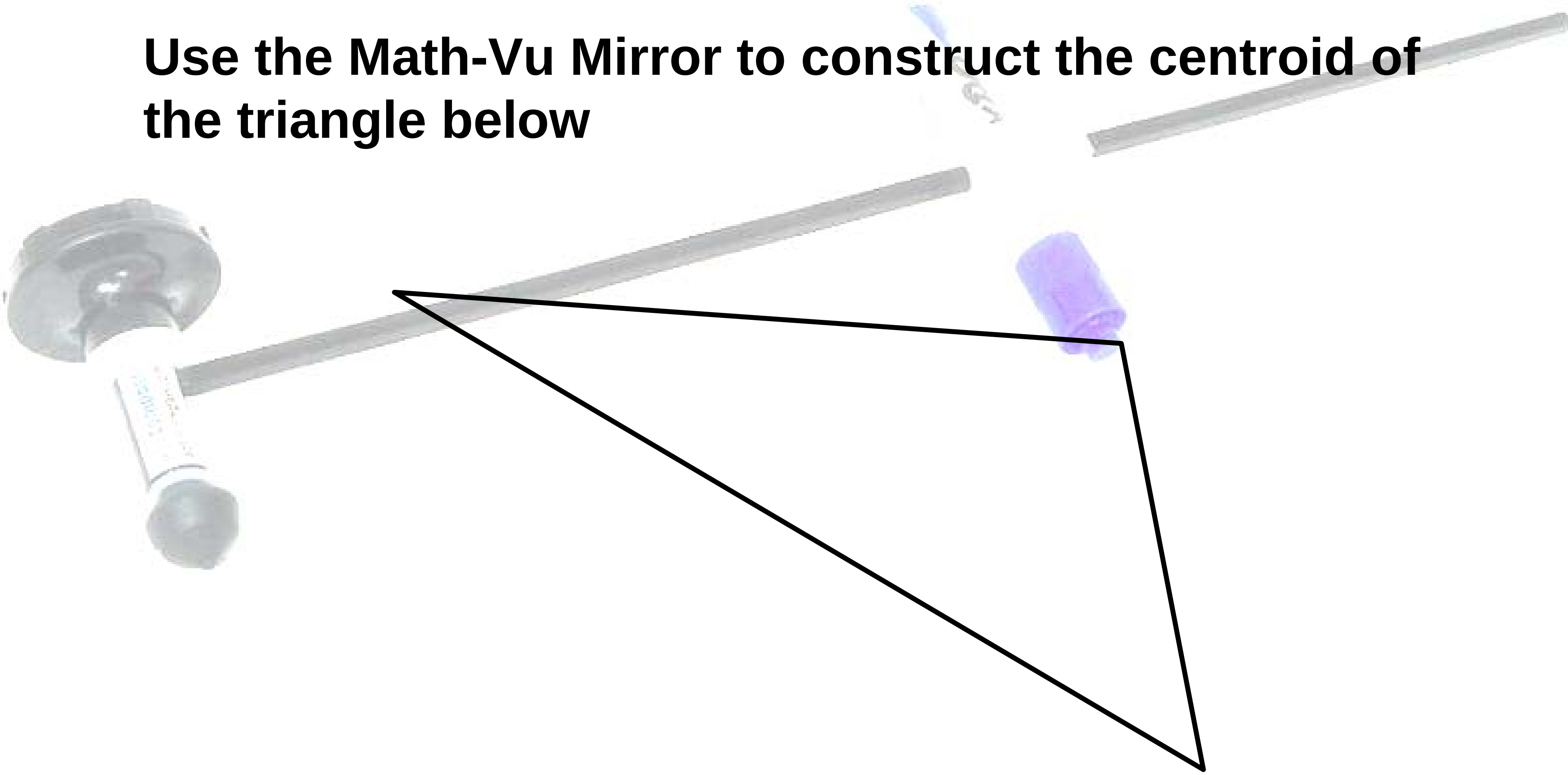


Constructing the Centroid

(with Math-Vu Mirror)

[return to start page]

Use the Math-Vu Mirror to construct the centroid of the triangle below



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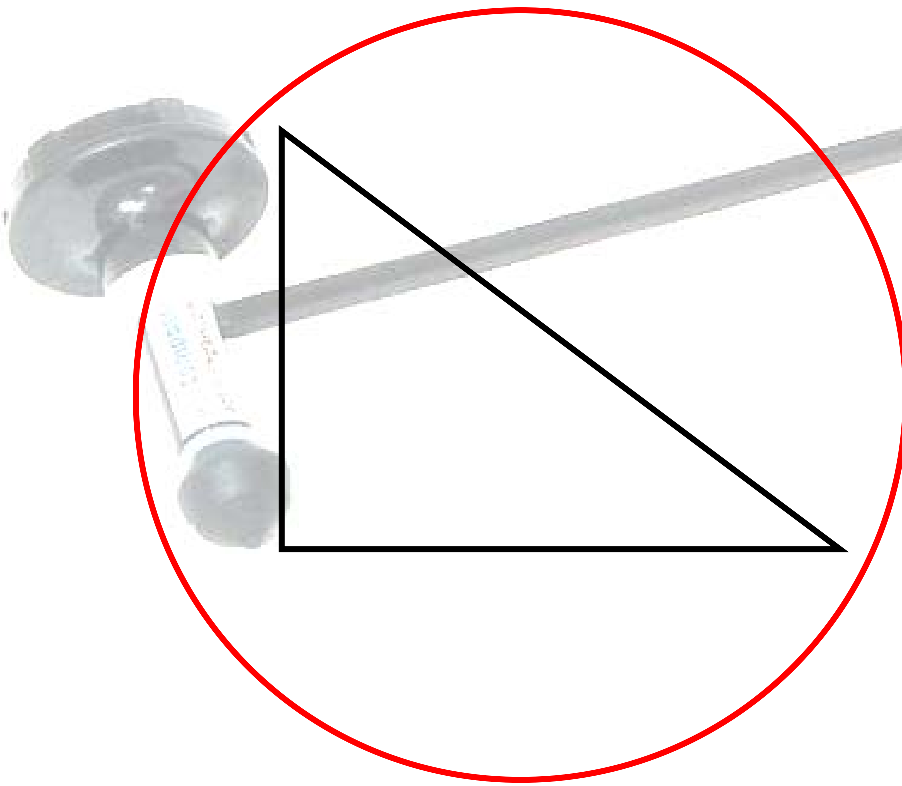
A+ Compass™



Constructing the Centroid

(verify with A+ Pedestal)

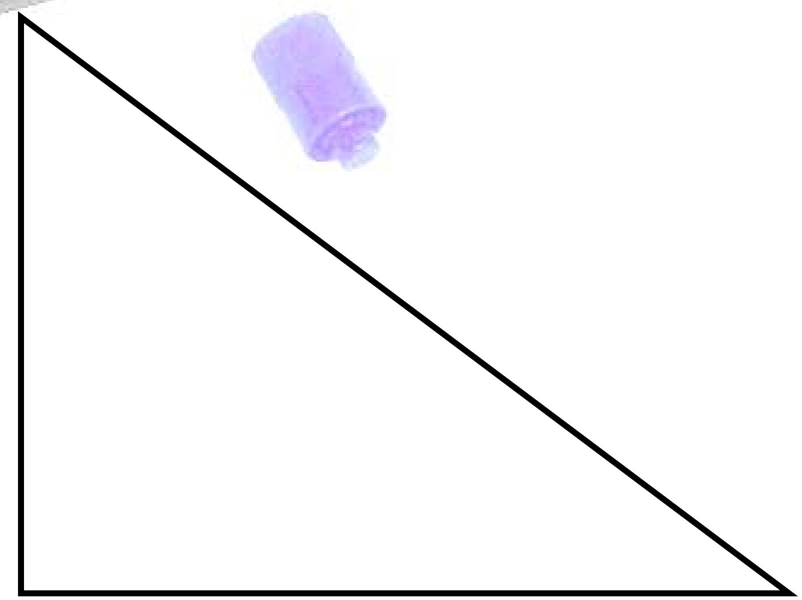
[return to start page]

A+ Compass™

Constructing the Centroid

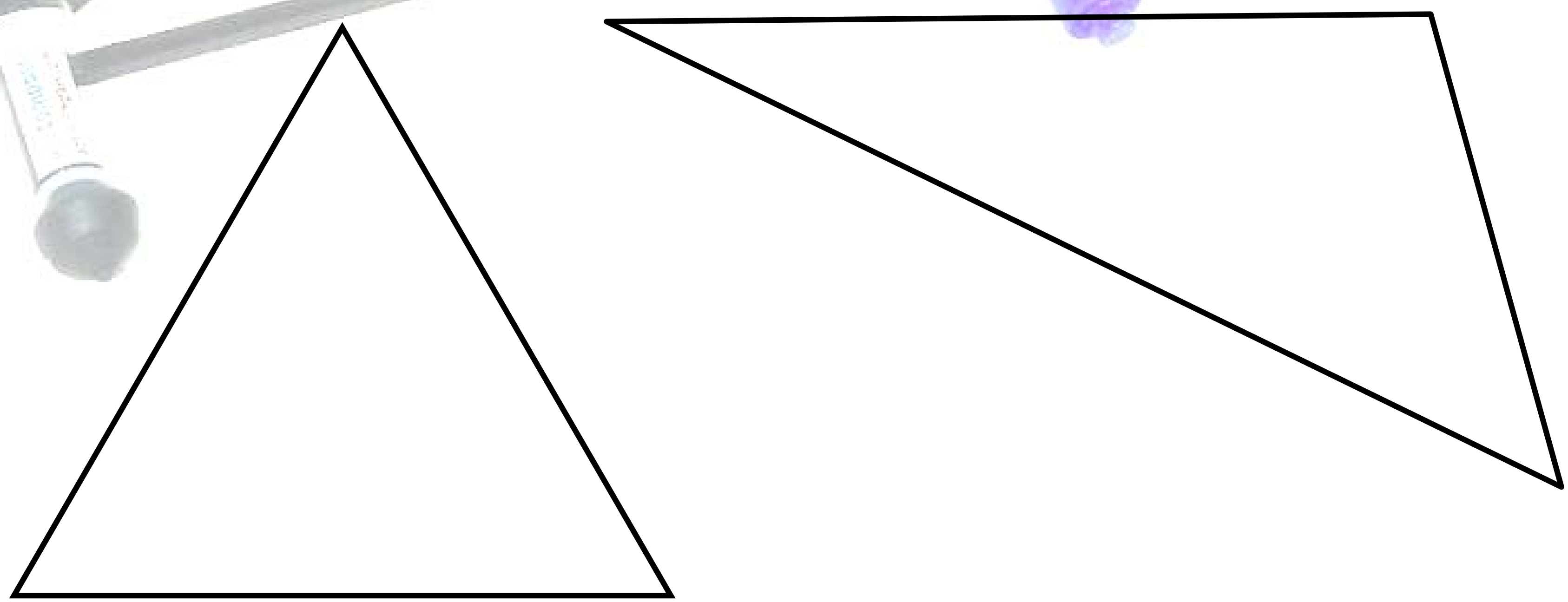
Use compass and straightedge to construct the centroid of the triangle below.

Because the centroid of a triangle coincides with its center of gravity, the triangle should balance at this point when placed on the A+ pedestal.



[return to start page]

Use compass and straightedge to construct the centroid of each triangle below. Verify the centroid by balancing on the A+ pedestal



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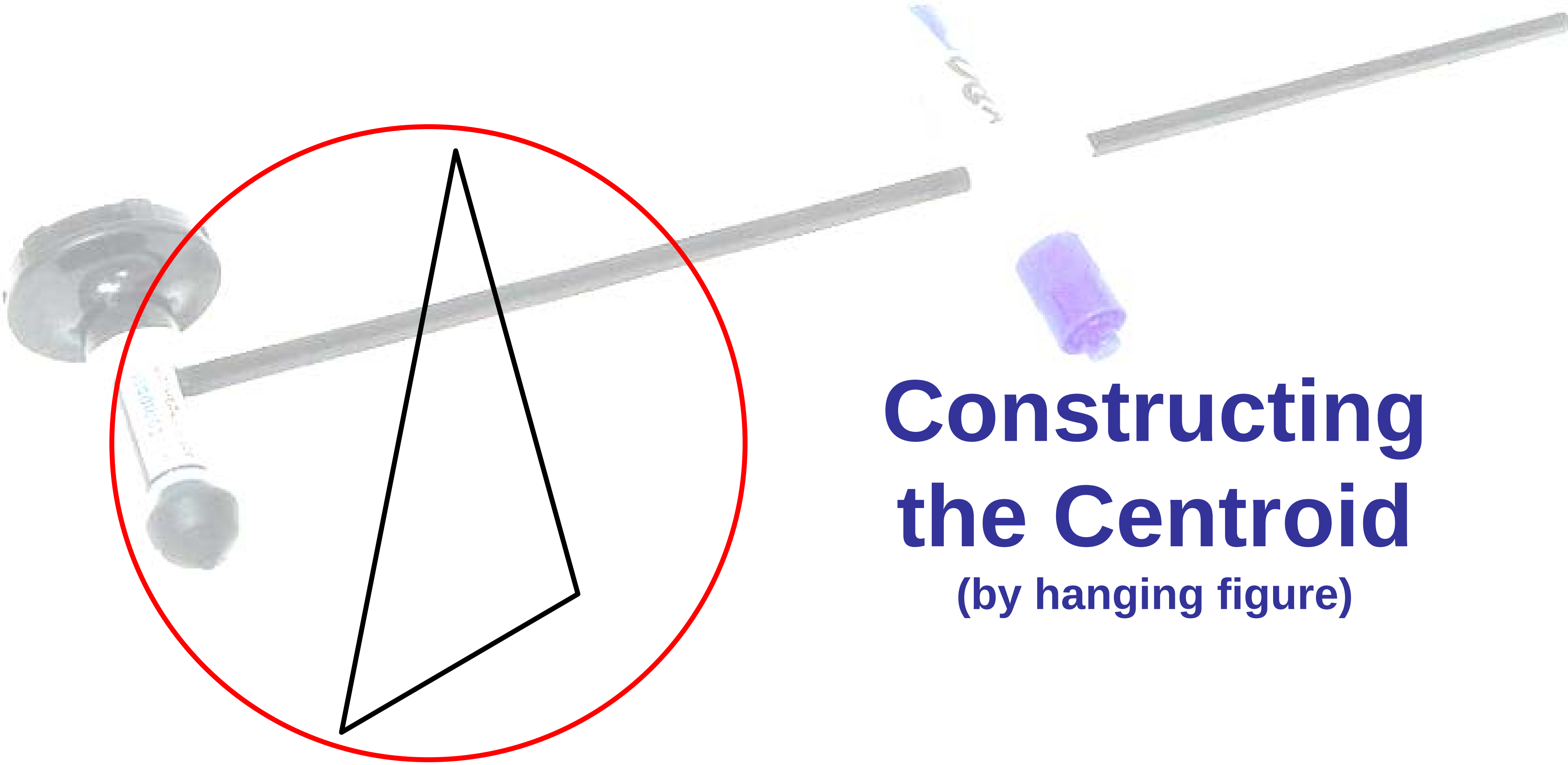


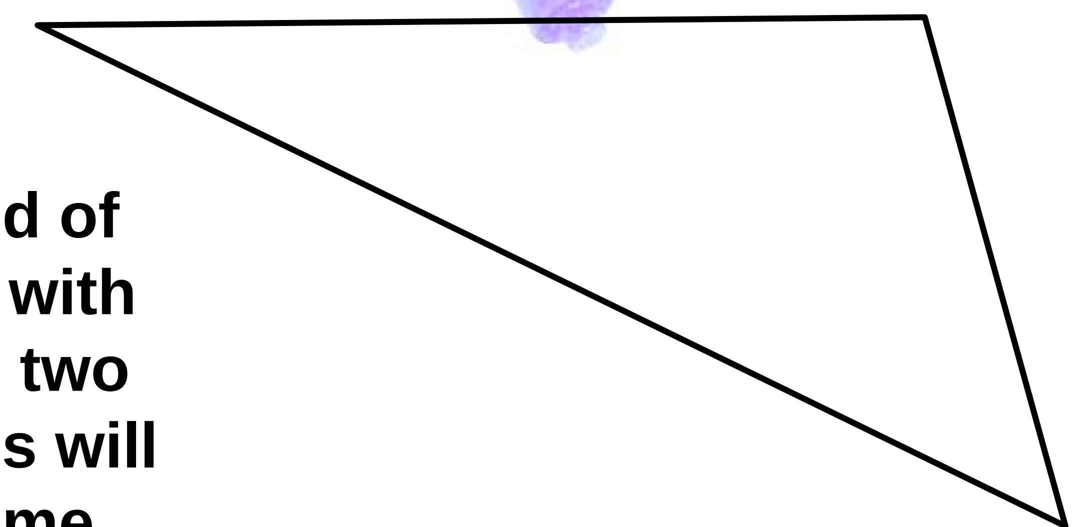
Constructing the Centroid

(by hanging figure)

[return to start page]

Constructing the Centroid

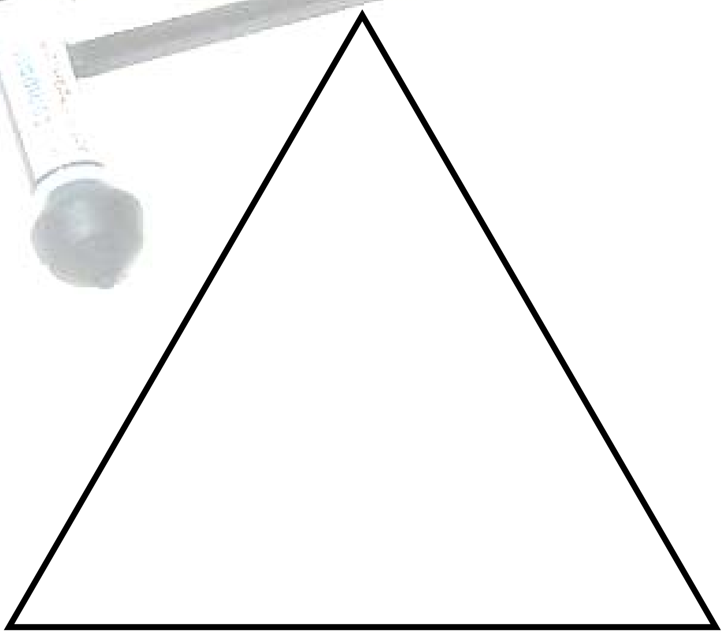
Hang each triangle from the pre-drilled holes and mark the vertical lines on the triangle to construct the centroid of the triangle below.

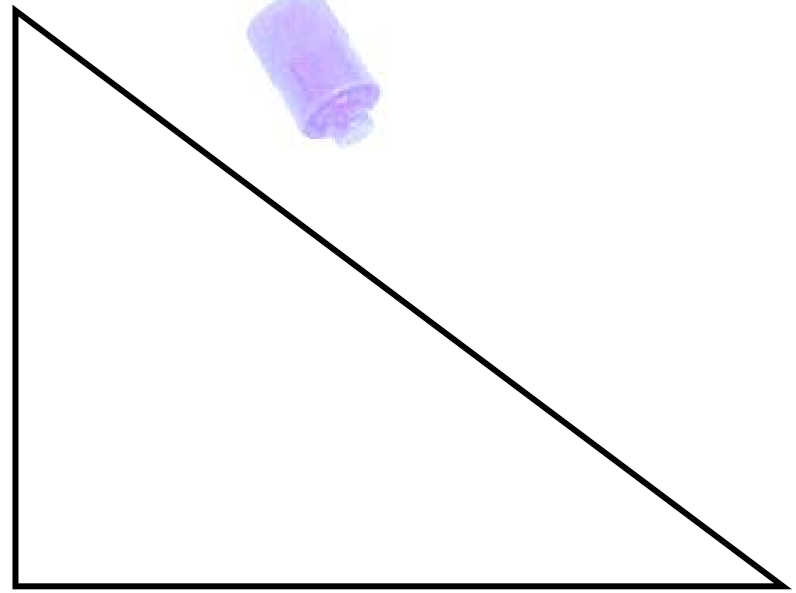


Because the centroid of a triangle coincides with its center of gravity, two or more vertical lines will pass through the same point.

[return to start page]

Hang each triangle from the pre-drilled holes to construct the centroid of each triangle below. Verify the centroid by balancing on the A+ pedestal





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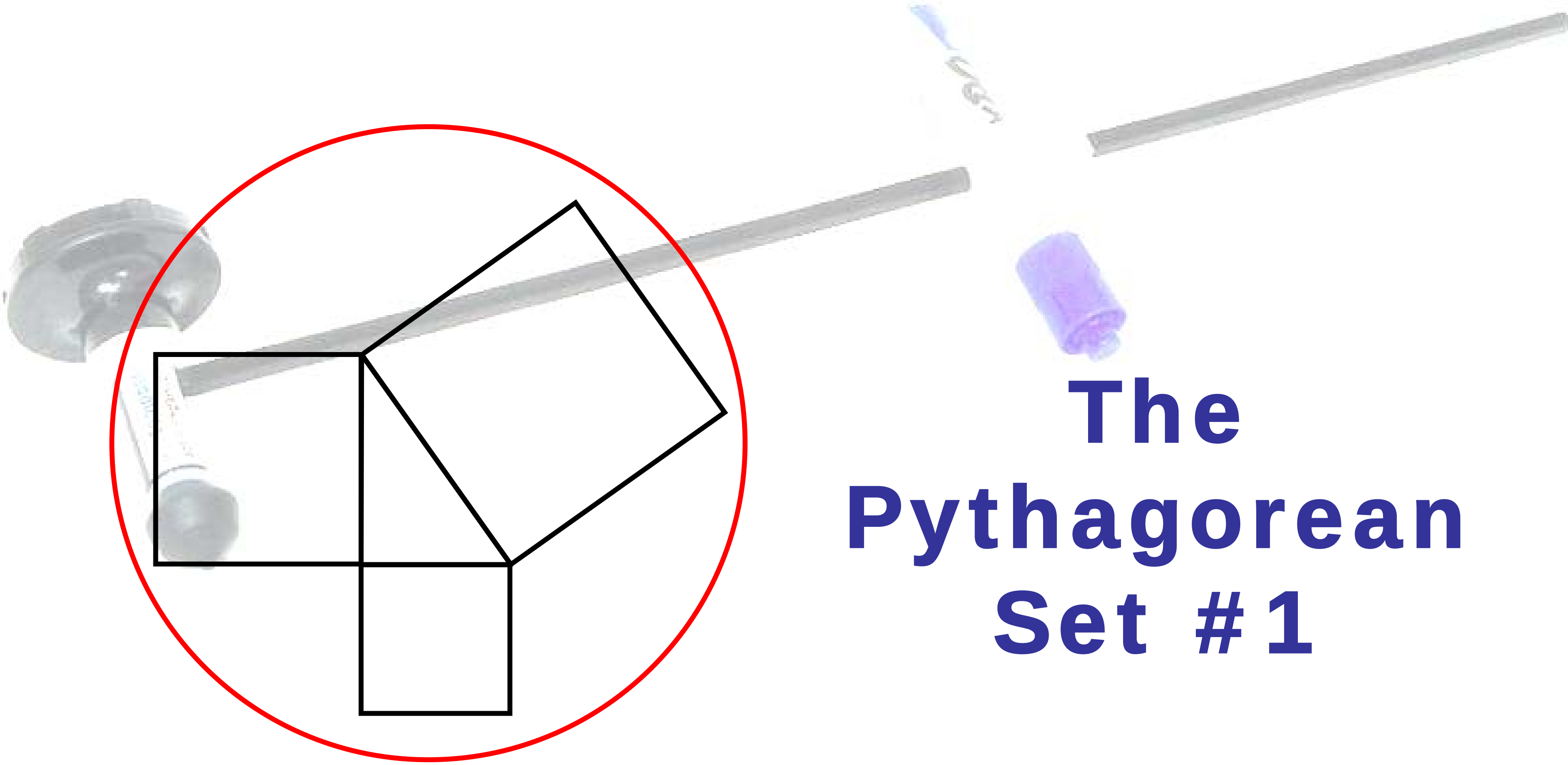

The Pythagorean Set #1

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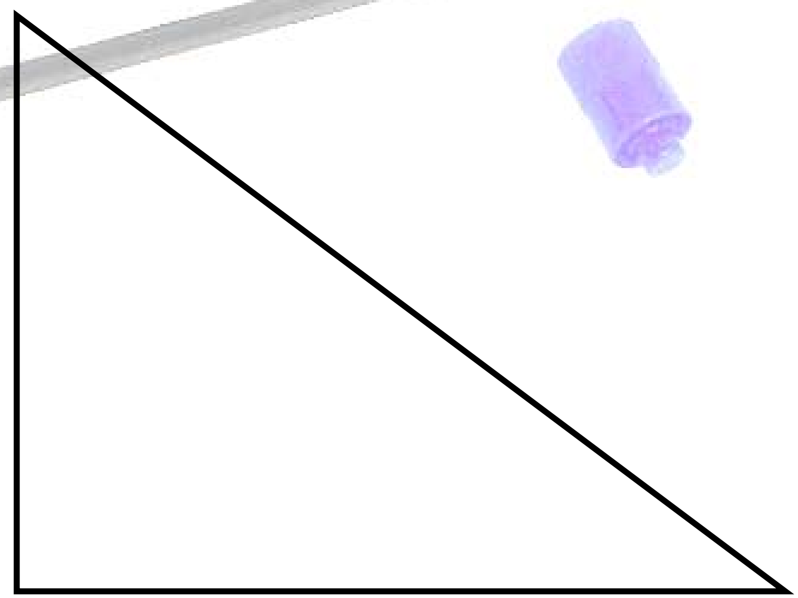
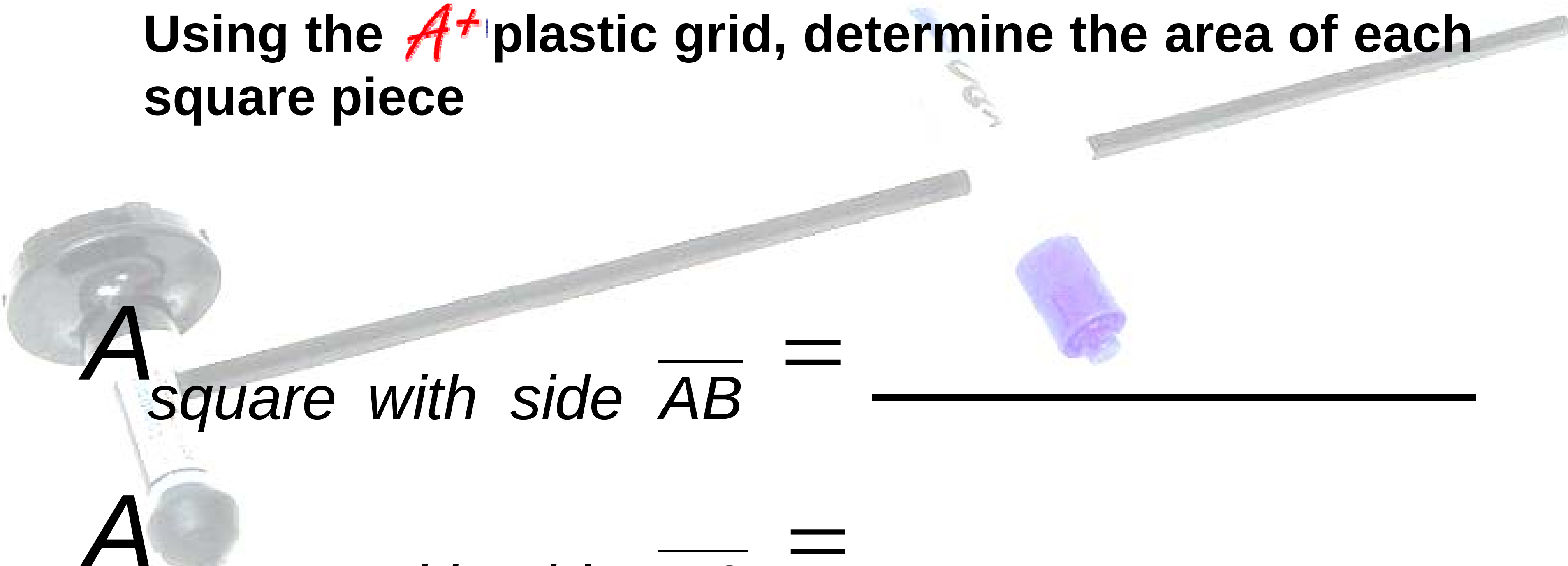
Place the appropriate A+ square pieces along each side of the triangle below



[return to start page]

Using the A+ plastic grid, determine the area of each square piece



$$A_{\text{square with side } \overline{AB}} = \underline{\hspace{6cm}}$$

$$A_{\text{square with side } \overline{AC}} = \underline{\hspace{6cm}}$$

$$A_{\text{square with side } \overline{BC}} = \underline{\hspace{6cm}}$$

[return to start page]

What relationships exist between these measures?

____

____

More specifically, what is the relationship between the sum of the areas of the squares on the legs and the area of the square on the hypotenuse?

____

____

____

[return to start page]

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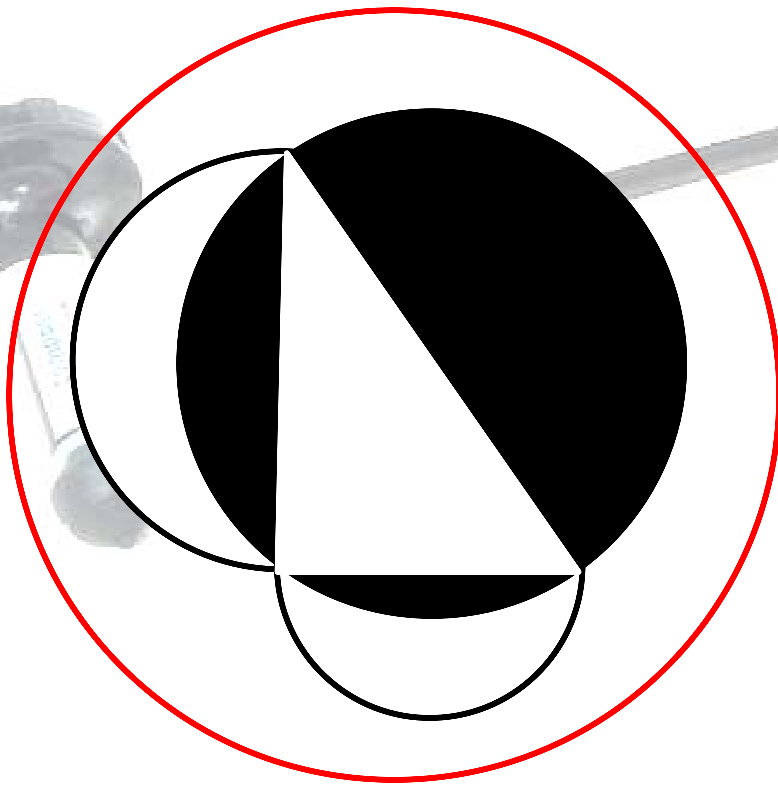
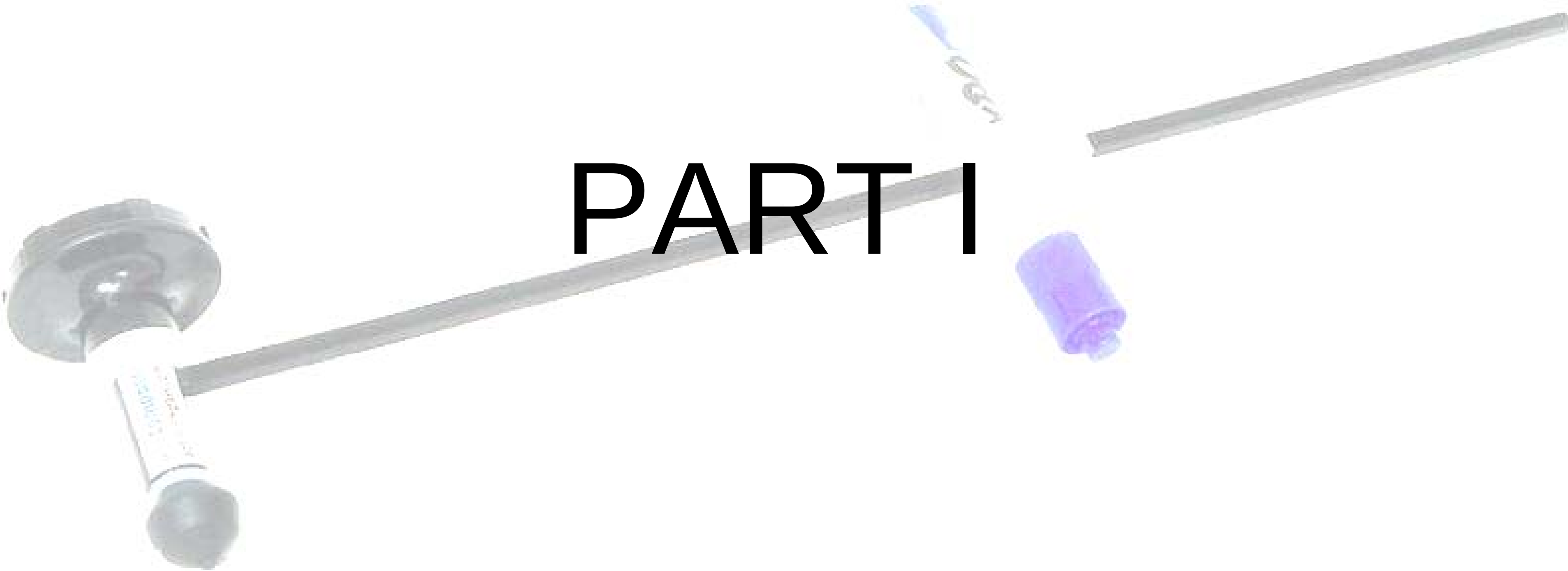


The Pythagorean Set #2

[return to start page]



PART I

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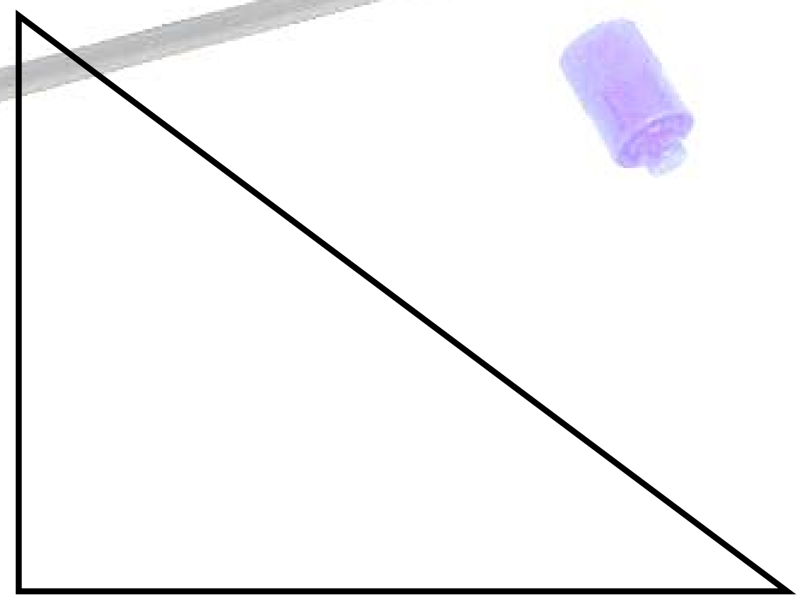
A+ Compass™

The Pythagorean Set #2

Place the appropriate A+ semicircle pieces along each side of the triangle below



[return to start page]

Using the A+ plastic grid to determine the diameter & radius of each semicircle piece, find the areas below.

$$\left(A_{semicircle} = \frac{1}{2}\pi r^2 \right)$$

$$A_{semicircle\ \ with\ \ diameter\ \ \overline{AB}} = \underline{\hspace{6cm}}$$

$$A_{semicircle\ \ with\ \ diameter\ \ \overline{AC}} = \underline{\hspace{6cm}}$$

$$A_{semicircle\ \ with\ \ diameter\ \ \overline{BC}} = \underline{\hspace{6cm}}$$

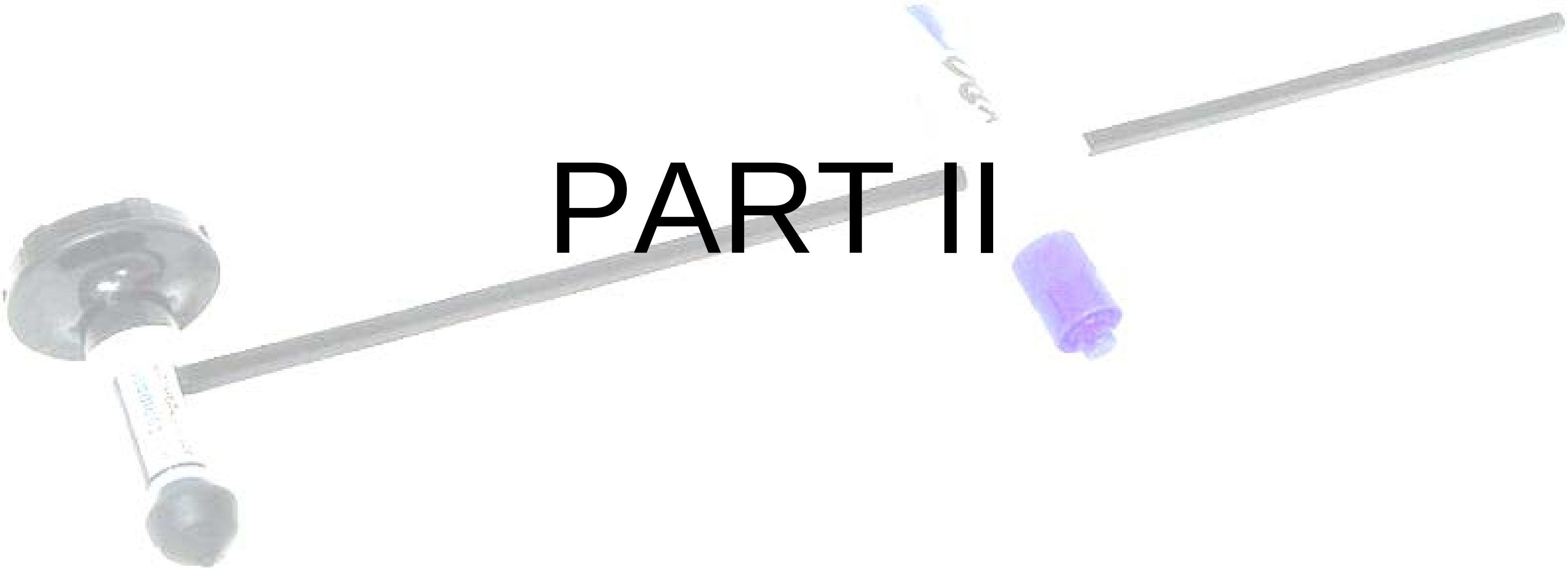
[return to start page]

What relationships exist between these measures?

More specifically, what is the relationship between the sum of the areas of the semicircle on the legs and the area of the semicircle on the hypotenuse?

[return to start page]

PART II



[return to start page]

A+ Compass™

The Pythagorean Set #2

The previous activity shows that you can replace the squares on each side of the triangle with any similar figures (like the semicircles).

This idea can be extended to demonstrate that the lunes formed on the legs of a right triangle have an area equal to the triangle itself.

Superimpose the large circle over the semicircle on the hypotenuse to view the lunes formed.

Confirm this relationship in The Geometer's Sketchpad®.

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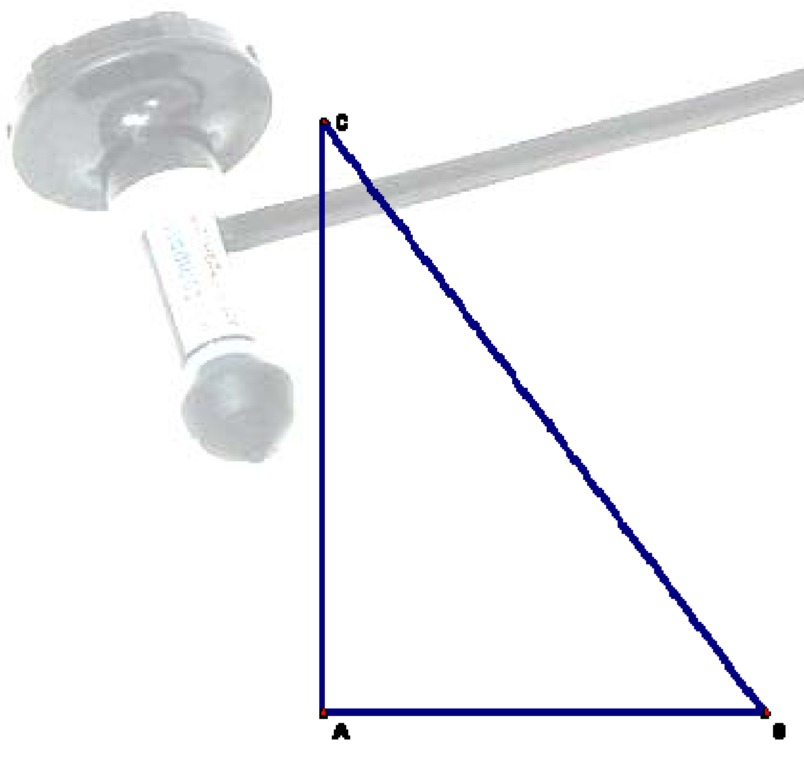
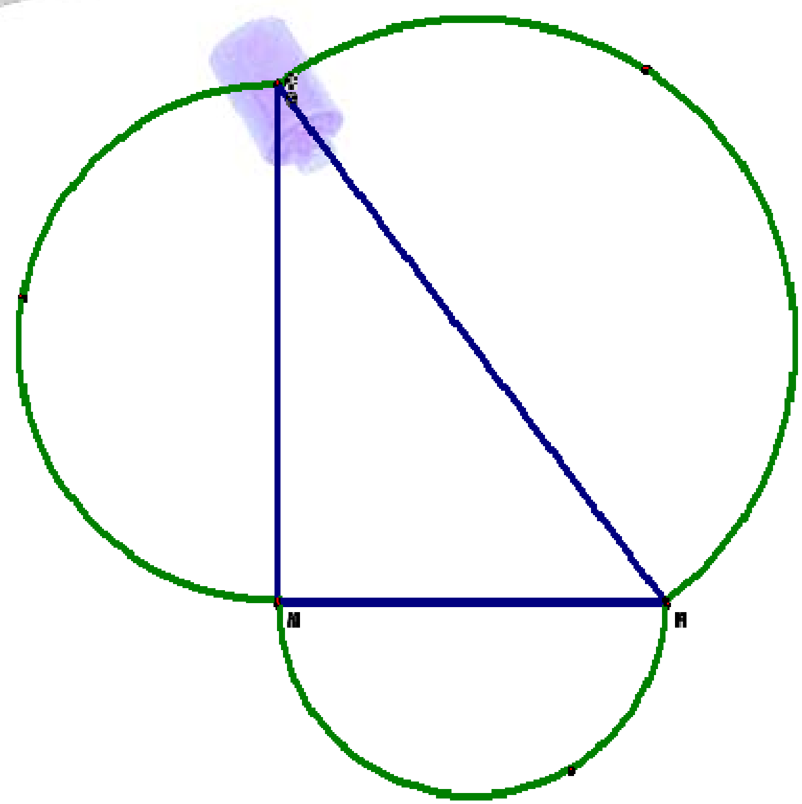
Construct a 3-4-5 right triangle



Place semicircles on each side of the triangle



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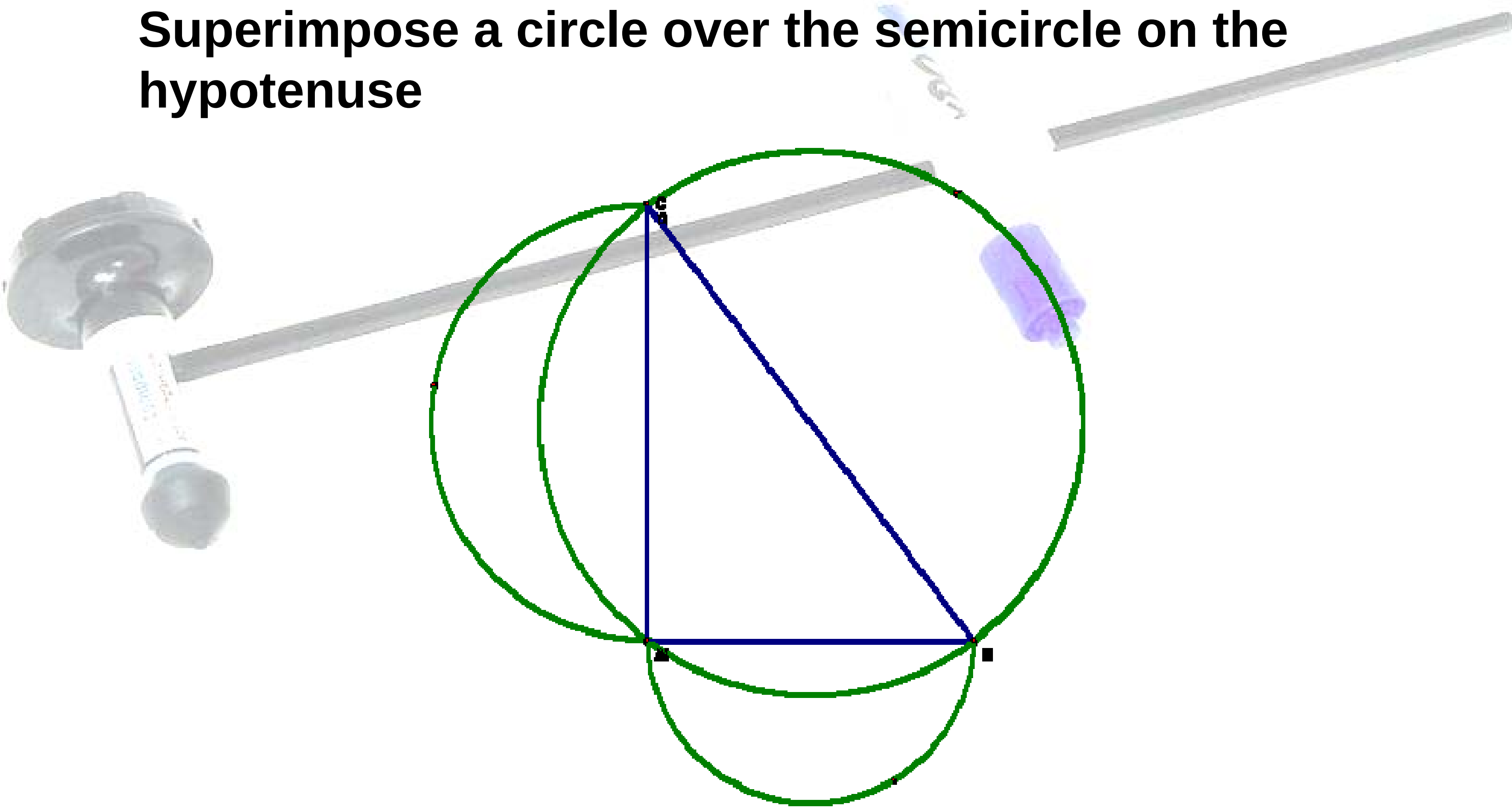
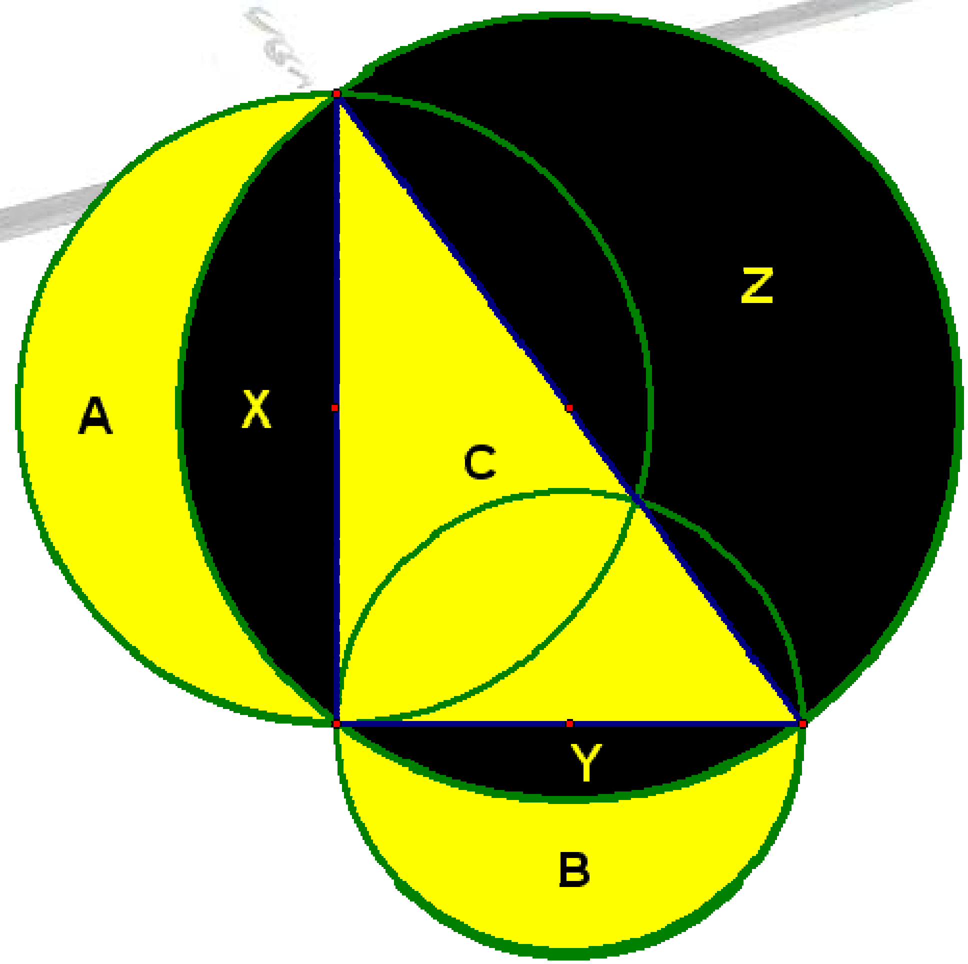
Superimpose a circle over the semicircle on the hypotenuse



The Pythagorean Set #2

Find the area of the lunes (A and B) formed on each leg of the right triangle and compare to the area of the right triangle itself (C)



Area of lune A:

____

Area of lune B:

____

Area of right triangle C:

____

Area of lune A + Area of lune B: __________________________

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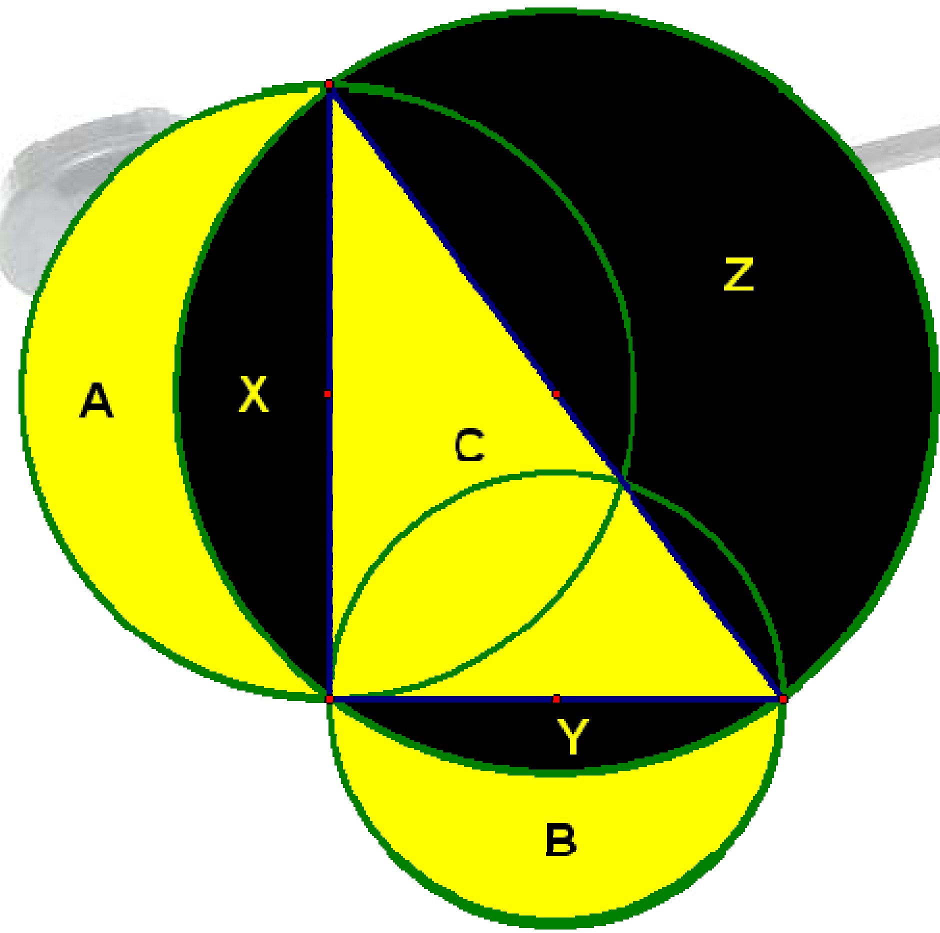
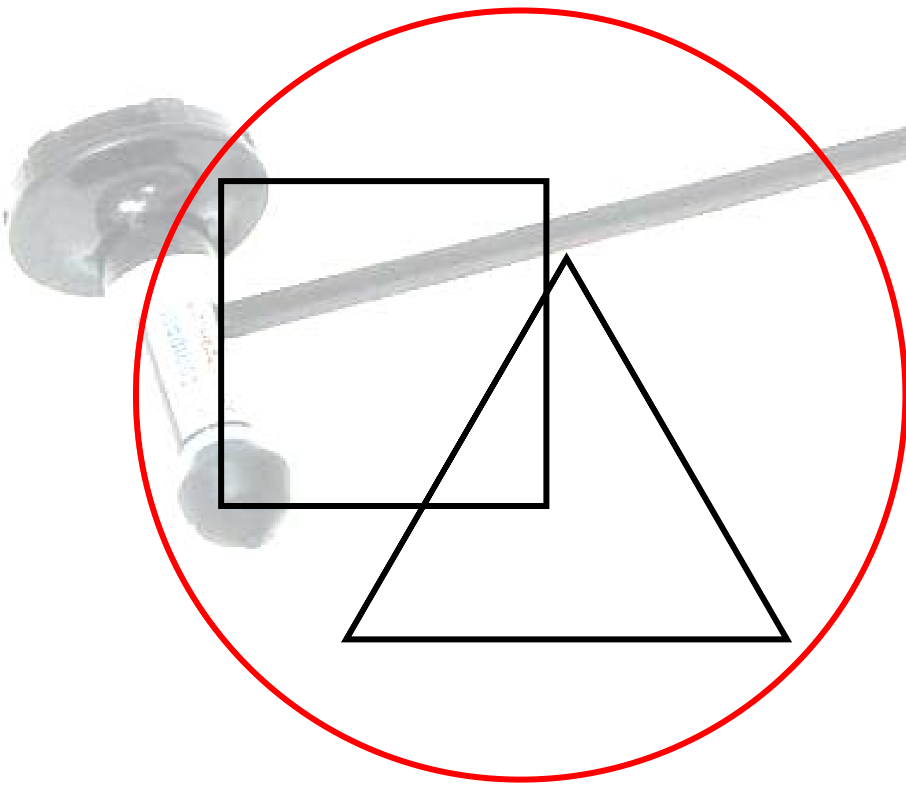
Confirm this with a proof:





The Haberdasher's Problem

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In PART I of this activity, you will use the 4 Haberdasher plastic pieces provided.

For the first part of this activity, you will arrange these pieces into an equilateral triangle. This is the beginning arrangement for the Haberdasher's Problem.

In the second part of this activity, you will arrange these pieces into a square. This is referred to as the Haberdasher's Problem – converting an equilateral triangle into a square.

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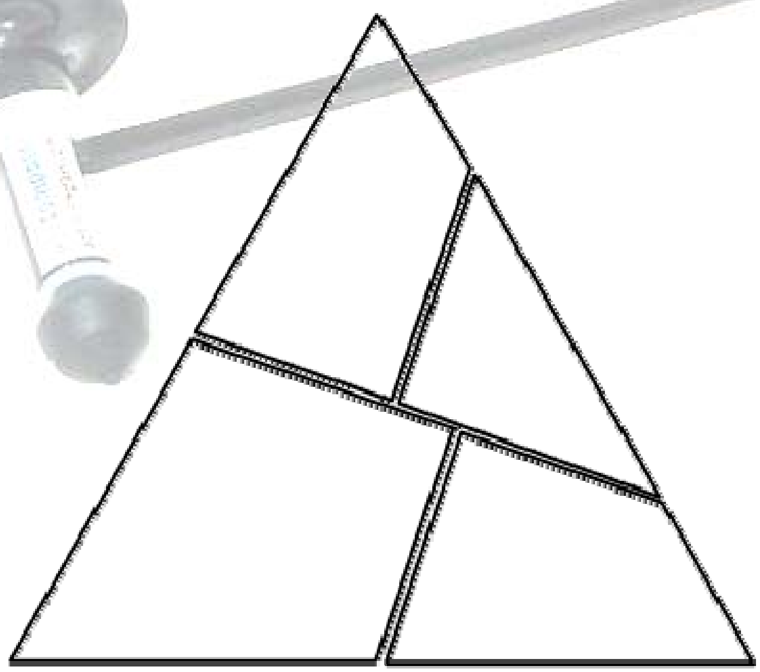
SPOILER ALERT:

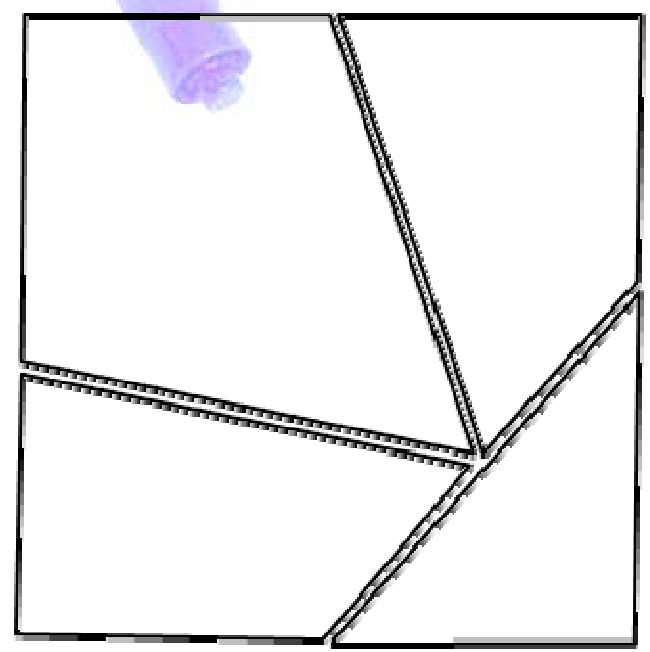
The solution guide to each of these problems is printed on the next slide.

SOLUTION TO ARRANGING PIECES

INTO AN EQUILATERAL TRIANGLE:



INTO A SQUARE:



[return to start page]