**Essential Elements of a Geometry Proof…………………**

**Computer Lab 2 periods**

* **Each group member has the same color marker. You will start as a group and then break out to the computers in pairs. Find your team!**



 One of the oldest surviving fragments of Euclid’s Elements.

Geometric proofs can be written in one of two ways: two column, or a paragraph. A paragraph proof is essentially a two-column proof written in sentences. However, since it is unfortunately easier to leave steps out when writing a paragraph proof, we'll learn the two-column method first.

**Even though each proof problem you do is different, there are patterns and structure we can look for in each problem we solve. Our goal is to identify essential elements of writing a two column geometry proof.**

**With your group (same marker color) identify and list what you think are essential elements of a “proof”. Write these on the paper provided. Do this without debate or conversation. So, no chit chat. Don’t worry about being right or wrong… we are going to revise this later.**

**Exploring the Proof Process**

There are many ways to think our way through the proof process. **We need to think about our thinking.**

The type of reasoning used in a proof is called DEDUCTIVE reasoning.

Definition : A system of reasoning to reach conclusions that must be true whenever the assumptions on which the reasoning is based are true.

**Activity 1 – DO AS A GROUP**

Go to my website and select Essential Elements of a Proof –LAB link. This will open the printed document. Use the links below to get to where you need to be.

**ACTIVITY 1 DEDUCTIVE REASONING**

Do you think you have used deductive reasoning before? \_\_\_\_\_\_\_\_

<http://www.glencoe.com/sites/common_assets/mathematics/nat_geo_2010/interactive_lab/G_02/G_02_dev_100.html>

1. Read the OPENER. Click on the forward button



2. Then click on the deductive reasoning button.

**Connecting to Algebra… your past experience connects to geometry and proof.**

3. The blue buttons advance through the steps of the problem.



 Think about your steps as you solve the equation… you are only allowed to use properties that are TRUE and therefore allowed to be used when solving an equation. Follow the RULES of ALGEBRA! Deductive reasoning leads you to the solution.

**When you are done, click the forward button again.**

4. Next solve ALL three problems. **Do the quiz.**

Think about your thinking! Apply deductive reasoning!

 Solve the equation and identify your thinking! List the reasons at EACH step.

 Given: 5x + 8 = 13 - 2x

So, you have been using deductive reasoning through your equation solving experience!

**Activity 2**

Next, let’s apply this to geometric proof. Select the link below to get to the activity.

**ACTIVITY 2 TWO COLUMN PROOF**

[**http://www.glencoe.com/sites/common\_assets/mathematics/nat\_geo\_2010/interactive\_lab/G\_04/G\_04\_dev\_100.html**](http://www.glencoe.com/sites/common_assets/mathematics/nat_geo_2010/interactive_lab/G_04/G_04_dev_100.html)

* **Proofs and Congruent Triangles. Click the forward button and start the proofs.**

**You will be using deductive reasoning at each step to complete each proof.**

**Copy your work for the proof I selected.**

**Use your colored pencils to mark the information in the diagram!**

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 **THINK ABOUT YOUR THINKING PROCESS!**

![C:\Users\Owner\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\3NXKRPFJ\MM900323763[1].gif]()Did you **apply** some of the essential steps to proof that you identified at the start of today? Are you doing more than what you listed? Keep those in mind.

An essential element of proof is deductive reasoning!

**Activity 3**

Next, go to the link for **ACTIVITY 3 TWO COLUMN PROOFS**

**If the link below fails, then copy and paste it into Chrome.**

[**http://feromax.com/cgi-bin/ProveIt.pl**](http://feromax.com/cgi-bin/ProveIt.pl)

**Scroll to the bottom and look for**

![C:\Users\Owner\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\2WZN7A50\MC900281333[1].wmf]()

**Work your way through each proof 1-3.** These may get challenging.

Copy your work for the proof I selected below:



 Your diagram NEEDS to be drawn ( essential)

**Activity 4 Finally……Compare to other groups**

**Get back with your MARKER group and revise your list of essential elements of a proof. Now it’s time to chit chat!**

Give greater detail to each element you listed. For example, make connections between ideas, draw arrows to connect, etc… Have discussion.

![C:\Users\Owner\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\9EN6YEYL\MC900423171[1].wmf]()When the teacher gives the signal, move to another group’s paper and do the same thing. Write on the paper in the color you have been given and add to the work of the group. If you have nothing else to add to the paper you are on, then put a smiley face on it. A smiley face indicates you have nothing left to add and you completely agree with what is written.

When we are done we will have shared as class our ideas of essential elements of a two column geometry proof.

Teacher Check list for Essential Elements of a Two Column Proof

1. Draw the figure that illustrates what is to be proved. The figure may already be drawn for you, or you may have to draw it yourself.
2. List the given statements, and then list the conclusion to be proved. Now you have a beginning and an end to the proof.
3. Mark the figure according to what you can deduce about it from the information given. This is the step of the proof in which you actually find out how the proof is to be made, and whether or not you are able to prove what is asked. Congruent sides, angles, etc. should all be marked so that you can see for yourself what must be written in the proof to convince the reader that you are right in your conclusion.
4. Write the steps down carefully, without skipping even the simplest one. Some of the first steps are often the given statements (but not always).
5. Write the conclusion, the statement that you set out to prove.

Or

Source:

<http://www.wikihow.com/Write-a-Congruent-Triangles-Geometry-Proof>

I added to some of these. This source is a nice resource. Give to students if their lists are incomplete.. or help prompt the conversation to completeness.

Writing math proofs can be the hardest part of geometry, but they are essential. Every geometry course has a proofs section or unit, and congruent triangle proofs take up a large portion and take time to master. Since the process may depend on your triangles and your givens, you rarely follow exactly the same process, which can get very frustrating. But there is an overall pattern, and following these guidelines will help.

**Look for patterns and structure. Be precise in your reasons. Add to support MP ( me)**

**Set up a two-column proof format.** The the left-hand column should be labeled "Statements" and the right-hand column labeled "Reasons."

**Copy the diagram onto your paper, especially if the teacher requires you to do so.**

**List your givens as the first step in your statements column.** Under the reasons column, you should write "given."

**Translate the givens into useful information.** For each given, you'll want to think what you could do with that knowledge. At this point in the proof, most of your reasons will be definitions.

* If the one of the givens is "Point C is the midpoint of AB," your statement would read "AC = CB" and your reason would be "Definition of midpoint," or the full theorem: If a segment has a midpoint, then it divides the segment into two congruent parts.
* If segment XY bisects segment NM, and P is the point where XY intersects NM, your statement would read "NP = PM" and your reason would be "Definition of bisector," or the full theorem: If a segment is bisected, then it is divided into two congruent parts.
* If the givens say "KL is perpendicular to HJ," your statement would be "Angle KLH is a right angle." Your reason would then be: If two perpendicular lines intersect, then they form right angles. After this, you would reference the step that says "KL is perpendicular to HJ," and write the number in parentheses next to the reason. The letters will depend on the diagram, which is one reason why the diagram is important.

**Look for any isosceles triangles in the diagram based on your givens.** Isosceles triangles are triangles that have two legs of equal length. Write the two legs are congruent as a statement citing "Definition of isosceles" as the reason.

**Look for parallel lines.** If a third line runs through both of them, it will form alternate interior angles and corresponding angles. These are quite common in triangle proofs. The overall shape formed by the angles looks like a the letter "Z " or “N” or “F”

* Write in your statements column that those angles are congruent to each other with the reason being "Alternate interior angles are congruent when lines are parallel" or "Corresponding angles are congruent when lines are parallel."
* Do not use reasons such as "Definition of parallel" or "Definition of alternate interior angles." These are not valid proof reasons!

**Look in the diagram for vertical angles.** Vertical angles will form an X and are the angles across from each other, touching at the center but not along their sides. These vertical angles are congruent. An example would be to use the statement "Angle P is congruent to angle R" with the reason "Vertical angles are congruent."

**Look in the diagram for any lines or angles shared by triangles.** This is where the reflexive property comes into play.

* Your statement should read "XY = XY" or "Angle A = angle A" and the reason would be "Reflexive property of congruence."

**Transfer every congruency statement you've found so far, including the givens, into the diagram.** Congruent sides get marked with hash marks; congruent angles are marked with arcs.

**Look at one of the triangles in the picture.** Note all the marking you just made and the ones that were given to you. How many angles are congruent? How many sides? Match this information with one of the triangle congruency theorems. Your statement should read "Triangle ABC is congruent to triangle XYZ" and the reason would be the appropriate choice between AAS, ASA, SAS, SSS, HL, etc.

* SSS stands for side, side, side. All three sides must be congruent.
* Two sides and an angle must be congruent for it to be SAS (side, angle, side).
* See if your triangles have congruent right angles, and two congruent sides, one being the hypotenuse (which is the side directly across from the right angle). If they do, then state them as being congruent with the reason HL (Hypotenuse Leg Theorem).
* It can be ASA or AAS if two angles are congruent, but only one side.

**Take another look at the "Prove" line of your problem.** If it's the same as your last statement, then you are finished.