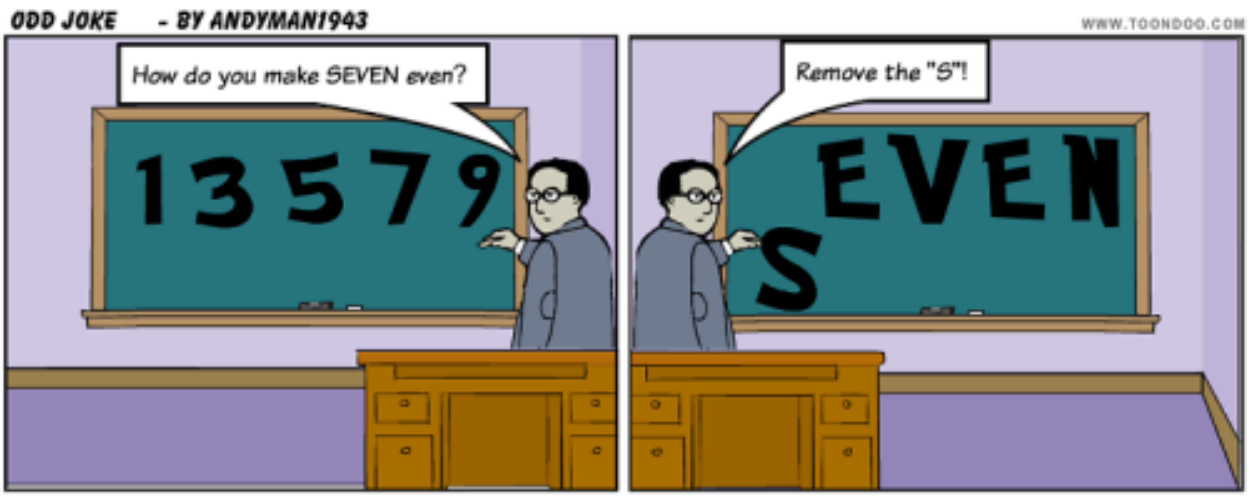
Introduction to Proofs

Geometry Workbook #3

Proof Style Exploration, Algebraic Proofs, Even/Odd Proofs



Name:____________________

Block: ____________________

Ms.Finneyfrock

Proofs: Essential Questions Pre-Assessment

1. What is a proof?

2. What is the difference between inductive and deductive reasoning?

3. Can you prove a conjecture by inductive reasoning? Why or why not?

4. Why is it important to justify your answers?

5. How would you define any even number?

6. How would you define any odd number?

Proof Exploration

After finishing our Logic Unit, we know that we need to organize our thoughts and use deductive reasoning in order to prove a conjecture. A proof is a logical argument that establishes the truth of a statement.   In this unit, we are going to explore different types of proofs. Examples of styles of proofs come from http://www.regentsprep.org/regents/math/geometry/gp3/styleofproof.htm.

Items needed to write a proof:

1. **Givens:** A mathematical proof always begins with stating the givens. Usually, givens can be placed anywhere in the proof, as long as it makes logical sense.

2. **Diagram:** If a diagram is not provided, draw a diagram based on the givens. Visualization is extremely helpful before starting a proof.

3. **Prior knowledge to connect statements**: We must use prior knowledge of theorems, postulates, and definitions in order to provide warrants for our claims

4. **TIME**: Proofs take time. You have to remain patient! It's possible you won't create the proof correct the first time! That's okay!! Logically think through your statements to see what you need to change! We want it to logically make sense!!

5. **Order:** It's very important to show that the argument is written in a way that logically makes sense!

Read and answer questions on pages 8-11. You will figure out which style of proof you prefer!

Ways to show you actively read:

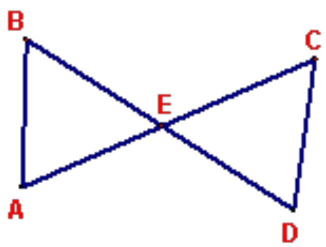
Highlight
Notes in the margins
Questions in the margins
Answer all questions

Two Column Proofs

A **two-column proof** is a way to organize your thought process when create a proof. Two column proofs are organized into two columns. The first column is your **claim** the second column is your **warrant.**

When writing a two-column proof you must do the following.

- Number each step
- Start with the given information
- **You must have a warrant for every claim**
- Draw a picture to mark your given information.
- Your warrants will be definitions, postulates, theorems, and other properties previously given.



Given: E is the midpoint of $\overline{BD}$

$\overline{AE} \cong \overline{EC}$

Prove: $\Delta AEB \cong \Delta CED$

Claim	Warrant
$\overline{AE} \cong \overline{EC}$	Given
$\measuredangle BEA \cong \measuredangle DEC$	Vertical Angles are congruent
E is the midpoint of BD	Given
$\overline{BE} \cong \overline{ED}$	Definition of Midpoint
$\Delta AEB \cong \Delta CED$	SAS

Pros:

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Cons:

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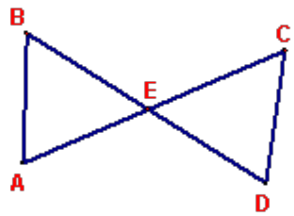
Flow Chart Proofs

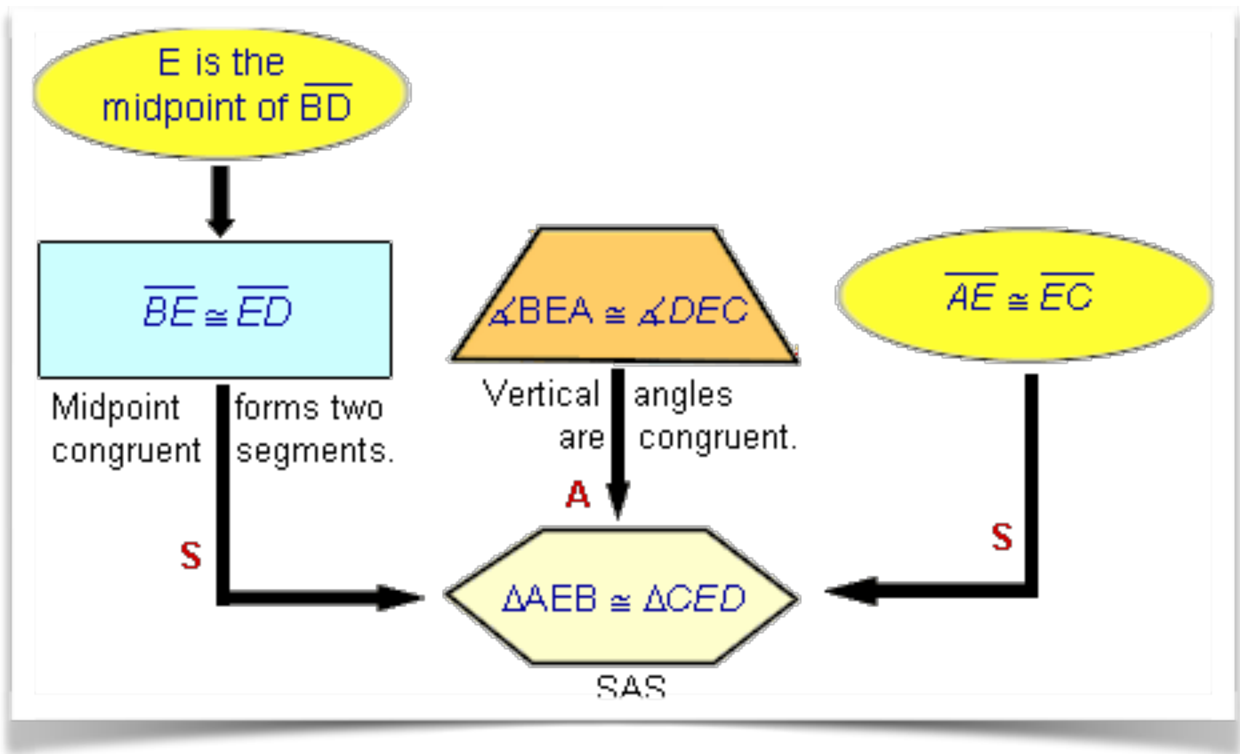
Flow Chart Proofs are organized with boxes and arrows. Each claim is inside the box and every warrant is underneath each box. In flowchart proofs the progression is shown through arrows.



Given: E is the midpoint of $\overline{BD}$

$\overline{AE} \cong \overline{EC}$

Prove: $\Delta AEB \cong \Delta CED$

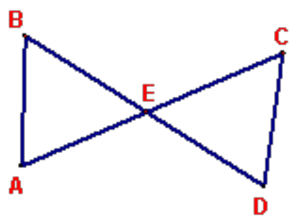


Pros:

Cons:

Paragraph Proofs

Paragraph Proof is a proof written in the form of a paragraph. This is a logical argument written as a paragraph, giving evidence and details to arrive at a conclusion. The paragraph is lengthy and contains steps and reasons that lead to the final conclusion.



Given: E is the midpoint of $\overline{BD}$

$\overline{AE} \cong \overline{EC}$

Prove: $\triangle AEB \cong \triangle CED$

We are given the figure above and the facts that E is the midpoint of $\overline{BD}$ and that $\overline{AE} \cong \overline{EC}$. Since E is the midpoint of $\overline{BD}$, we know that $\overline{BE} \cong \overline{ED}$ because the midpoint of a segment divides the segment into two congruent segments. Since vertical angles are congruent, $\measuredangle BEA \cong \measuredangle DEC$. We now have sufficient information to satisfy the SAS method of proving triangles congruent. $\triangle AEB \cong \triangle CED$ because if two sides and the included angle of one triangle are congruent to the corresponding parts of another triangle, the triangles are congruent.

Pros:

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Cons:

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Favorite Style of Proof

Answer the following questions below. Come in to class ready to defend your reasoning. **Write all of your responses in My claim is _________ my warrant is ______________ format.**

1. What is your favorite style of proof?

2. What is the most efficient style of proof?

3. Do you see yourself only using one style of proof?

4. Look up **your favorite style of proof.** Using the information you found and the information earlier in the book, write an argument defending **why** that's the best style of proof. Your argument should be written in claim and warrant format and be between **5 and 10 sentences.**

5. The website I used for question #4 to find more information about my proof style is

____.

Algebraic Properties of Equality

Look up the definitions for the following properties. Possible sites to use are mathopenref.com mathplanet.com , hotmath.com, mathwords.com

Algebraic Properties	
Addition Property of Equality	
Subtraction Property of Equality	
Multiplication Property of Equality	
Division Property of Equality	
Distributive Property of Multiplication of Addition or over Subtraction	
Substitution Property of Equality	
Reflexive Property of Equality	
Symmetric Property of Equality	
Transitive Property of Equality	
Commutative Property of Addition and Multiplication	
Associative Property of Addition and Multiplication	

Algebraic Proof

Given: $x = 5$
$3x + 4y = 31$

Prove: $y = 4$

Claim	Warrant
1. $3x + 4y = 31$	1
2. $x = 5$	2
3. $15 + 4y = 31$	3
4. $4y = 16$	4
5. $y = 4$	5

Paragraph or Flow Chart Proof:

Given: $3x+12 = 8x - 18$

Prove: $x = 6$

Claim	Warrant
1. $3x+12 = 8x-18$	1
2. $12 = 5x-18$	2
3. $30 = 5x$	3
4. $6 = x$	4
5. $x = 6$	5

Paragraph or Flow Chart Proof:

Algebraic Proof Practice

Prove the following. You can choose which style of proof you'd like to use.

Given: $3(x - 5/3) = 1$

Prove: $x = 4$

Claim	Warrant

Paragraph or Flow Chart Proof:

Given: $8x - 5 = 2x + 1$

Prove: $x = 1$

Claim	Warrant

Paragraph or Flow Chart Proof:

Given: $4x + 8 = x + 2$

Prove: $x = -2$

Claim	Warrant

Paragraph or Flow Chart Proof:

Given: $3(5x + 1) = 13x + 5$

Prove: $x = 1$

Claim	Warrant

Paragraph or Flow Chart Proof:

Even/Odd Proofs

We can use direct proof to prove statements of the form "if p then q"

In direct proofs we assume that the original statement p is true, and we use it to show directly that the statement q is also true

Direct proofs have the following steps...

Assume the statement p is true

Use what we know about p and other facts as necessary to show that p-> q is true.

Definition of Even:

Definition of Odd:

Example: Let p: n is an odd integer
Let q: n^2 is an odd integer.
Assume p.

Claim	Warrant

Continue Even/Odd Notes from Peardeck

Even Odd Practice Proofs

Remember to define your p and q. Always start by assuming p is true!

1. Let n be an integer. If n is even, then n^2 is even.

2. Let n be an integer. If n^2 is odd, then n is odd.

3. Let *n* and *m* be an integer. If n and m are even integers then m+n is even.

Proofs: Essential Questions Post-Assessment

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Delta Math Work

Extra Space for Notes