Title: Go With The Flow!

Brief Overview:

In this three-lesson unit, students will be introduced to flow chart proofs. Students will become familiar with the flow chart format by using them to organize real life scenarios, and then use what they have learned to prove triangle congruence. The methods within the lessons stress logically sequencing definitions, postulates and theorems, as well as finding the essential elements necessary to lead into one of the triangle congruence postulates. It is assumed that students have experience with SSS, SAS, AAS, ASA and HL postulates.

NCTM Content Standard/National Science Education Standard:

Geometry

- Recognize reasoning and proof as fundamental aspects of mathematics.
- Make and investigate mathematical conjectures.
- Develop and evaluate mathematical arguments and proofs.
- Select and use various types of reasoning and methods of proof.
- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.
- Use visualization, spatial reasoning, and geometric modeling to solve problems.

Grade/Level:

Grades 9 – 12, Geometry

Duration/Length:

Three 90 minute periods.

Student Outcomes:

Students will be able to:

- Use logical reasoning to complete triangle congruency proofs.
- Analyze triangles in order to identify essential information and postulate to complete a proof.

Materials and Resources:

- Flow chart and worksheets on overhead transparency sheets
- Overhead markers
- Sentence strips with magnets or tape
- Scissors
- Glue sticks or tape

- Worksheets:
  - Real Life Proofs
  - Identifying Triangle Congruency
  - Flow Chart Proofs #1 – 5
  - Cut ‘n Paste template
  - Missing Parts
  - Flow Chart Proofs #6 – 14
  - Two Column Proofs
  - Proofs #15 – 19
  - More Two Column Proofs
  - Flow Chart Template
  - Round Table Proofs

Development/Procedures:

Lesson 1

Launch – Introduce the idea of flow chart proof using the “making a peanut butter and jelly sandwich” example from the “Real Life Proofs” worksheets.

To use the flow chart, “preliminary information” goes in the dotted ellipses. This information does not contribute directly to forming the sandwich. “Essential steps/ingredients” go in the three solid squares below the dotted ellipses. Reasons for each step go on the lines below each shape.

In this example, students do not need to use the fourth dotted ellipse, for the proof is complete after the step where students eat the sandwich.

Continue with the “writing a research paper” from “Real Life Proofs”, allowing students to volunteer the majority of inputs. Allow students to complete “going to the mall” in pairs at their seats. Note that answers for these proofs don’t need to match the provided answer key exactly, but students should have the general idea presented in the solutions. After reviewing their solutions, students should pose their own givens and ultimate goals to their partners and challenge them to complete a flow chart proof.

Preassessment – Distribute “Identifying Triangle Congruency” for postulate and theorem review.

Teacher Facilitation – Model completing a triangle congruence proof with given statements and reasons, using “Flow Chart Proof #1”. The instructor should link these proofs with the previous real life examples by emphasizing that “essential ingredients” to a triangle congruence proof are the angles and sides that are

congruent (e.g. SAS). This information is always placed in the solid squares. Any "preliminary information" will be information which leads to essential information, and is written in the dotted ellipses. For example, "preliminary information" might be that an angle bisector exists, which will lead to the "essential information" of two angles being congruent. The fourth solid square will state the triangles now proven congruent by the essential information. The blank underneath the fourth square will be filled in with the appropriate triangle congruency theorem or postulate.

For "Flow Chart Proof #2", give students statements and reasons to cut and paste from the "Cut 'n Paste" template. Use magnetic sentence strips to model how to match the "Cut 'n Paste" strips into the flow chart as students complete the proof at their desks. Encourage students to first sort through the strips to identify those that are reasons, and those that are statements. It is also helpful to identify which strips are the given information, and which strips are added information. For an added visual technique, project a flow chart on the board and put sentence strips on board within the projected image of the flow chart. Stress to students that the dotted circles on the flow chart may or may not need to be used. These are for preliminary information that does not contribute directly to a triangle congruence theorem, but can be used as stepping stones to the facts that one can use to prove triangles congruent.

Student Application –Distribute the remaining proofs from "Flow Chart Proofs #1 – 5". Student should cut out sentence strips for each proof, sort them, and then complete the proofs. They should only do one proof at a time to avoid mixing up statements and reasons from each proof. Take appropriate breaks to review solutions to the proofs on the board, and determine breaks based upon the understanding of the students.

Embedded Assessment – Partway through class, the instructor can ask groups of students to put their solutions to proofs on the board or present them to the class. Classmates can ask each other questions based on their presentations to clarify any confusion.

Reteaching/Extension –

- Encourage students who finish the four cut and paste proofs to redo proof #5 without cutting and pasting, trying to find an alternative postulate to prove congruency. Refer to the answer key for Proof #5 for alternative solutions. They will be asked to find a second solution to the problem.

- For those students who have not finished their original proofs, they may continue to work on them with increased instructor assistance

Lesson 2

Preassessment – Warm up with the worksheet "Missing Parts", which asks students to identify missing information necessary to prove triangles congruent.

Launch – Students will complete Proof #6 in pairs, since they will have to complete the proof without cut-out strips.

Teacher Facilitation – Use proof # 6 to introduce into corresponding parts of congruent triangles are congruent (CPCTC). Ask students why they can make the statement that $\overline{JM} \cong \overline{KM}$. Students should respond or be led to the reason CPCTC. Inform students that this is entered in the last dotted ellipse, and stress the importance of the *flow*. That is, CPCTC cannot be assumed until congruency has been proven.

Student Application – Students will complete Proofs #7-14 using flow charts.

Embedded Assessment – Each group will present one of the proofs on overhead.

Reteaching/Extension –

- Students experiencing difficulty can finish their proofs with increased instructor assistance.
- Students who have finished their proofs with a good understanding will expand on their ideas in their presented proof to create their own form of proof (e.g. a proof using something other than a flow chart).
- Students should discuss their ideas in small groups; the instructor should not lead them to any conclusions. The instructor should simply ask if students can rewrite the proof without the boxes, circles and arrows, such that a third party could read and understand the statements and reasons in order.

Lesson 3

Preassessment – Distribute "Two Column Proofs", in which students will complete two proofs in two-column form, one of which has all the statements and the reasons are missing and the other which supplies the reasons and asks for the statements.

Launch – Have the students present and discuss their solutions, and compare and contrast the two-column form to the flow chart. This

discussion can be in the form of a "think-pair-share" focused around the questions "Which form of proof do you prefer and why?" and "Which form of proof do you think a third party would find easiest to understand and why?"

Teacher Facilitation – Discuss the alternative forms of proof completed during "reteaching/ extension". Students may or may not have suggested two-column proofs. If so, allow the student to explain their reasoning and methods. The students may also have suggested additional valid proof methods; encourage them to share their ideas with the class.

Student Application – Students will complete Proofs #15-19 using the proof method of their choice. Encourage students to use more than one method on all proofs. For those that choose flow charts, provide copies of the "Flow Chart Template."

Embedded Assessment – Organize students into groups of 3 or 4 in a circle, or a shape that allows passing of paper. Each individual is given a half a sheet of paper with a two-column proof from "Round Table Proofs" worksheet. Each proof has six pieces of information missing. Each student should write their name at the top of the paper, and draw a picture describing the given information. Then they pass their paper to the person to their left who writes their name at the top and completes the first line of missing information. They pass it to the next member, and this continues until the proof is completed. After the last line is completed, the paper should be returned to its original owner, who will be responsible for checking the group's answers. If they wish to make changes they must discuss changes as a group.

Reteaching/Extension –

- Students should write 3 – 4 sentences about how they work through proofs. Prompt students, asking them, "What's the first thing you do when you see a proof?", "How do you know what comes first, or last?", and "Which proof format do you now think is the best, and why?"

Summative Assessment:

The instructor should instruct students to combine proofs #1-19 for a portfolio on proofs. In addition they should create their own proof, providing a labeled drawing of two triangles, givens, statements and reasons mixed up and an answer key.

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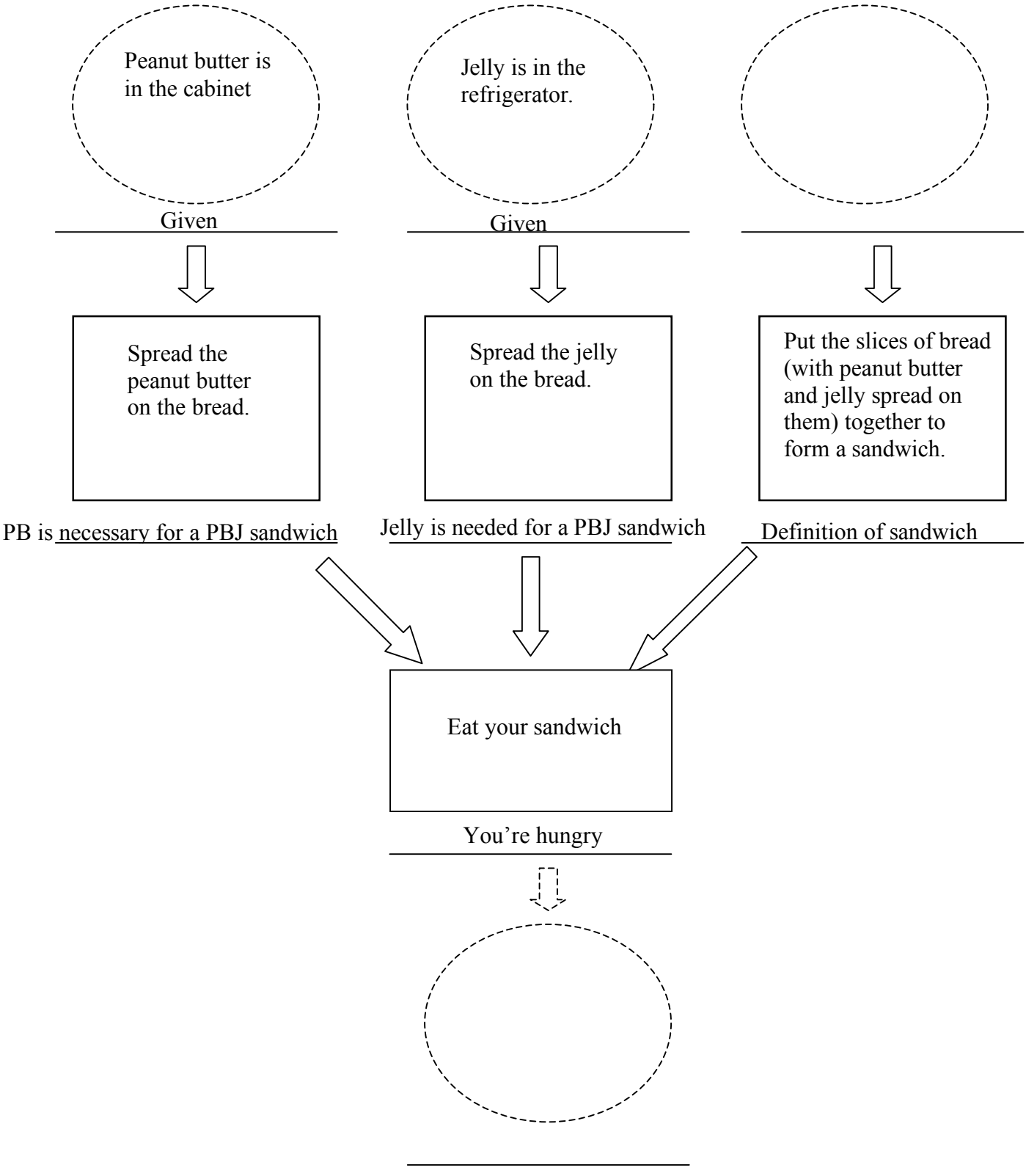
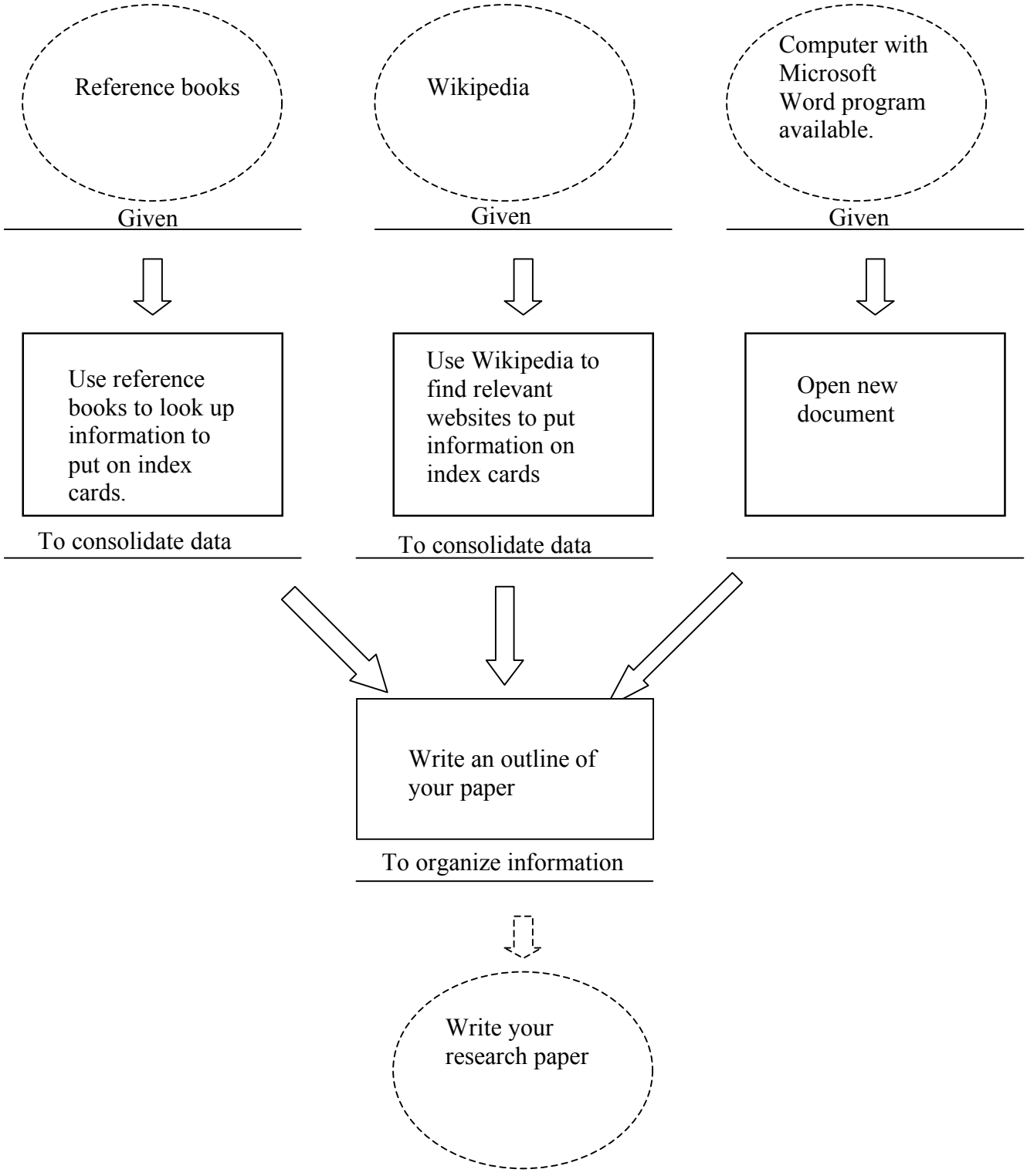
Real Life Proofs

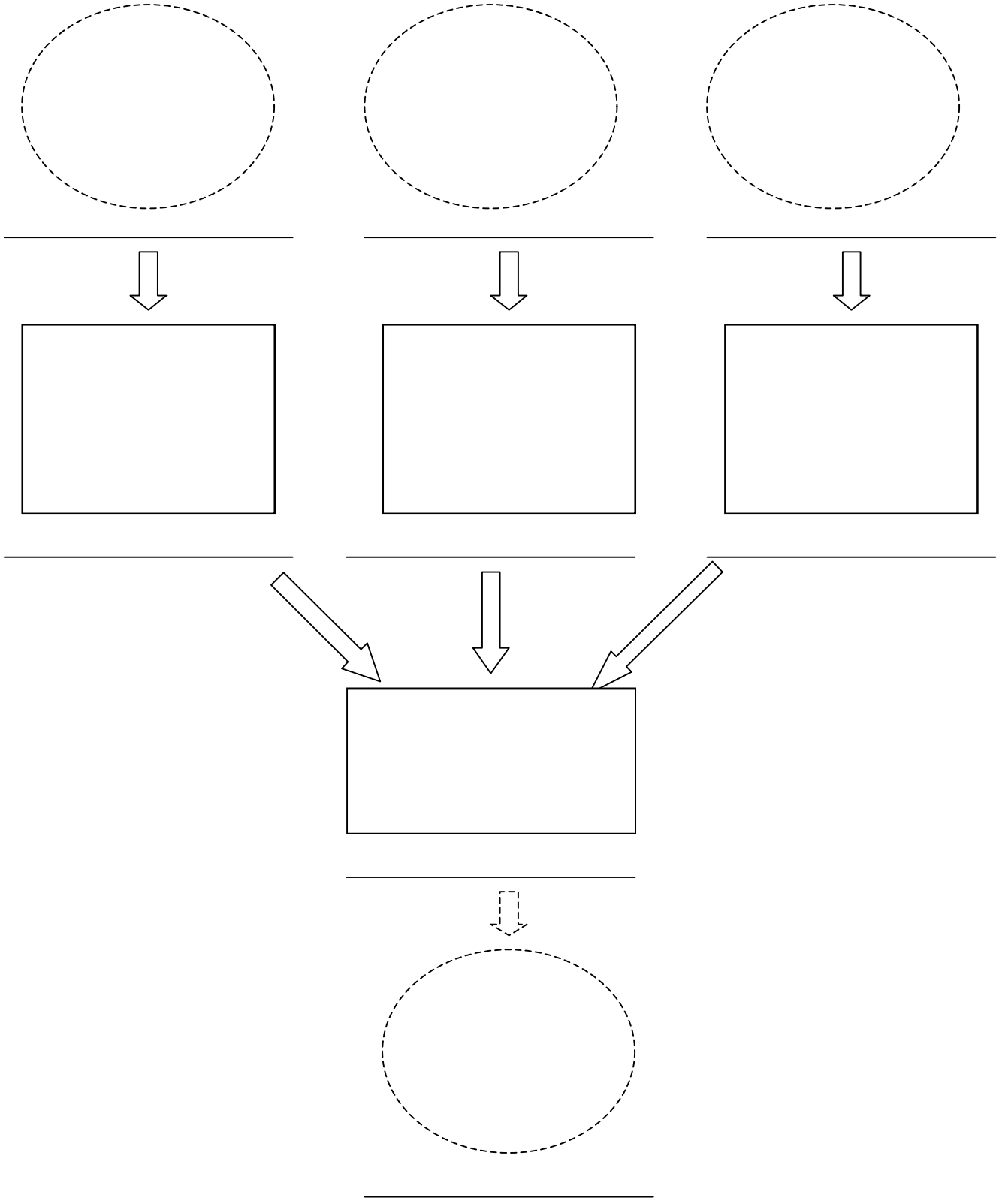
Given: You have peanut butter in your cabinet, jelly in your refrigerator.
Ultimate Goal: You want to eat a peanut butter and jelly sandwich.



Given: You have reference books, Wikipedia, and a computer with Microsoft Word software.
Ultimate Goal: You need to write a research paper.

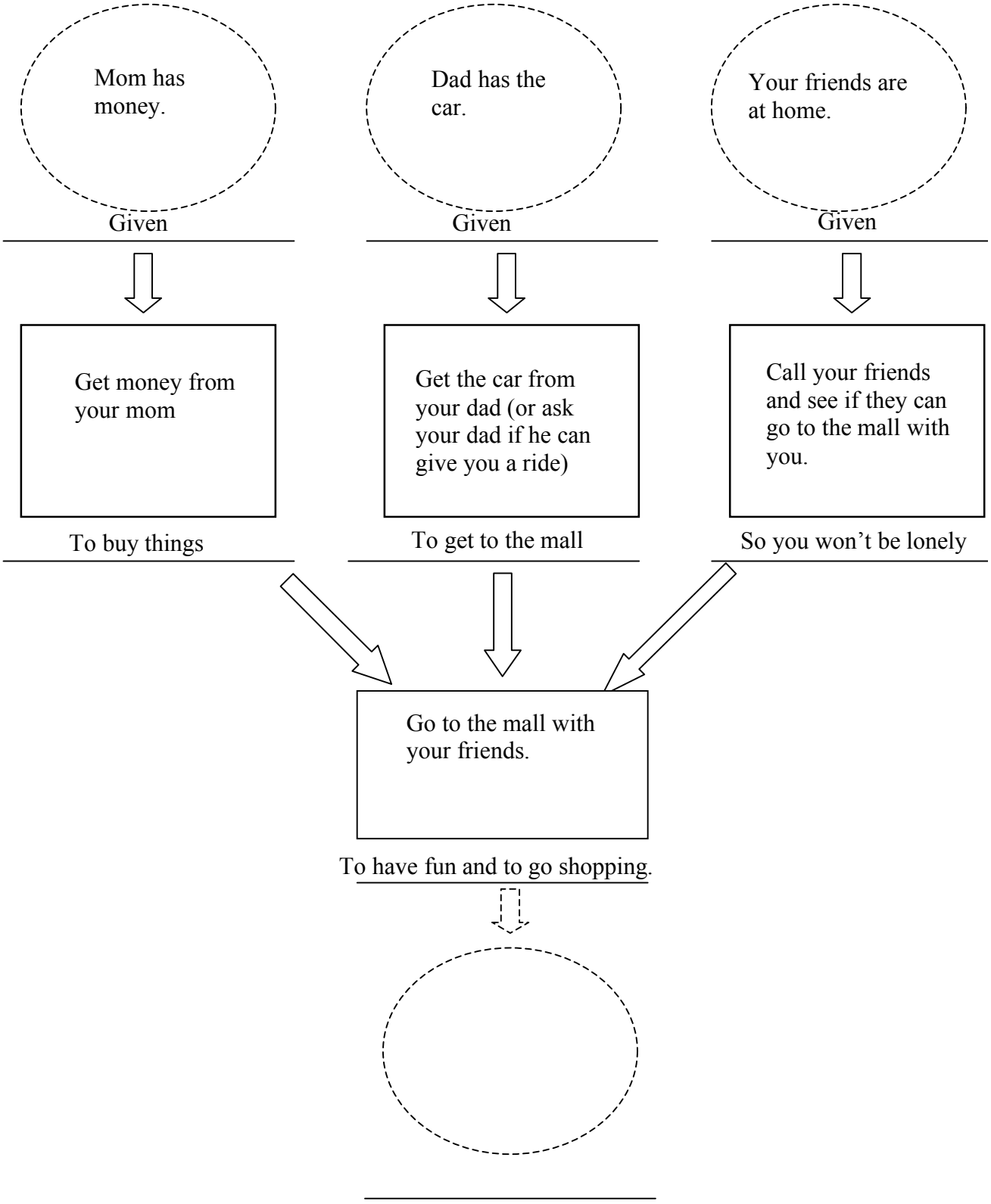


Given: Your mom has money, your dad has a car, and your friends are at home
Ultimate Goal: You want to go to the mall



Given: Your mom has money, your dad has a car, and your friends are at home
Ultimate Goal: You want to go to the mall

ANSWER KEY

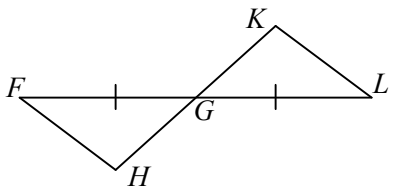


Identifying Triangle Congruency

Name: _____
Date: _____

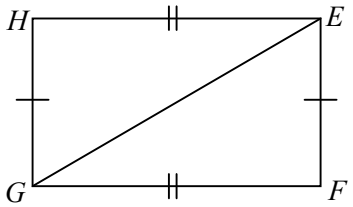
For each example, choose the proper triangle congruency postulate theorem to use to prove triangles congruent.

1.

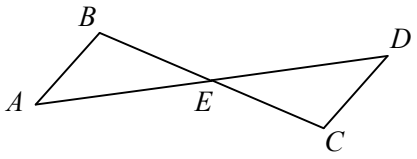


$\overline{FH} \parallel \overline{KL}$

2.



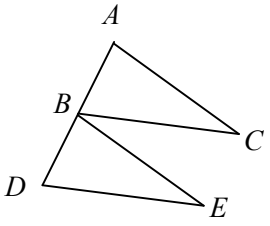
3.



$\overline{AE} \cong \overline{DE}$

$\overline{BE} \cong \overline{CE}$

4.

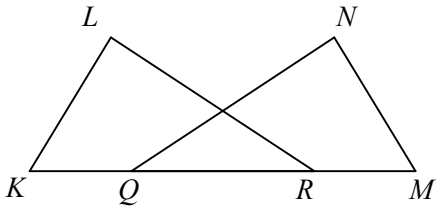


B is the midpoint of $\overline{AD}$

$\overline{BC} \parallel \overline{DE}$

$\angle C \cong \angle E$

5.

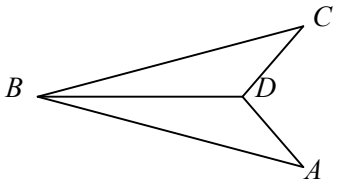


$\angle MQN \cong \angle KRL$

$\overline{KQ} \cong \overline{MR}$

$\angle K \cong \angle M$

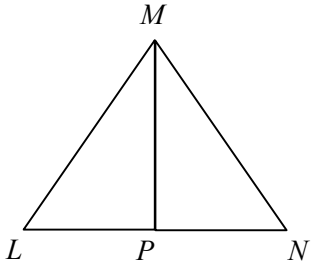
6.



$\angle ABD \cong \angle CBD$

$\angle A \cong \angle C$

7.



ΔLMP and ΔNMP are right triangles

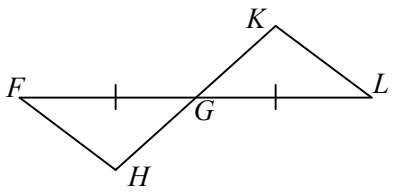
P is the midpoint of $\overline{LN}$

Identifying Triangle Congruency

Name: _ANSWER KEY____
Date: _____

For each example, choose the proper triangle congruency postulate theorem to use to prove triangles congruent.

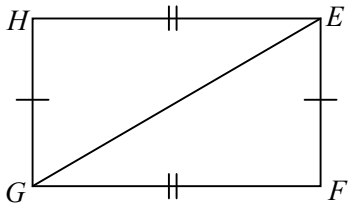
1.



$\overline{FH} \parallel \overline{KL}$

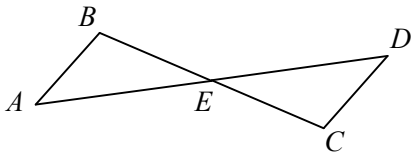
ANSWER: ASA

2.



ANSWER: SSS

3.

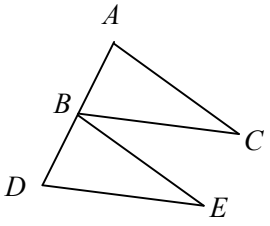


$\overline{AE} \cong \overline{DE}$

$\overline{BE} \cong \overline{CE}$

ANSWER: SAS

4.



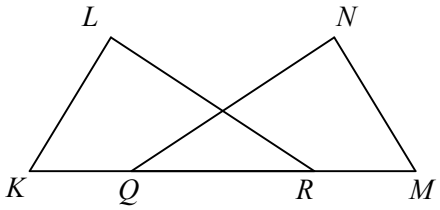
B is the midpoint of $\overline{AD}$

$\overline{BC} \parallel \overline{DE}$

$\angle C \cong \angle E$

ANSWER: AAS

5.



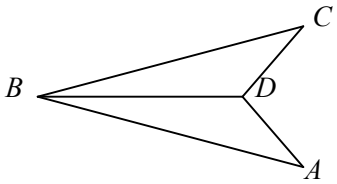
$\angle MQN \cong \angle KRL$

$\overline{KQ} \cong \overline{MR}$

$\angle K \cong \angle M$

ANSWER: ASA

6.

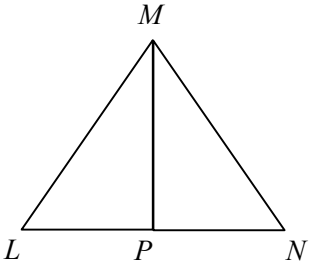


$\angle ABD \cong \angle CBD$

$\angle A \cong \angle C$

ANSWER: AAS

7.



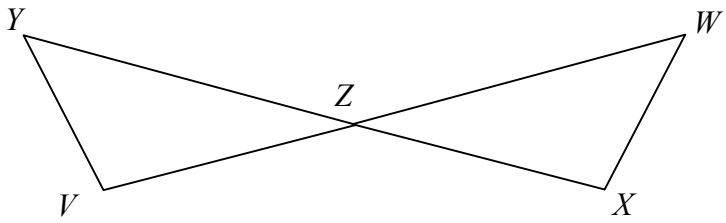
ΔLMP and ΔNMP are right triangles

P is the midpoint of $\overline{LN}$

ANSWER: HL or SAS

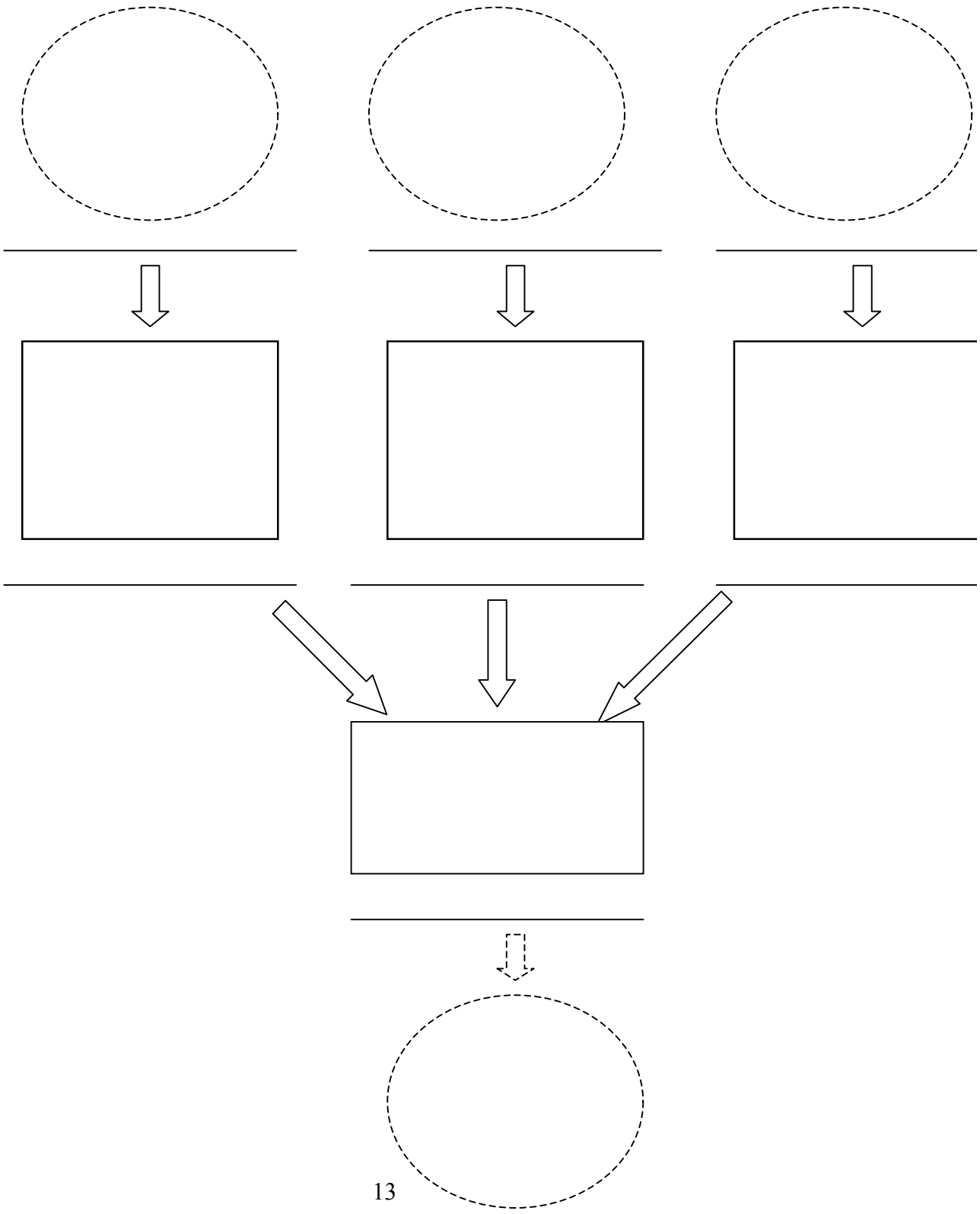
Flow Chart Proofs #1 – 5

Proof #1



Given: $\overline{YZ} \cong \overline{WZ}$
$\overline{ZV} \cong \overline{ZX}$

Prove: $\triangle VYZ \cong \triangle XWZ$

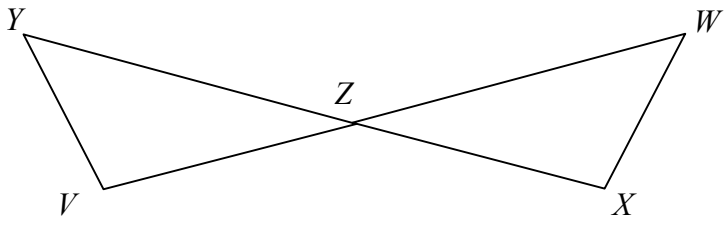


Flow Chart Proofs #1 – 5

Proof #1 ANSWER KEY

Given: $\overline{YZ} \cong \overline{WZ}$
$\overline{ZV} \cong \overline{ZX}$

Prove: $\triangle VYZ \cong \triangle XWZ$



$\overline{YZ} \cong \overline{WZ}$

Given

$\overline{ZV} \cong \overline{ZX}$

Given

$\angle YZV \cong \angle WZX$

Vertical Angles

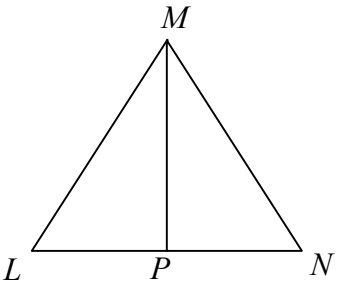
$\triangle VYZ \cong \triangle XWZ$

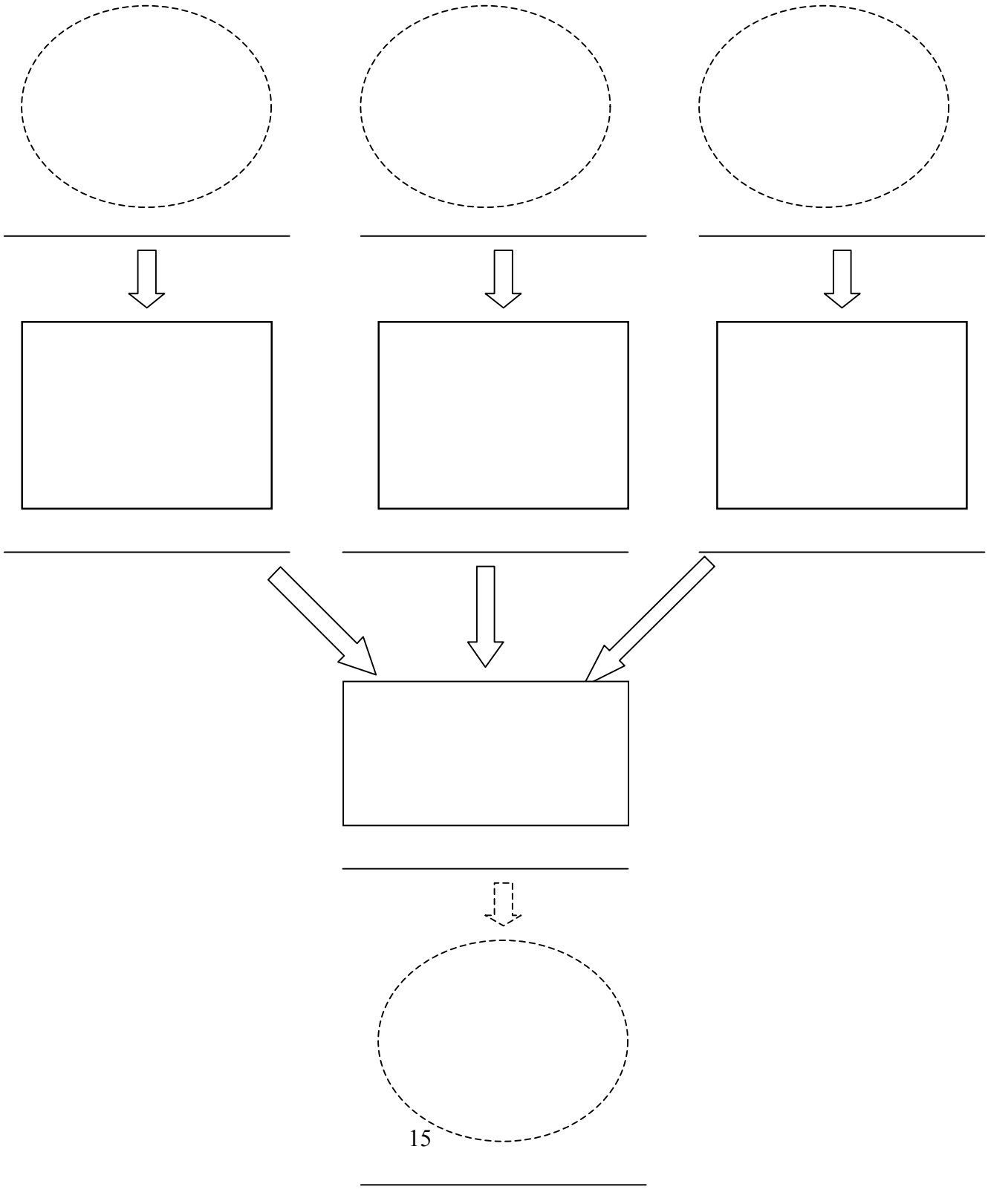
SAS

Proof #2

Given: $\angle MPL$ and $\angle MPN$ are right angles
$\overline{LP} \cong \overline{NP}$

Prove: $\triangle LMP \cong \triangle NMP$

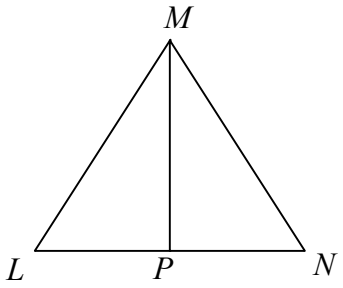


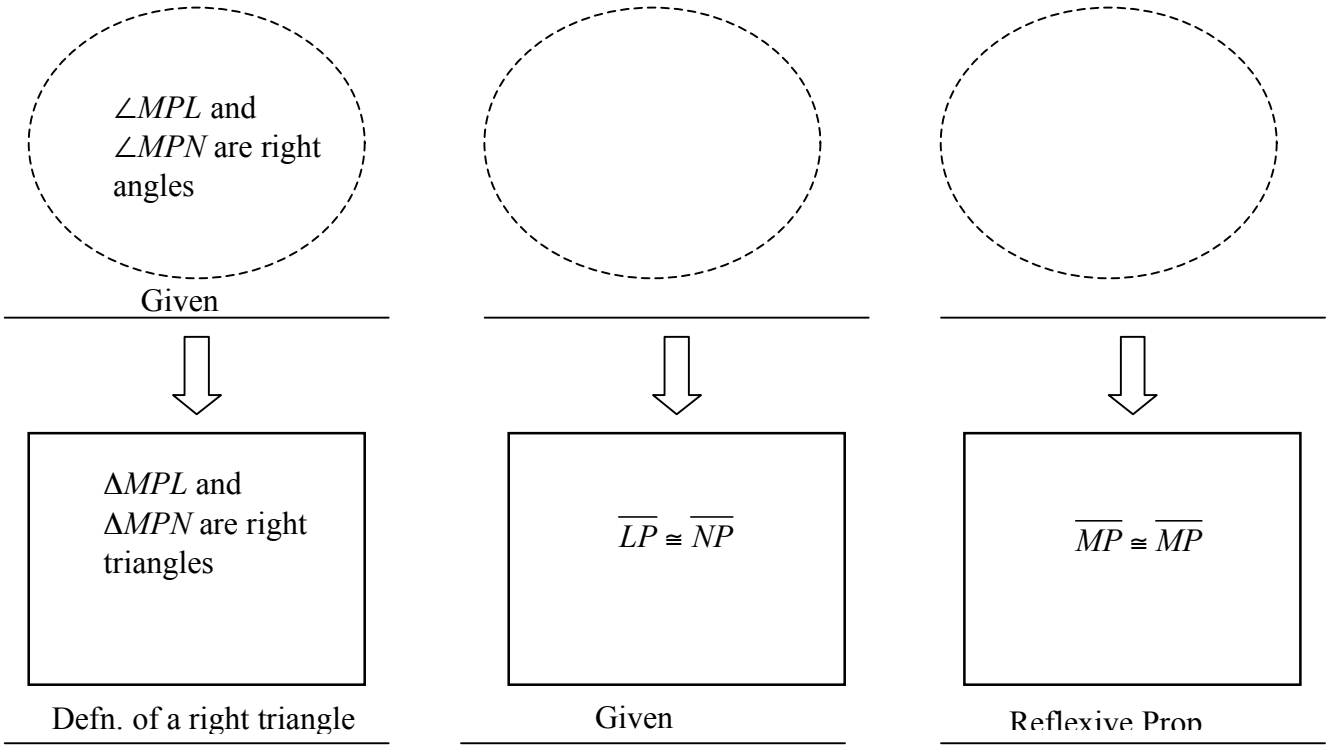


Proof #2 ANSWER KEY

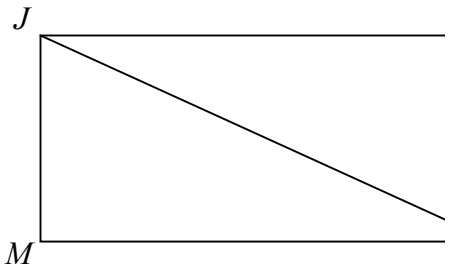
Given: $\angle MPL$ and $\angle MPN$ are right angles
$\overline{LP} \cong \overline{NP}$

Prove: $\triangle LMP \cong \triangle NMP$

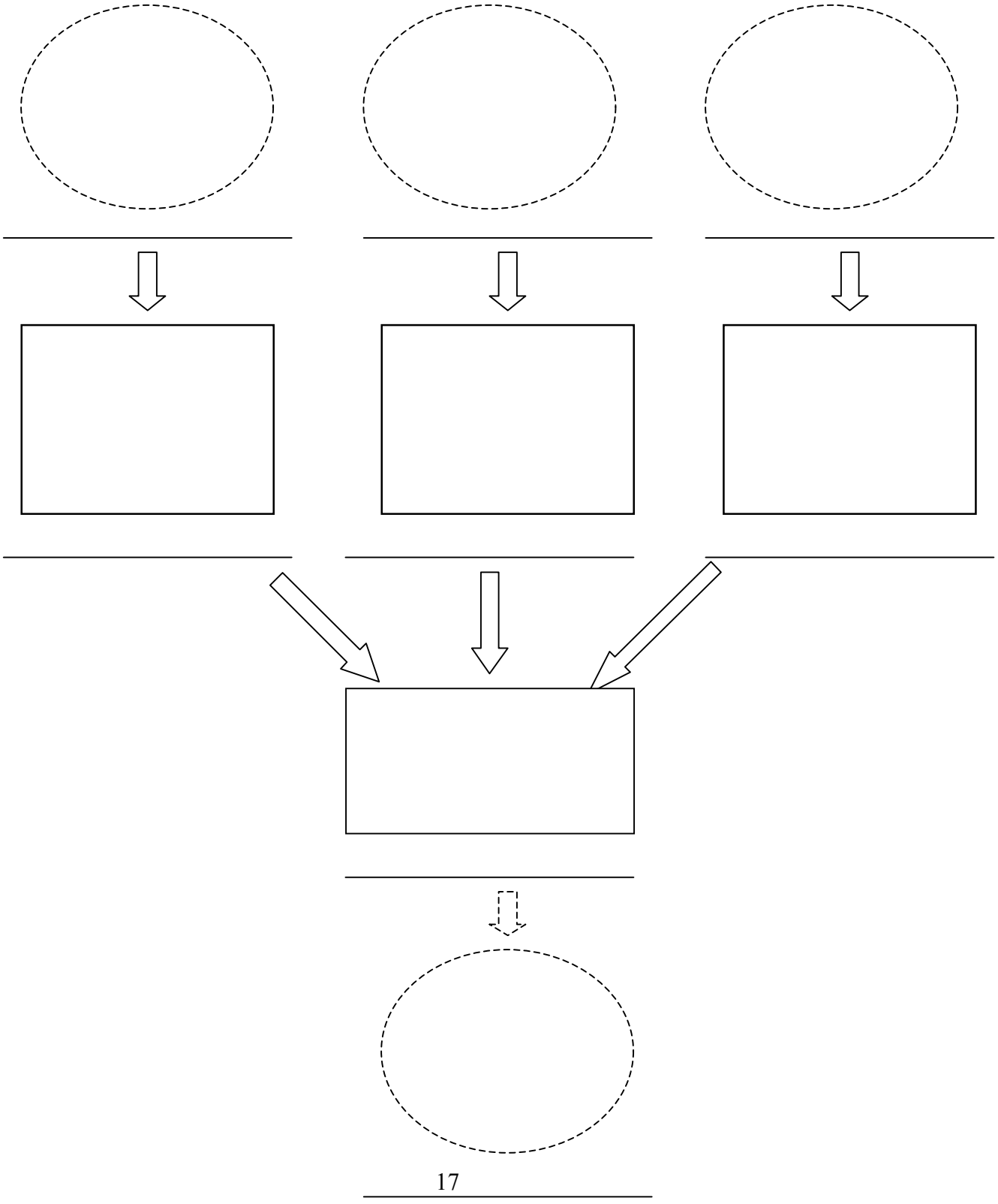




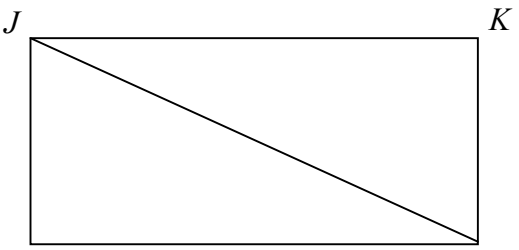
Proof #3



Given: ⌊ *JKLM* is a rectangle
Prove: □*JLM* ≅□*LJK*



Proof #3 ANSWER KEY



Given: $\square$ *JKLM* is a rectangle

Prove: $\triangle JLM \cong \triangle LJK$

$\square$ *JKLM* is a rectangle	$\square$ *JKLM* is a rectangle	
Given	Given	
$\overline{JM} \cong \overline{LK}$	$\overline{JK} \cong \overline{LM}$	$\overline{JL} \cong \overline{JL}$
Opp. sides of a rect. are congruent	Opp. sides of a rect. are congruent	Reflexive Prop.

$\triangle JLM \cong \triangle LJK$

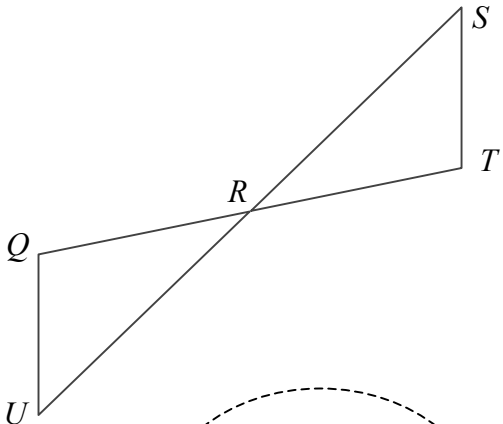
SSS

Ta

Proof #4

Given: $\overline{QU} \,//\, \overline{TS}$, R is the midpoint of $\overline{QT}$

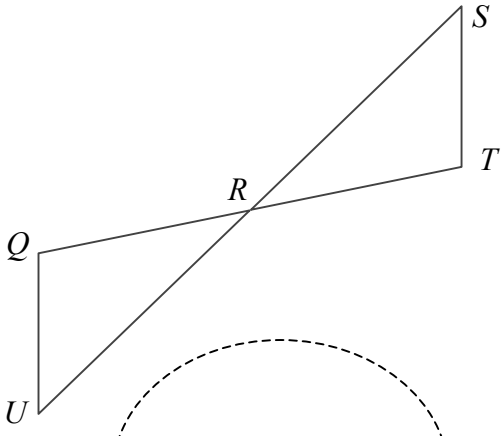
Prove: $\Delta RQU \cong \Delta RTS$



Proof #4 ANSWER KEY

Given: $\overline{QU} \parallel \overline{TS}$, R is the midpoint of $\overline{QT}$

Prove: $\Delta RQU \cong \Delta RTS$



$\overline{QU} \parallel \overline{TS}$	R is the midpoint of QT	
Given	Given	
$\angle Q \cong \angle T$	$\overline{QR} \cong \overline{TR}$	$\angle QRU \cong \angle TRS$
Alternate Interior Angles	Definition of a Midpoint	Vertical Angles

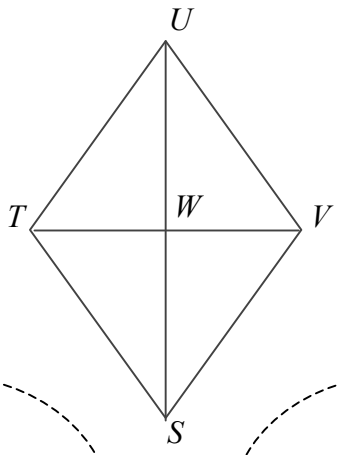
$\triangle RQU \cong \triangle RTS$

ASA

_____

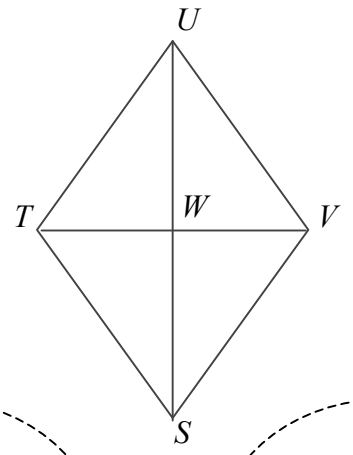
Proof #5

Given: $\square STUV$ is a parallelogram
Prove: $\triangle UTW \cong \triangle SVW$



Proof #5 ANSWER KEY

Given: $\square STUV$ is a parallelogram
Prove: $\triangle UTW \cong \triangle SVW$



$\square STUV$ is a parallelogram

Given

$\overline{WU} \cong \overline{WS}$

Diags of a //ogram bisect each other

$\square STUV$ is a parallelogram

Given

$\overline{WT} \cong \overline{WV}$

Diags of a //ogram bisect each other

$\angle TWU \cong \angle VWS$

Vertical Angles

$\triangle UTW \cong \triangle SVW$

SAS

zz

Cut ‘n Paste Template

Cut N’ Paste – Proof #2

$\triangle LMP \cong \triangle NMP$	$\overline{MP} \cong \overline{MP}$	Given
∠MPL and ∠MPN are right angles	Given	Defn. of a right triangle
HL	$\overline{LP} \cong \overline{NP}$	Reflexive Prop.
ΔMPL and ΔMPN are right triangles		

Cut N’ Paste = Proof #3

$\overline{JM} \cong \overline{LK}$	$\triangle JLM \cong \triangle LJK$	Given
Opp. sides of a rect. are congruent	$\overline{JK} \cong \overline{LM}$	$\square$ JKLM is a rectangle
SSS	Opp. sides of a rect. are congruent	Reflexive Prop.
$\overline{JL} \cong \overline{JL}$	$\square$ JKLM is a rectangle	Given

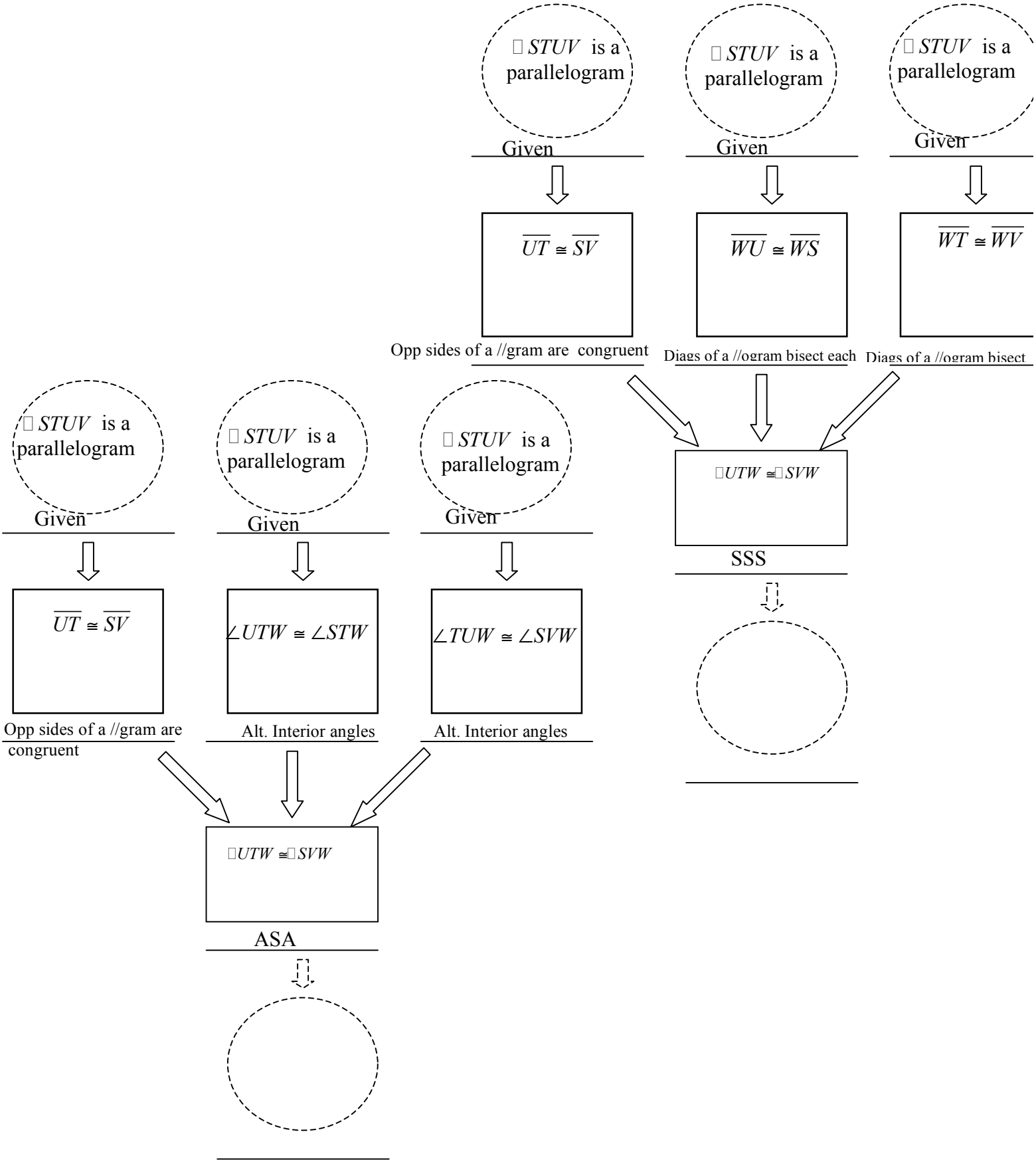
Cut N’ Paste = Proof #4

$\triangle RQU \cong \triangle RTS$	$\angle QRU \cong \angle TRS$	Given
Definition of a Midpoint	ASA	$\overline{QR} \cong \overline{TR}$
$\angle Q \cong \angle T$	Vertical Angles	R is the midpoint of QT
$\overline{QU} \parallel \overline{TS}$	Alternate Interior Angles	Given

Cut N’ Paste = Proof #5

Diags of a //ogram bisect each other	$\angle TWU \cong \angle VWS$	Given
Diags of a //ogram bisect each other	$\overline{WU} \cong \overline{WS}$	$\triangle UTW \cong \triangle SVW$
$\square STUV$ is a parallelogram	Vertical Angles	$\overline{WT} \cong \overline{WV}$
SAS	$\square STUV$ is a parallelogram	Given

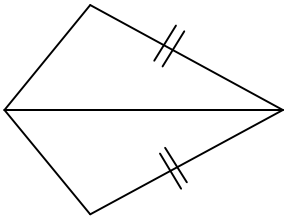
Other possible solutions to proof #5 (extension, day 1)



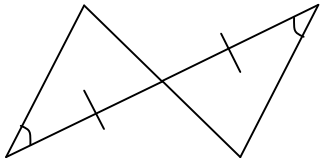
Missing Parts

Name: _____
Date: _____

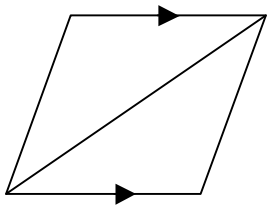
Directions: For each picture, decide what other parts need to be congruent in order to prove the triangles congruent using the given postulate or theorem. Mark the correct congruent parts on your picture.

1. 

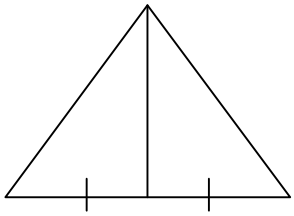
Using SSS

2. 

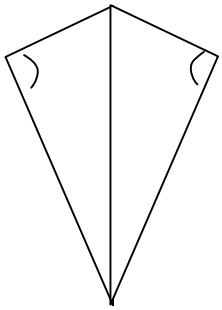
Using SAS

3. 

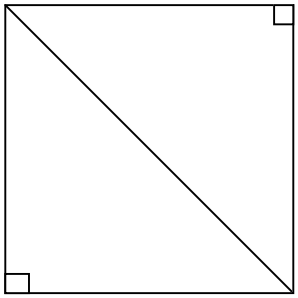
Using ASA

4. 

Using HL

5. 

Using AAS

6. 

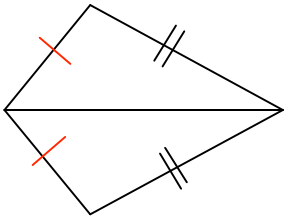
Using HL

Missing Parts

Name: _ANSWER KEY____
Date: _____

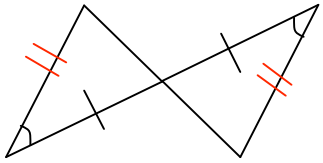
Directions: For each picture, decide what other parts need to be congruent in order to prove the triangles congruent using the given postulate or theorem. Mark the correct congruent parts on your picture.

1.



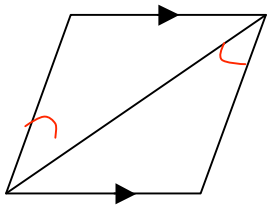
Using SSS

2.



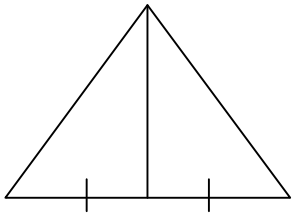
Using SAS

3.



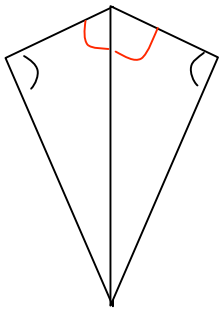
Using ASA

4.



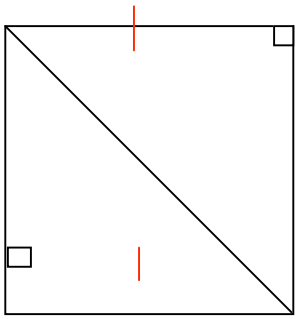
Using HL
The triangles need to be right triangles

5.



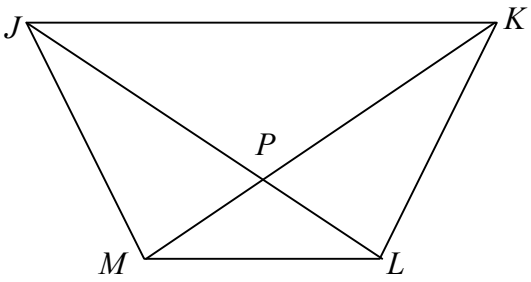
Using AAS
The third angle is another alternative

6.



Using HL
The left and right sides could also be congruent.

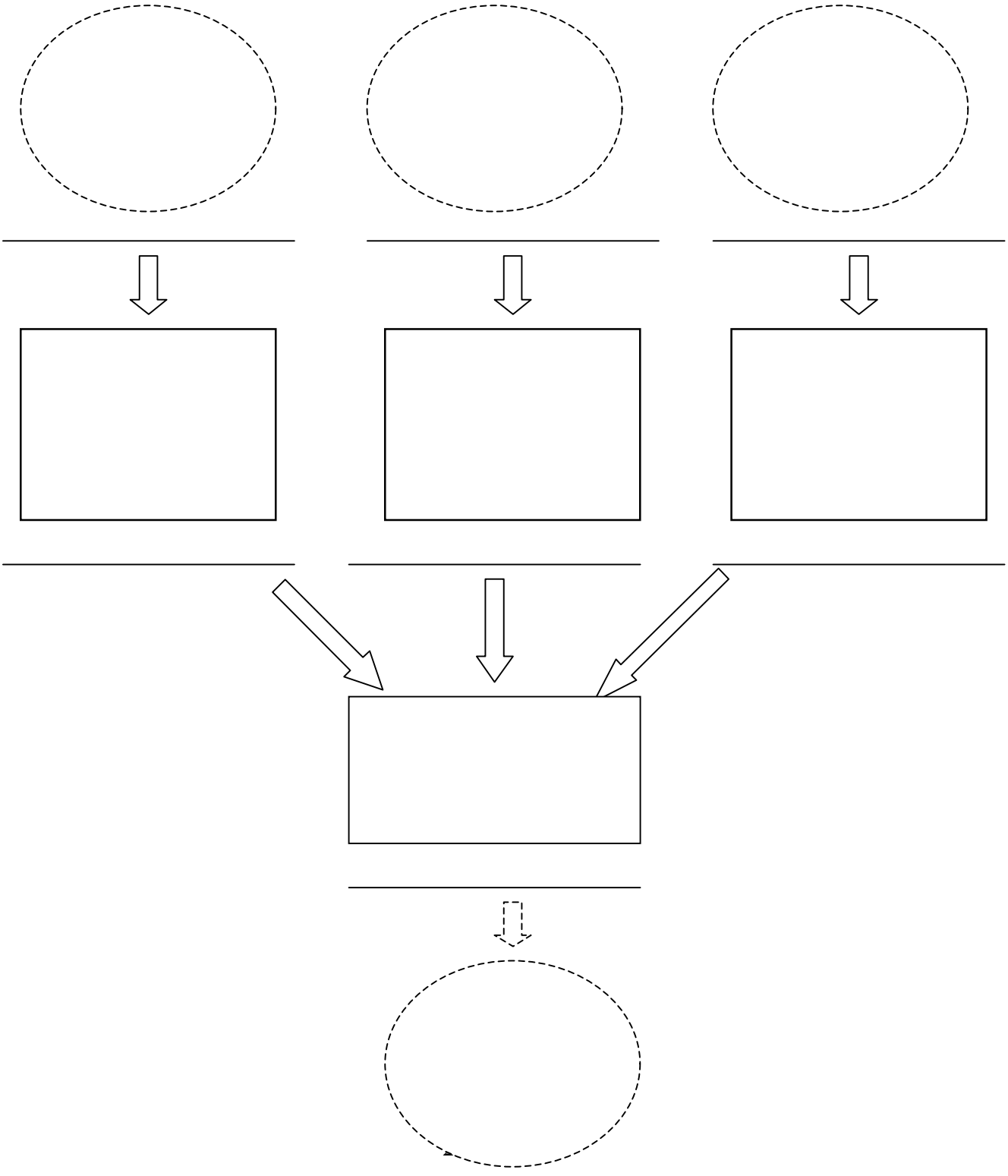
Proof #6



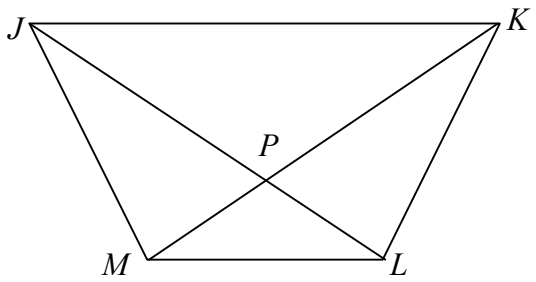
Given: $\triangle PML$ is isosceles

$\angle JLK$ and $\angle KMJ$ are right angles

Prove: $\triangle JMP \cong \triangle KLP$



Proof #6 ANSWER KEY



Given: $\triangle PML$ is isosceles
$\angle JLK$ and $\angle KMJ$ are right angles

Prove: $\triangle JMP \cong \triangle KLP$

$\triangle PML$ is isosceles

Given

$\angle JLK$ and $\angle KMJ$ are right angles

Given

$\overline{PM} \cong \overline{PL}$

Defn. Isosceles Triangle

$\angle JLK \cong \angle KMJ$

All right angles are congruent

$\angle JPM \cong \angle KPL$

Vertical Angles

$\triangle JMP \cong \triangle KLP$

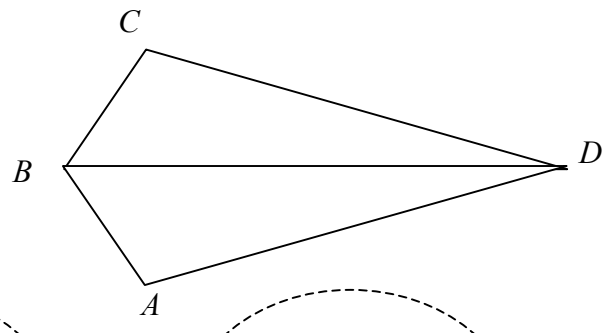
AAS

28

Proof #7

Given: $\angle CBD \cong \angle ABD$
$\angle C \cong \angle A$

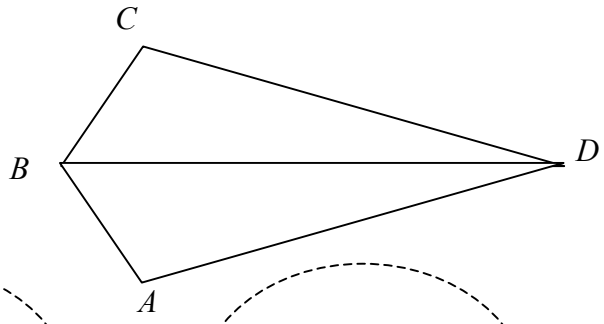
Prove: $\angle CDB \cong \angle ADB$ using triangle congruence



Proof #7 ANSWER KEY

Given: $\angle CBD \cong \angle ABD$
$\angle C \cong \angle A$

Prove: $\angle CDB \cong \angle ADB$ using triangle congruence



$\angle CBD \cong \angle ABD$	$\angle C \cong \angle A$	$\overline{BD} \cong \overline{BD}$
Given	Given	Reflexive Property

$\triangle CBD \cong \triangle ABD$

AAS

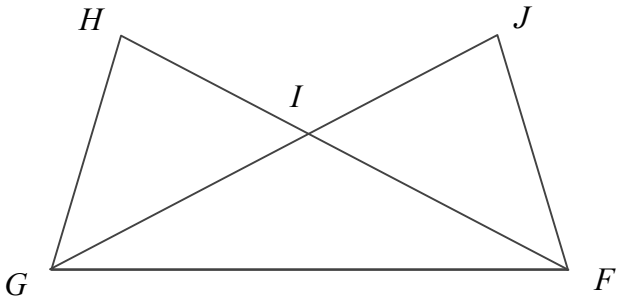
$\angle CDB \cong \angle ADB$

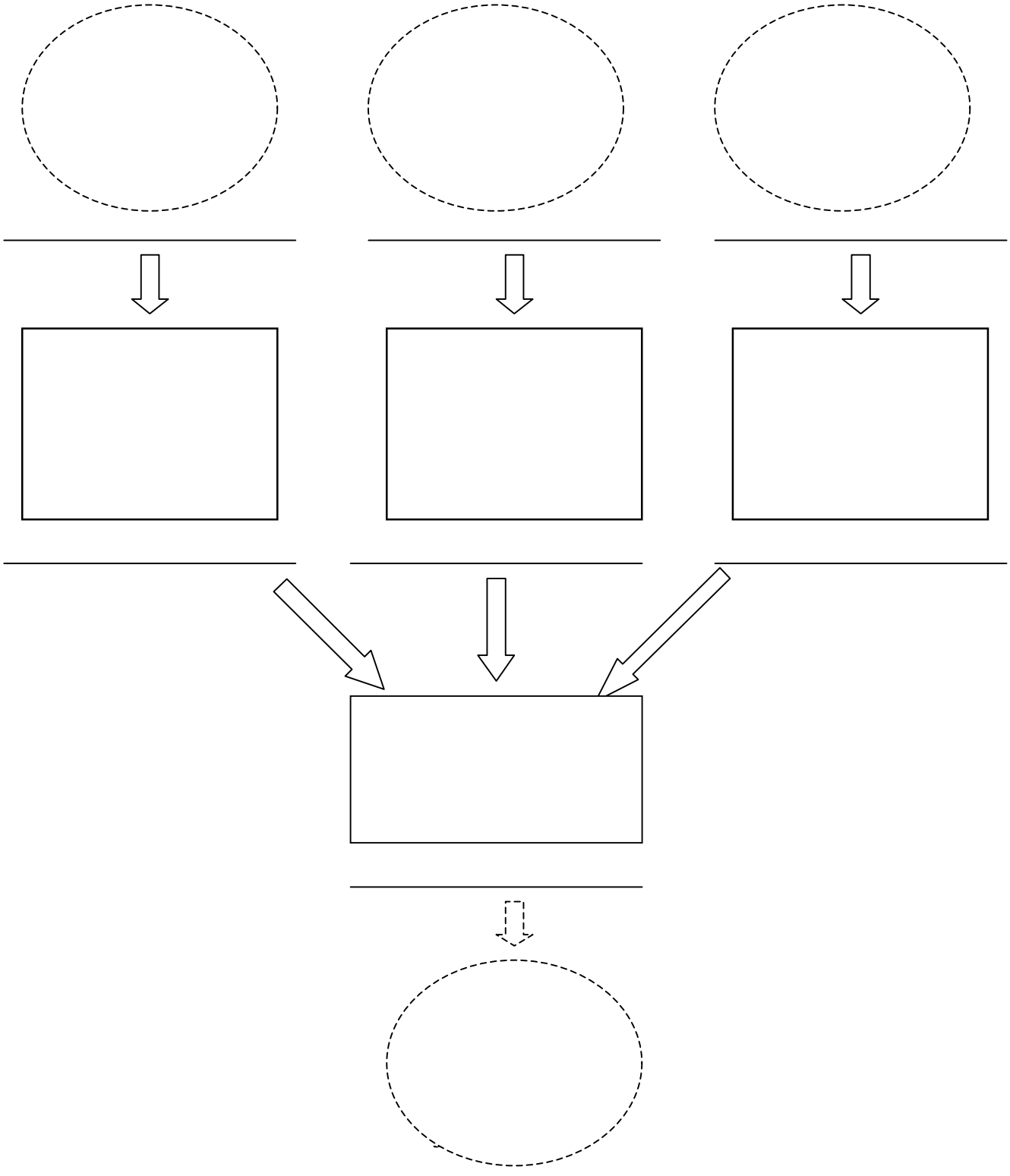
CPCTC

Proof #8

Given: $\overline{HG} \cong \overline{JF}$
$\overline{HF} \cong \overline{JG}$

Prove: $\angle JGF \cong \angle HFG$



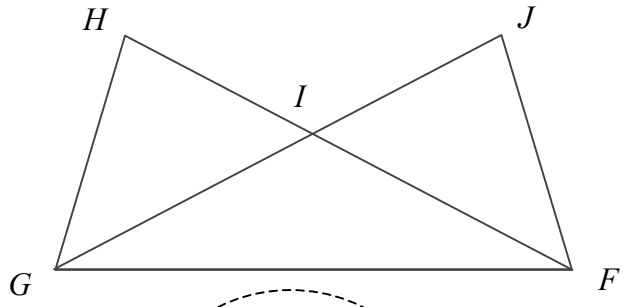


Proof #8 ANSWER KEY

Given: $\overline{HG} \cong \overline{JF}$

$\overline{HF} \cong \overline{JG}$

Prove: $\angle JGF \cong \angle HFG$



$\overline{HG} \cong \overline{JF}$	$\overline{HF} \cong \overline{JG}$	$\overline{GF} \cong \overline{GF}$
Given	Given	Reflexive Property

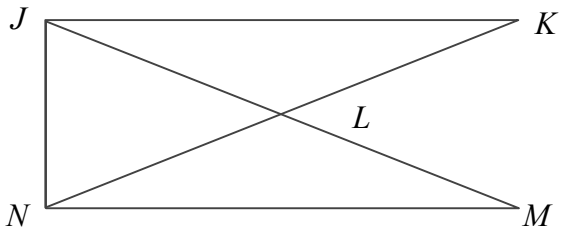
$\triangle HGF \cong \triangle JFG$

SSS

$\angle JGF \cong \angle HFG$

CPCTC

Proof #9



Given: $\angle KJN$ and $\angle MNJ$ are right angles

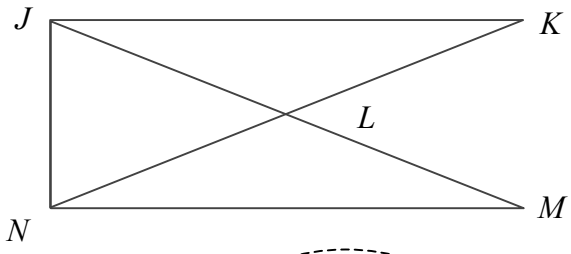
$\overline{JM} \cong \overline{NK}$

Prove: $\angle MJN \cong \angle KNJ$

Proof #9 ANSWER KEY

Given: $\angle KJN$ and $\angle MNJ$ are right angles
$\overline{JM} \cong \overline{NK}$

Prove: $\angle MJN \cong \angle KNJ$



$\angle KJN$ and $\angle MNJ$ are right angles	$\overline{JM} \cong \overline{NK}$	$\overline{JN} \cong \overline{JN}$
Given	Given	Reflexive

$\triangle JKN \cong \triangle MNK$

HL

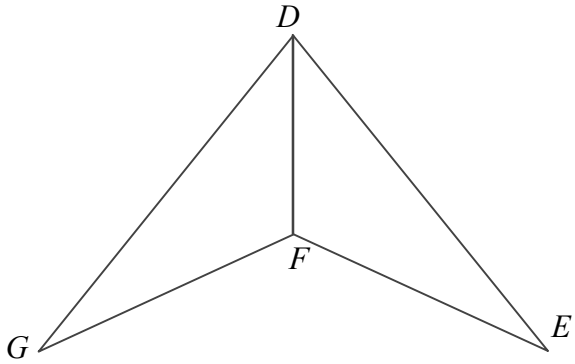
$\angle MJN \cong \angle KNJ$

CPCTC

Proof #10

Given: $\overline{DF}$ bisects ∠GDE
$\overline{DG} \cong \overline{DE}$

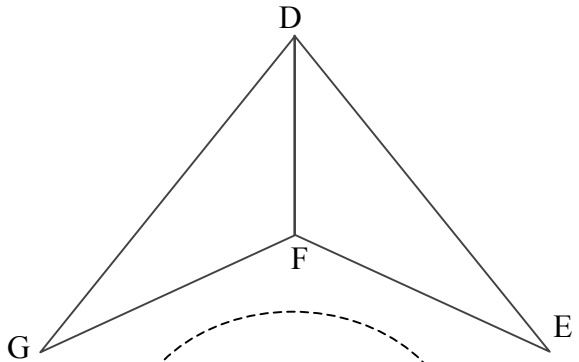
Prove: $\angle G \cong \angle E$



Proof #10 ANSWER KEY

Given: $\overline{DF}$ bisects $\angle GDE$
$\overline{DG} \cong \overline{DE}$

Prove: $\angle G \cong \angle E$



$\overline{DF}$ bisects $\angle GDE$		
Given		
$\angle GDF \cong \angle EDF$	$\overline{DG} \cong \overline{DE}$	$\overline{DF} \cong \overline{DF}$
Defn. of Angle Bisector	Given	Reflexive Property

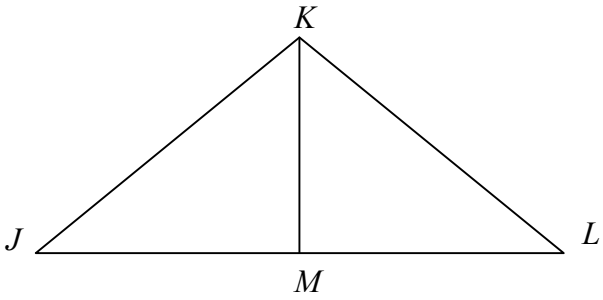
$\triangle DGF \cong \triangle DEF$

SAS

$\angle G \cong \angle E$

CPCTC

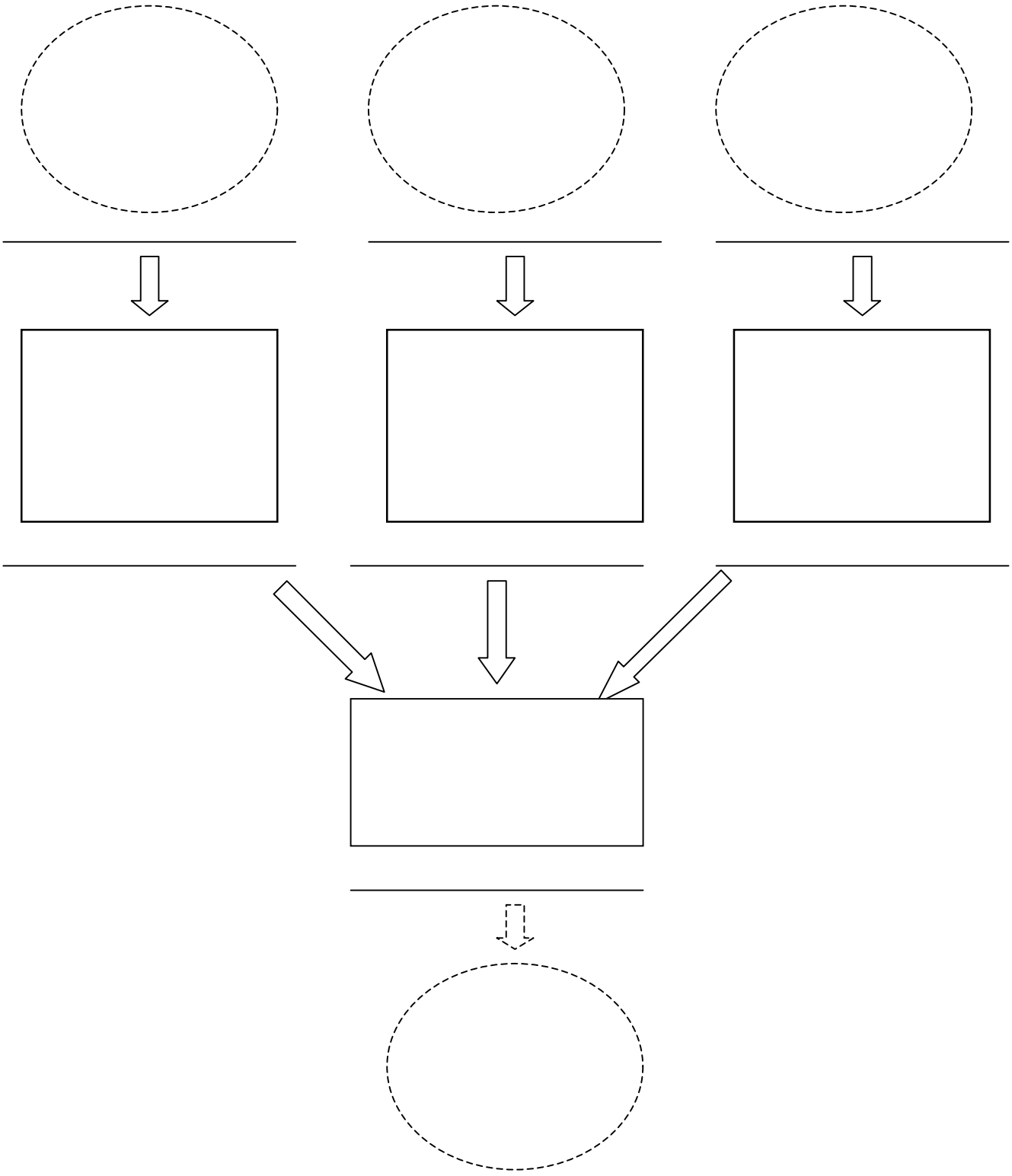
Proof #11



Given: $\triangle JKL$ is an isosceles triangle

$\overline{KM}$ is an angle bisector

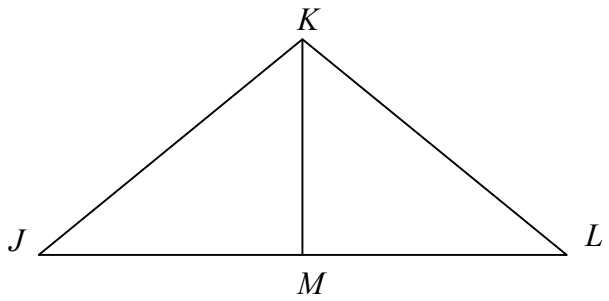
Prove: $\overline{JM} \cong \overline{LM}$



Proof #11 ANSWER KEY

Given: $\triangle JKL$ is an isosceles triangle
$\overline{KM}$ is an angle bisector

Prove: $\overline{JM} \cong \overline{LM}$



$\triangle JKL$ is an isosceles triangle

Given

$\overline{KM}$ is an angle bisector

Given

A: $\angle J \cong \angle L$

Or

B: $\overline{JK} \cong \overline{LK}$

A: Isos. Triangle Theorem
Or
B: Defin. Isos. Triangle

$\angle JKM \cong \angle LKM$

Defn. Angle Bisector

$\overline{KM} \cong \overline{KM}$

Reflexive Property

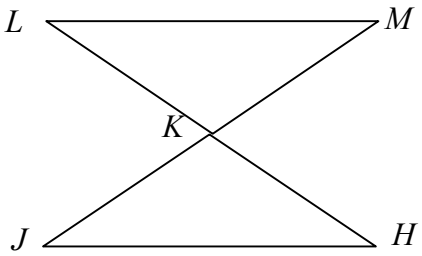
$\triangle JKM \cong \triangle LKM$

A: AAS or B: SAS

$\overline{JM} \cong \overline{LM}$

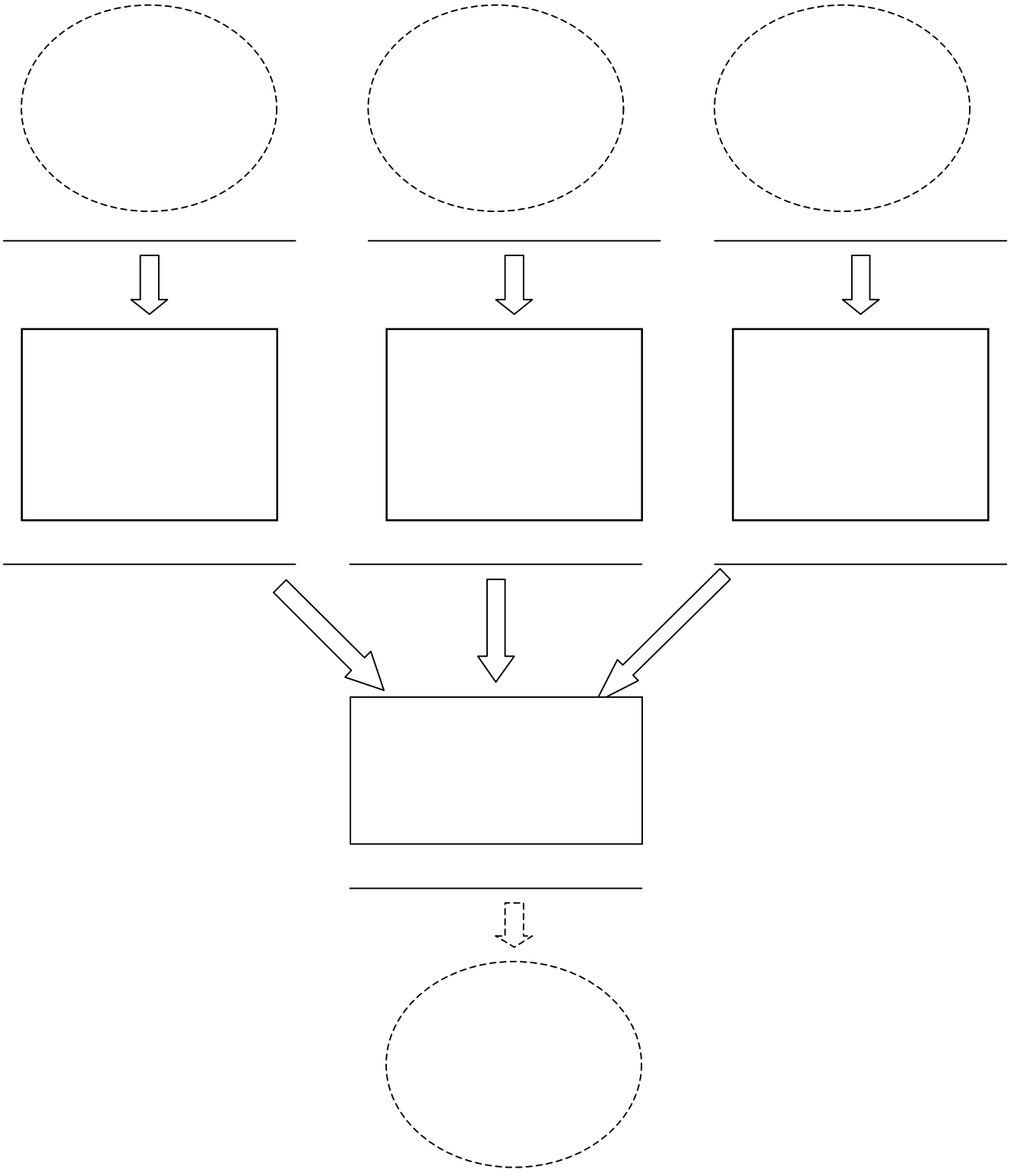
CPCTC

Proof #12

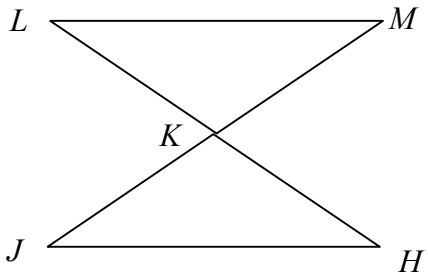


Given: $\overline{LH}$ and $\overline{JM}$ bisect each other at K

Prove: $\overline{HJ} \cong \overline{ML}$



Proof #12 ANSWER KEY



Given: $\overline{LH}$ and $\overline{JM}$ bisect each other at K

Prove: $\overline{HJ} \cong \overline{ML}$

$\overline{LH}$ and $\overline{JM}$ bisect each other at K	$\overline{LH}$ and $\overline{JM}$ bisect each other at K	
$\overline{LK} \cong \overline{HK}$	$\overline{MK} \cong \overline{JK}$	$\angle LKM \cong \angle HKJ$
Defn. of a bisector	Defn. of a bisector	Vertical Angles

$\triangle LKM \cong \triangle HKJ$

SAS

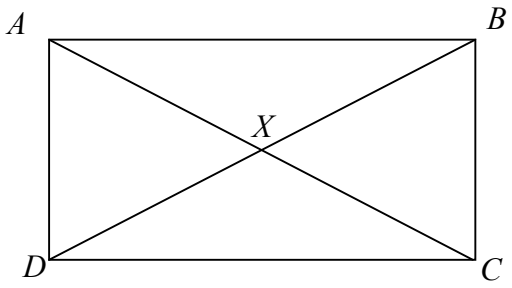
$\overline{HJ} \cong \overline{ML}$

CPCTC

Proof #13

Given: *ABCD* is a rectangle

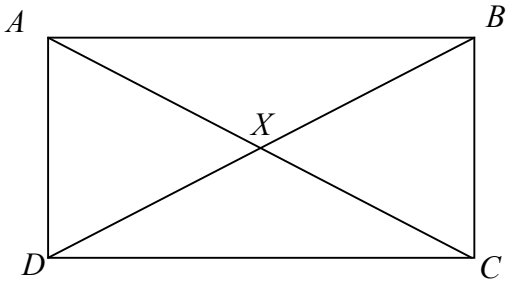
Prove: $\angle BDC \cong \angle ACD$



Proof #13 ANSWER KEY

Given: $ABCD$ is a rectangle

Prove: $\angle BDC \cong \angle ACD$



$ABCD$ is a rectangle

Given

$\angle ADC$ and $\angle BCD$ are right angles

Defn. of a rectangle

$\overline{AC} \cong \overline{BD}$

Diags. of a rectangle are congruent

$\overline{CD} \cong \overline{CD}$

or

$\overline{AD} \cong \overline{BC}$

Reflexive or Opp. sides of a rectangle are congruent

$\triangle ADC \cong \triangle BCD$

HL

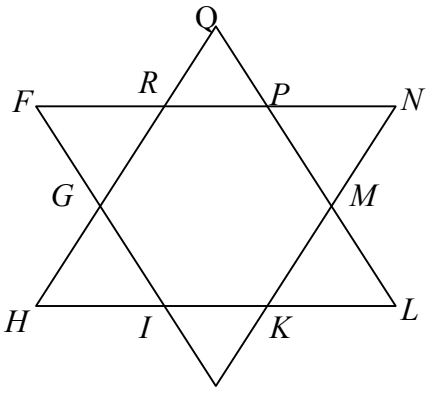
$\angle BDC \cong \angle ACD$

CPCTC

Proof #14

Given: *RPMKIG* is a regular hexagon
$\triangle FNJ$ is equilateral

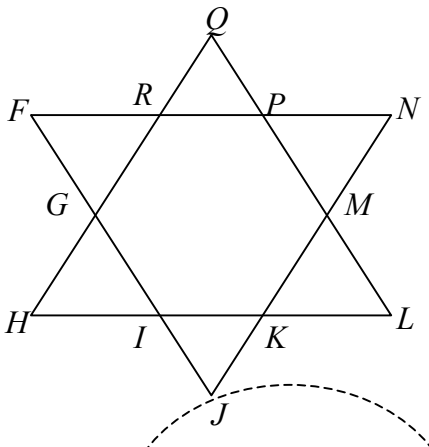
Prove: $\angle FGR \cong \angle NMP$



Proof #14 ANSWER KEY

Given: *RPMKIG* is a regular hexagon
$\triangle FNJ$ is equilateral

Prove: $\angle FGR \cong \angle NMP$



RPMKIG is a regular hexagon

Given

$\overline{GR} \cong \overline{PM}$

Defn. regular polygons

$\triangle FNJ$ is equilateral

Given

$\angle F \cong \angle N$

Equilateral triangles are equiangular

$\angle GRP \cong \angle MPR$

Defn. regular polygons

$\angle FRG \cong \angle NPM$

Supplements of congruent angles are congruent

$\triangle FRG \cong \triangle NPM$

AAS

$\angle FGR \cong \angle NMP$

CPCTC

Two Column Proofs

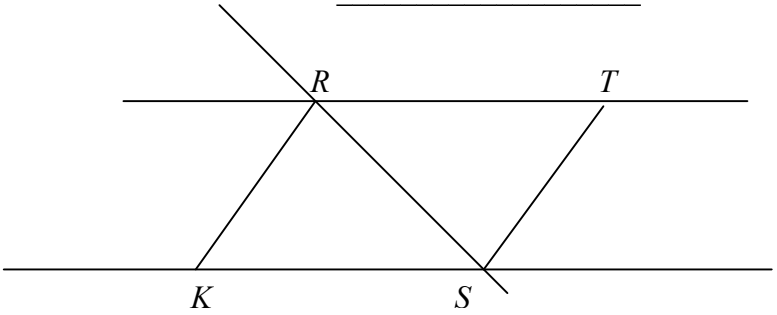
Name: _____

Date: _____

1.

Given: $\overline{RT} \parallel \overline{KS}$, $\overline{KR} \parallel \overline{ST}$

Prove: $\triangle KRS \cong \triangle TSR$

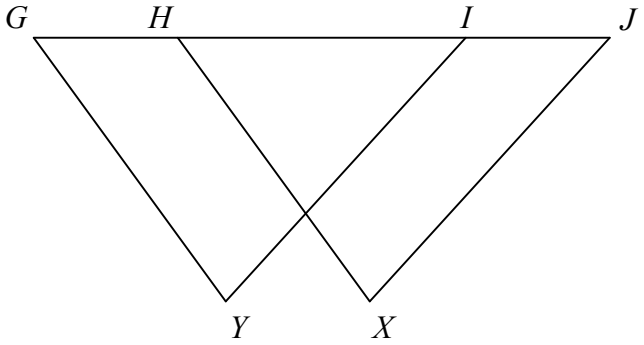


STATEMENTS	REASONS
1. $\overline{RT} \parallel \overline{KS}$	1.
2. $\angle TRS \cong \angle RSK$	2.
3. $\overline{KR} \parallel \overline{ST}$	3.
4. $KRTS$ is a parallelogram	4.
5. $\angle RKS \cong \angle STR$	5.
6. $\overline{RS} \cong \overline{RS}$	6.
7. $\Delta KRS \cong \Delta TSR$	7.

2.

Given: $\overline{GH} \cong \overline{IJ}$, $\overline{GY} \parallel \overline{HX}$, $\overline{IY} \parallel \overline{JX}$

Prove: $\triangle GYI \cong \triangle HXJ$



STATEMENTS	REASONS
1.	1. Given
2.	2. Additive Property
3.	3. Given
4.	4. Definition of Corresponding Angles
5.	5. Given
6.	6. Definition of Corresponding Angles
7.	7. ASA

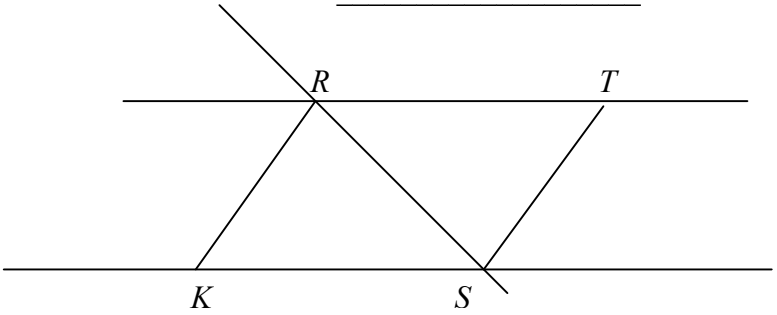
Two Column Proofs

Name: __ANSWER KEY___
Date: _____

1.

Given: $\overline{RT} \parallel \overline{KS}$, $\overline{KR} \parallel \overline{ST}$

Prove: $\triangle KRS \cong \triangle TSR$

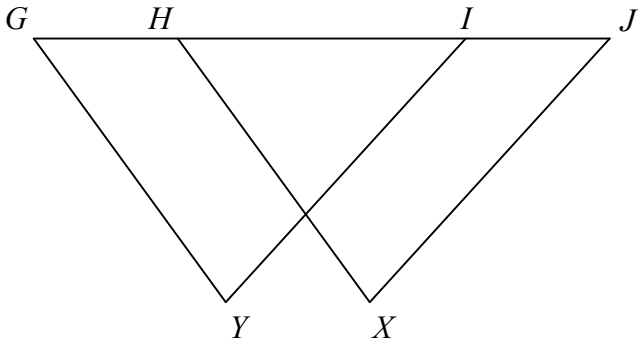


STATEMENTS	REASONS
1. $\overline{RT} \parallel \overline{KS}$	1. Given
2. $\angle TRS \cong \angle RSK$	2. Definition of Alt. Interior Angles
3. $\overline{KR} \parallel \overline{ST}$	3. Given
4. $KRTS$ is a parallelogram	4. Def. of Parallelogram
5. $\angle RKS \cong \angle STR$	5. Property of Parallelogram
6. $\overline{RS} \cong \overline{RS}$	6. Reflexive Property
7. $\Delta KRS \cong \Delta TSR$	7. AAS

2.

Given: $\overline{GH} \cong \overline{IJ}$, $\overline{GY} \parallel \overline{HX}$, $\overline{IY} \parallel \overline{JX}$

Prove: $\triangle GYI \cong \triangle HXJ$

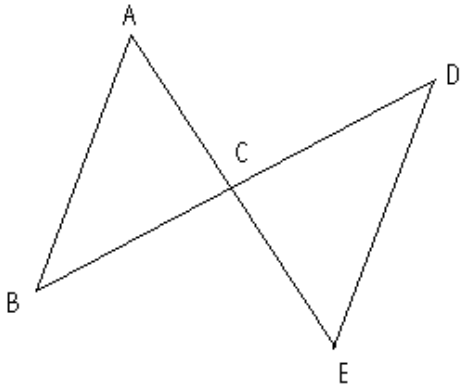


STATEMENTS	REASONS
1. $\overline{GH} \cong \overline{IJ}$	1. Given
2. $\overline{GI} \cong \overline{HJ}$	2. Additive Property
3. $\overline{GY} \parallel \overline{HX}$	3. Given
4. $\angle IGY \cong \angle JHX$	4. Definition of Corresponding Angles
5. $\overline{IY} \parallel \overline{JX}$	5. Given
6. $\angle GIY \cong \angle HJX$	6. Definition of Corresponding Angles
7. $\Delta GYI \cong \Delta HXJ$	7. ASA

Proof # 15

Given: $\overline{AB} \parallel \overline{ED}$, and C is the midpoint of $\overline{BD}$

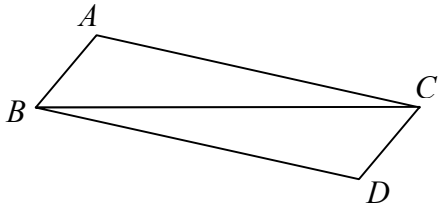
Prove: $\triangle BCA \cong DCE$



Proof # 16

Given: $\overline{AB} \cong \overline{DC}$, $\overline{AC} \cong \overline{DB}$

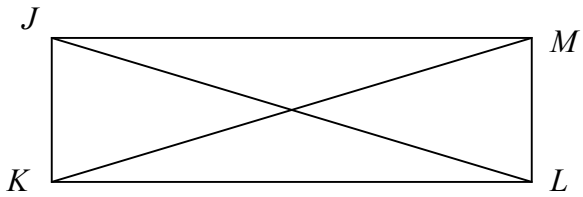
Prove: $\triangle CBD \cong \triangle BCA$



Proof # 17

Given: $JKLM$ is a rectangle

Prove: $\overline{JL} \cong \overline{MK}$



Proof # 18

Given: $\triangle FGHI$ is a kite, with $\overline{FG} \cong \overline{GH}$

Prove: $\triangle FIG \cong \triangle HIG$

Proof # 19

Given: $\overline{LM}$ and $\overline{NO}$ bisect each other at P

Prove: $\overline{LN} \cong \overline{OM}$

Proof # 15 ANSWER KEY

Given: $\overline{AB} \parallel \overline{ED}$, and C is the midpoint of $\overline{BD}$ Prove: $\triangle BCA \cong DCE$

STATEMENTS	REASONS
1. $\overline{AB} \parallel \overline{ED}$	1. Given
2. $\angle ABC \cong \angle EDC$	2. Def. of Alt. Int. Angles
3. C is the midpoint of $\overline{BD}$	3. Given
4. $\overline{BC} \cong \overline{DC}$	4. Def. of Midpoint
5. $\angle ACB \cong \angle ECD$	5. Vertical Angles
6. $\triangle BCA \cong DCE$	6. ASA

Proof # 16 ANSWER KEY

Given: $\overline{AB} \cong \overline{DC}$, $\overline{AC} \cong \overline{DB}$ Prove: $\angle CBD \cong \angle BCA$

STATEMENTS	REASONS
1. $\overline{AB} \cong \overline{DC}$	1. Given
2. $\overline{AC} \cong \overline{DB}$	2. Given
3. $\overline{BC} \cong \overline{BC}$	3. Reflexive Property
4. $\triangle ABC \cong \triangle DCB$	4. SSS
5. $\angle CBD \cong \angle BCA$	5. CPCTC

Proof # 17 ANSWER KEY

Given: $JKLM$ is a rectangle Prove: $\overline{JL} \cong \overline{MK}$ using congruent triangles

STATEMENTS	REASONS
1. $JKLM$ is a rectangle	1. Given
2. $\overline{JK} \cong \overline{ML}$	2. Definition of a rectangle
3. $\angle JKL \cong \angle MLK$	3. Definition of a rectangle
4. $\overline{KL} \cong \overline{KL}$	4. Reflexive
5. $\triangle JKL \cong \triangle MLK$	5. SAS
6. $\overline{JL} \cong \overline{MK}$	6. CPCTC

Proof # 18 ANSWER KEY

Given: $\square FGHI$ is a kite, with $\overline{FG} \cong \overline{HG}$ Prove: $\angle FIG \cong \angle HIG$

STATEMENTS	REASONS
1. $\square FGHI$ is a kite	1. Given
2. $\overline{FG} \cong \overline{HG}$	2. Given
3. $\overline{FI} \cong \overline{HI}$	3. Definition of a Kite
4. $\overline{GI} \cong \overline{GI}$	4. Reflexive
5. $\triangle FGI \cong \triangle HGI$	5. SSS
6. $\angle FIG \cong \angle HIG$	6. CPCTC

Proof # 19 ANSWER KEY

Given: $\overline{LM}$ and $\overline{NO}$ bisect each other at P Prove: $\overline{LN} \cong \overline{OM}$

STATEMENTS	REASONS
1. $\overline{LM}$ and $\overline{NO}$ bisect each other at P	1. Given
2. $\overline{LP} \cong \overline{PM}$, $\overline{NP} \cong \overline{PO}$	2. Definition of Bisect
3. $\angle LPN \cong \angle OPM$	3. Vertical Angles
4. $\triangle LPN \cong \triangle MPO$	4. SAS
5. $\overline{LN} \cong \overline{OM}$	5. CPCTC

Round Table Proofs

Student #1: _____ Student #2_____
Student #3: _____ Student #4_____

Given: $\overline{AB} \cong \overline{BC}, \overline{BD} \perp \overline{AB}$ Picture:

Prove: $\Delta ABD \cong \Delta CBD$

STATEMENTS	REASONS
1. $\overline{AB} \cong \overline{BC}$	1.
2.	2. Isosceles Triangle Theorem
3.	3. Given
4. $\angle BDA \cong \angle BDC$	4.
5.	5. Reflexive property
6. $\Delta ABD \cong \Delta CBD$	6.

Student #1: _____ Student #2_____
Student #3: _____ Student #4_____

Given: $\overline{EF} \,//\, \overline{HI}$, G is the midpoint of $\overline{EI}$ Picture:

Prove: $\Delta EGF \cong \Delta IGH$

STATEMENTS	REASONS
1. G is the midpoint of $\overline{EI}$	1.
2.	2. Definition of midpoint
3.	3. Given
4. $\angle FEG \cong \angle HIG$	4.
5. $\angle EGF \cong \angle IGH$	5.
6. $\Delta EGF \cong \Delta IGH$	6.

Student #1: _____ Student #2_____

Student #3: _____ Student #4_____

Given: $ABCD$ is a parallelogram with diagonal $\overline{DB}$

Picture:

Prove: $\angle ADB \cong \angle CBD$

STATEMENTS	REASONS
1. $ABCD$ is a parallelogram w/ diag $\overline{DB}$	1.
2. $\overline{AD} \cong \overline{CB}, \overline{AB} \cong \overline{BD}$	2.
3.	3.
4.	4. SSS
5. $\angle ADB \cong \angle CBD$	5.

Student #1: _____ Student #2_____

Student #3: _____ Student #4_____

Given: $\overline{PR}$ and $\overline{QS}$ bisect each other at T

Picture:

Prove: $\overline{PQ} \cong \overline{SR}$

STATEMENTS	REASONS
1.	1. Given
2. $\overline{PT} \cong \overline{TR}, \overline{QT} \cong \overline{TS}$	2.
3.	3.
4.	4. SAS
5. $\overline{PQ} \cong \overline{SR}$	5.

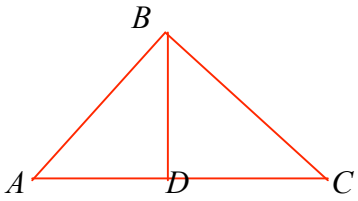
Round Table Proofs ANSWER KEY

Student #1: _____ Student #2_____
Student #3: _____ Student #4_____

Given: $\overline{AB} \cong \overline{BC}, \overline{BD} \perp \overline{AB}$

Prove: $\Delta ABD \cong \Delta CBD$

Picture:



STATEMENTS	REASONS
1. $\overline{AB} \cong \overline{BC}$	1. Given
2. $\angle BAD \cong \angle BCD$	2. Isosceles Triangle Theorem
3. $\overline{BD} \perp \overline{AB}$	3. Given
4. $\angle BDA \cong \angle BDC$	4. Definition of Perpendicular
5. $\overline{BD} \cong \overline{BD}$	5. Reflexive property
6. $\Delta ABD \cong \Delta CBD$	6. AAS

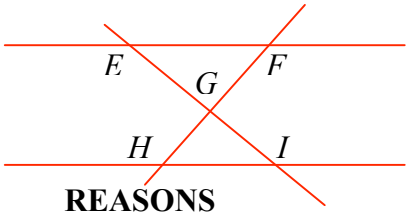
Student #1: _____ Student #2_____
Student #3: _____ Student #4_____

Given: $\overline{EF} \parallel \overline{HI}$, G is the midpoint of $\overline{EI}$

,

Prove: $\Delta EGF \cong \Delta IGH$

Picture:



STATEMENTS	REASONS
1. G is the midpoint of $\overline{EI}$	1. Given
2. $\overline{EG} \cong \overline{GI}$	2. Definition of midpoint
3. $\overline{EF} \parallel \overline{HI}$	3. Given
4. $\angle FEG \cong \angle HIG$	4. Alt. Int. Angles
5. $\angle EGF \cong \angle IGH$	5. Vertical Angles
6. $\Delta EGF \cong \Delta IGH$	6. ASA

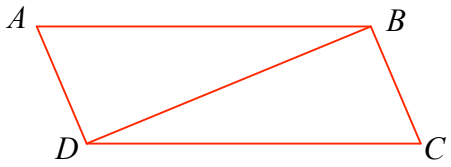
Student #1: _____ Student #2_____

Student #3: _____ Student #4_____

Given: $ABCD$ is a parallelogram with diagonal $\overline{DB}$

Prove: $\angle ADB \cong \angle CBD$

Picture:



STATEMENTS	REASONS
1. $ABCD$ is a parallelogram w/ diag $\overline{DB}$	1. Given
2. $\overline{AD} \cong \overline{CB}, \overline{AB} \cong \overline{BD}$	2. Property of Parallelogram
3. $\overline{DB} \cong \overline{DB}$	3. Reflexive Property
4. $\Delta ADB \cong \Delta CBD$	4. SSS
5. $\angle ADB \cong \angle CBD$	5. CPCTC

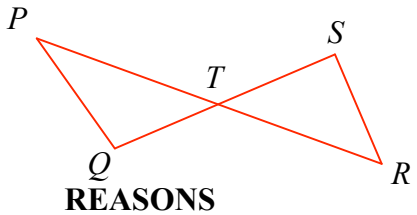
Student #1: _____ Student #2_____

Student #3: _____ Student #4_____

Given: $\overline{PR}$ and $\overline{QS}$ bisect each other at T

Prove: $\overline{PQ} \cong \overline{SR}$

Picture:



STATEMENTS	REASONS
1. $\overline{PR}$ and $\overline{QS}$ bisect each other at T	1. Given
2. $\overline{PT} \cong \overline{TR}, \overline{QT} \cong \overline{TS}$	2. Definition of Bisect
3. $\angle PTQ \cong \angle RTS$	3. Vertical Angles
4. $\Delta PTQ \cong \Delta RTS$	4. SAS
5. $\overline{PQ} \cong \overline{SR}$	5. CPCTC

Flow Chart Template