

Sec 2.6 Geometry – Triangle Proofs

Name: _____

COMMON POTENTIAL REASONS FOR PROOFS

Definition of Congruence: Having the exact same size and shape and there by having the exact same measures.

Definition of Midpoint: The point that divides a segment into two congruent segments.

Definition of Angle Bisector: The ray that divides an angle into two congruent angles.

Definition of Perpendicular Lines: Lines that intersect to form right angles or 90°

Definition of Supplementary Angles: Any two angles that have a sum of 180°

Definition of a Straight Line: An undefined term in geometry, a line is a straight path that has no thickness and extends forever. It also forms a straight angle which measures 180°

Reflexive Property of Equality: any measure is equal to itself ($a = a$)

Reflexive Property of Congruence: any figure is congruent to itself ($Figure A \cong Figure A$)

Addition Property of Equality: if $a = b$, then $a + c = b + c$

Subtraction Property of Equality: if $a = b$, then $a - c = b - c$

Multiplication Property of Equality: if $a = b$, then $ac = bc$

Division Property of Equality: if $a = b$, then $\frac{a}{c} = \frac{b}{c}$

Transitive Property: if $a = b$ & $b = c$ then $a = c$ OR if $a \cong b$ & $b \cong c$ then $a \cong c$.

Segment Addition Postulate: If point B is between Point A and C then $AB + BC = AC$

Angle Addition Postulate: If point S is in the interior of $\angle PQR$, then $m\angle PQS + m\angle SQR = m\angle PQR$

Side – Side – Side Postulate (SSS) : If three sides of one triangle are congruent to three sides of another triangle, then the triangles are congruent.

Side – Angle – Side Postulate (SAS): If two sides and the included angle of one triangle are congruent to two sides and the included angle of another triangle, then the triangles are congruent.

Angle – Side – Angle Postulate (ASA): If two angles and the included side of one triangle are congruent to two angles and the included side of another triangle, then the triangles are congruent.

Angle – Angle – Side Postulate (AAS) : If two angles and the non-included side of one triangle are congruent to two angles and the non-included side of another triangle, then the triangles are congruent

Hypotenuse – Leg Postulate (HL): If a hypotenuse and a leg of one right triangle are congruent to a hypotenuse and a leg of another right triangle, then the triangles are congruent

Right Angle Theorem (R.A.T.): All right angles are congruent.

Vertical Angle Theorem (V.A.T.): Vertical angles are congruent.

Triangle Sum Theorem: The three angles of a triangle sum to 180°

Linear Pair Theorem: If two angles form a linear pair then they are adjacent and are supplementary.

Third Angle Theorem: If two angles of one triangle are congruent to two angles of another triangle, then the third pair of angles are congruent.

Alternate Interior Angle Theorem (and converse): Alternate interior angles are congruent if and only if the transversal that passes through two lines that are parallel.

Alternate Exterior Angle Theorem (and converse): Alternate exterior angles are congruent if and only if the transversal that passes through two lines that are parallel.

Corresponding Angle Theorem (and converse) : Corresponding angles are congruent if and only if the transversal that passes through two lines that are parallel.

Same-Side Interior Angles Theorem (and converse) : Same Side Interior Angles are supplementary if and only if the transversal that passes through two lines that are parallel.

Pythagorean Theorem (and converse): A triangle is right triangle if and only if the given the length of the legs a and b and hypotenuse c have the relationship $a^2 + b^2 = c^2$

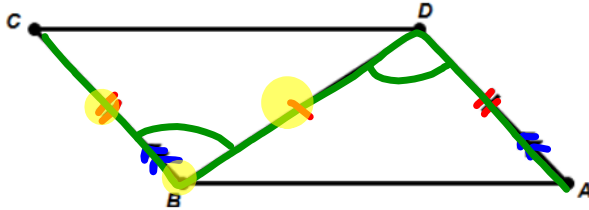
Isosceles Triangle Theorem (and converse): A triangle is isosceles if and only if its base angles are congruent.

Triangle Mid-segment Theorem: A mid-segment of a triangle is parallel to a side of the triangle, and its length is half the length of that side.

CPCTC: Corresponding Parts of Congruent Triangles are Congruent by definition of congruence.

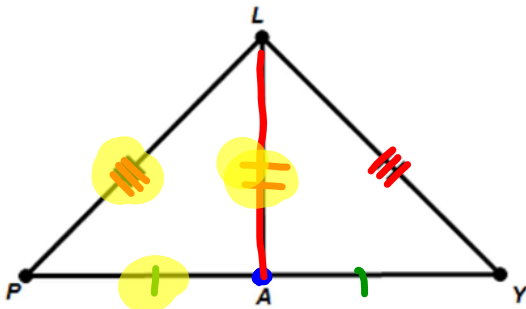
2. Prove which of the following triangles congruent if possible by filling in the missing blanks:

a. Given $\overline{CB} \cong \overline{AD}$ and $\overline{CB} \parallel \overline{AD}$



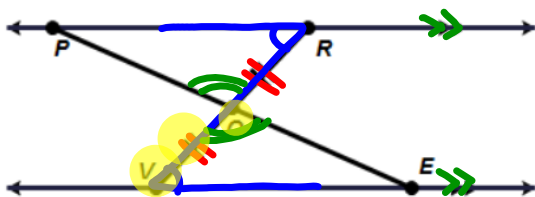
Statements	Reasons
1. $\overline{CB} \cong \overline{AD}$	Given
2. $\overline{CB} \parallel \overline{AD}$	Given
3. $\angle CBD \cong \angle ADB$	AIA Thm.
4. $\overline{BD} \cong \overline{BD}$	Reflexive Prop. of \cong
5. $\triangle BCD \cong \triangle DAB$	SAS

b. Given $\overline{PL} \cong \overline{YL}$ and Point A is the midpoint of \overline{PY}



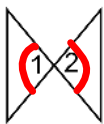
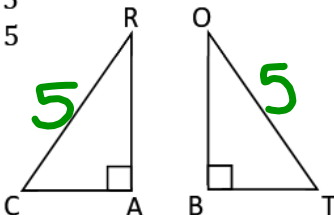
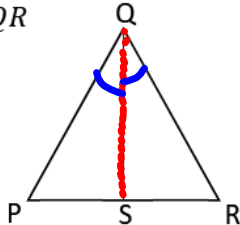
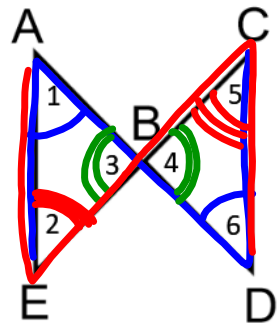
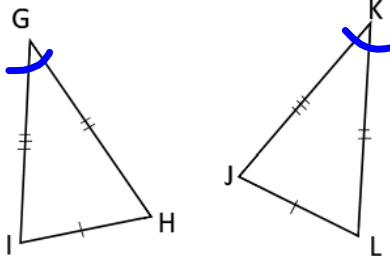
Statements	Reasons
1. $\overline{PL} \cong \overline{YL}$	Given
2. A is midpoint of \overline{PY}	Given
3. $\overline{AP} \cong \overline{AY}$	Definition of Midpoint
4. $\overline{LA} \cong \overline{LA}$	Reflexive property of congruence
5. $\triangle PLA \cong \triangle YLA$	By steps 1,3,4 and SSS

c. Given $\overline{VO} \cong \overline{RO}$ and $\overline{PR} \parallel \overline{VE}$



Statements	Reasons
1. $\overline{VO} \cong \overline{RO}$	Given
2. $\overline{PR} \parallel \overline{VE}$	Given
3. $\angle PRO \cong \angle LEVO$	AIA Thm.
4. $\angle ROP \cong \angle LVOE$	VA Thm.
5. $\triangle PRO \cong \triangle EVO$	ASA

Proofs: justify your statements with reasons

Given	Statement	Reason
	$\angle 1 \cong \angle 2$	Vertical Angles Theorem
<p>Given: $m\overline{CR} = 5$ $m\overline{TO} = 5$</p> 	$\angle A \cong \angle B$ $m\overline{CR} = m\overline{TO}$ $\overline{CR} \cong \overline{TO}$	Right Angles Theorem Definition of Congruence
<p>Given: \overline{QS} bisects $\angle PQR$</p> 	$\angle PQS \cong \angle RQS$	Definition of angle bisector
	$\overline{QS} \cong \overline{QS}$ Itself	Reflexive Property of Congruence
<p>Given: $\overline{AE} \parallel \overline{CD}$</p> 	$\angle 1 \cong \angle 6$	Alternate Interior Angles Theorem
	$\angle 3 \cong \angle 4$	Vertical Angles Theorem
	$\angle 2 \cong \angle 5$	AIA Thm.
	$\triangle GHI \cong \triangle KIJ$	SSS \cong Postulate
	$\angle G \cong \angle K$	CPCCTC corresponding angles congruent triangles congruent

The "extra"

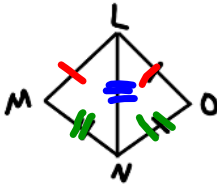
Geometry

Practice with Proving Triangles Congruent

Name: _____ Date: _____

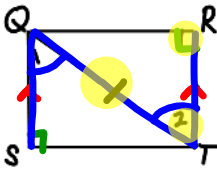
Matching: Use the choices listed at the bottom in the box for problems #1 – 4

Problem 1:



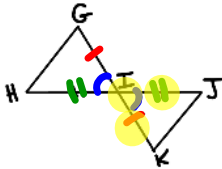
Statement	Reason
✓ 1. $\overline{LM} \cong \overline{LO}$	1. Given
✓ 2. $\overline{MN} \cong \overline{ON}$	2. Given
3. $\overline{LN} \cong \overline{LN}$	3. Reflexive Prop. of \cong
4. $\triangle LMN \cong \triangle LON$	4. SSS

Problem 2:



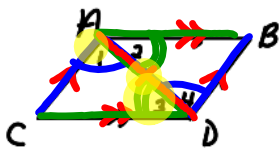
Statement	Reason
✓ 1. $\overline{QS} \parallel \overline{RT}$	1. Given
2. $\angle R$ and $\angle S$ are right angles	2. Given
3. $\angle R \cong \angle S$	3. Right Angle Theorem (RAT)
4. $\angle 1 \cong \angle 2$	4. AIA Thm.
5. $\overline{QT} \cong \overline{TQ}$	5. Reflexive Prop. of \cong
6. $\triangle QST \cong \triangle TRQ$	6. AAS

Problem 3:



Statement	Reason
✓ 1. $\overline{GI} \cong \overline{KI}$	1. Given
✓ 2. $\overline{HI} \cong \overline{JI}$	2. Given
3. $\angle GIH \cong \angle KIJ$	3. VA Thm.
4. $\triangle GIH \cong \triangle KIJ$	4. SAS

Problem 4:



Statement	Reason
✓ 1. $\overline{AC} \parallel \overline{BD}, \overline{AB} \parallel \overline{CD}$	1. Given
✓ 2. $\angle 1 \cong \angle 4, \angle 2 \cong \angle 3$	2. AIA Thm.
3. $\overline{AD} \cong \overline{DA}$	3. Reflexive Prop. of \cong
4. $\triangle ADC \cong \triangle DAB$	4. ASA

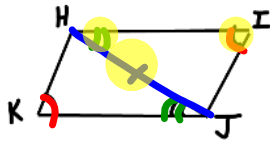
Choices for problems #1 – 4 (some will be used more than once):

- AAS
- ASA
- Alternate Interior Angles are \cong
- Given
- Reflexive Property
- SAS
- SSS
- Vertical Angles are \cong

Geometry
Fill in the blank proofs:

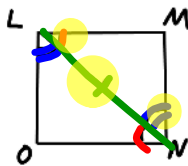
Practice with Proving Triangles Congruent

Problem 5:



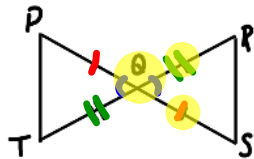
Statement	Reason
✓ 1. $\angle I \cong \angle K$	1. Given
✓ 2. $\angle IHJ \cong \angle KJH$	2. Given
3. $\overline{HJ} \cong \overline{JH}$	3. Reflexive Prop. of \cong
4. $\triangle HJK \cong \triangle JHI$	4. AAS

Problem 6:



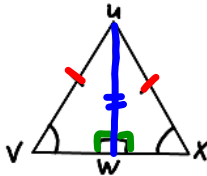
Statement	Reason
✓ 1. $\angle MLN \cong \angle ONL$	1. Given
✓ 2. $\angle OLN \cong \angle MNL$	2. Given
3. $\overline{LN} \cong \overline{NL}$	3. Reflexive Property
4. $\triangle LNO \cong \triangle NLM$	4. ASA

Problem 7:



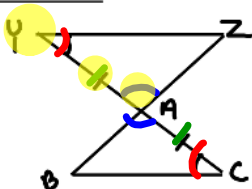
Statement	Reason
✓ 1. $\overline{PQ} \cong \overline{SQ}$	1. Given
✓ 2. $\overline{TQ} \cong \overline{RQ}$	2. Given
3. $\angle PQT \cong \angle SQR$	3. VA Thm.
4. $\triangle PQT \cong \triangle SQR$	4. SAS

Problem 8:



Statement	Reason
✓ 1. $\overline{UV} \cong \overline{UX}$	1. Given
2. $\angle UWV$ and $\angle UWX$ are right angles	2. Given
3. $\angle UWV \cong \angle UWX$	3. Right Angle Congruence (RAT)
4. $\overline{UW} \cong \overline{UW}$	4. Reflexive Property
✓ 5. $\angle V \cong \angle X$	5. Given
6. $\triangle UWV \cong \triangle UWX$	6. HL or AAS

Problem 9:

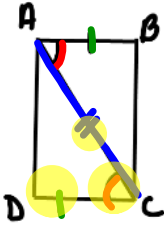


Statement	Reason
✓ 1. $\angle Y \cong \angle C$	1. Given
✓ 2. $\overline{YA} \cong \overline{CA}$	2. Given
3. $\angle YZA \cong \angle CAB$	3. Vertical Angles are congruent
4. $\triangle YZA \cong \triangle CAB$	4. ASA

Geometry

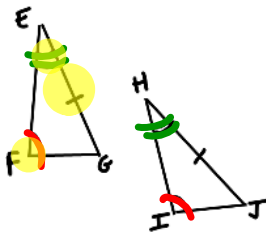
Practice with Proving Triangles Congruent

Problem 10:



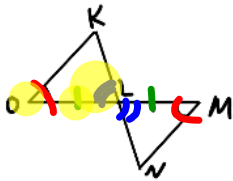
Statement	Reason
✓ 1. $\angle BAC \cong \angle DCA$	1. Given
✓ 2. $\overline{AB} \cong \overline{DC}$	2. Given
3. $\overline{AC} \cong \overline{CA}$	3. Reflexive Prop of \cong
4. $\triangle ABC \cong \triangle DCA$	4. SAS

Problem 11:



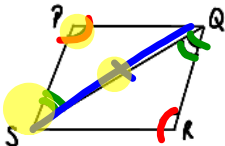
Statement	Reason
✓ 1. $\angle F \cong \angle I$	1. Given
✓ 2. $\angle E \cong \angle H$	2. Given
✓ 3. $\overline{EG} \cong \overline{HJ}$	3. Given
4. $\triangle EFG \cong \triangle HIJ$	4. AAS

Problem 12:



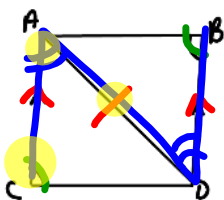
Statement	Reason
✓ 1. $\angle O \cong \angle M$	1. Given
✓ 2. $\overline{OL} \cong \overline{ML}$	2. Given
3. $\angle KLN \cong \angle MLO$	3. VA Thm.
4. $\triangle KLO \cong \triangle NLM$	4. ASA
5. $\angle K \cong \angle N$	5. CPCTC

Problem 13:



Statement	Reason
✓ 1. $\angle P \cong \angle R$	1. Given
✓ 2. $\angle PSQ \cong \angle RQS$	2. Given
3. $\overline{SQ} \cong \overline{QS}$	3. Reflexive
4. $\triangle PQS \cong \triangle RSQ$	4. AAS

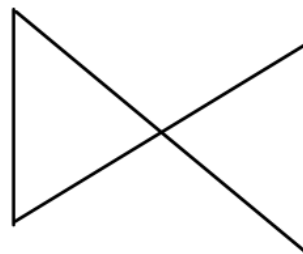
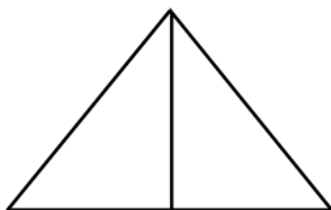
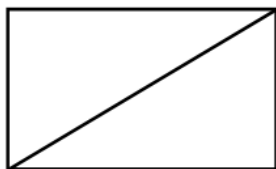
Problem 14:



Statement	Reason
✓ 1. $\overline{AC} \parallel \overline{BD}$	1. Given
✓ 2. $\angle B \cong \angle C$	2. Given
3. $\angle CAD \cong \angle BDA$	3. AIA Thm.
4. $\overline{AD} \cong \overline{DA}$	4. Reflexive Property
5. $\triangle ACD \cong \triangle DBA$	5. AAS

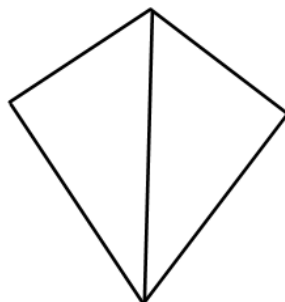
Euclidean Geometry
Triangle Proof Tips

Name _____



General Directions:

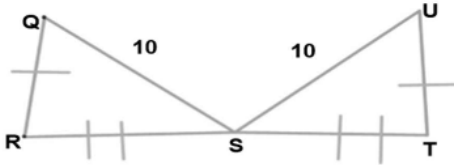
1. You need 3 congruencies to prove that 2 triangles are congruent.
 2. You cannot make up your own "given" information.
 3. Every time you get a side or angle congruence, move to the next piece of given information.
 4. When you run out of given information, try vertical angles or reflexive property.
-
- ❖ If you are given a midpoint of a segment, look for 2 congruent segments.
 - ❖ If you are given an angle bisector, look for two congruent angles.
 - ❖ If you are given parallel lines, look for Alternate Interior angles to be congruent.
 - ❖ If you are given for perpendicular lines look for right angles.
 - ❖ You can use the Reflexive Property and Vertical Angles without given information.



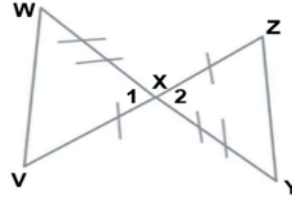
Triangle Congruence Proofs Practice

Name _____ Date _____

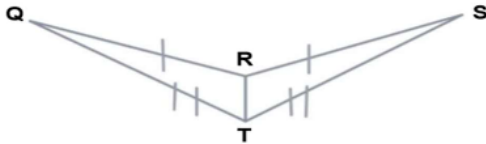
Given: $\overline{QR} \cong \overline{UT}$, $\overline{RS} \cong \overline{TS}$, $m\overline{QS} = 10$, $m\overline{US} = 10$
 Prove: $\triangle QRS \cong \triangle UTS$



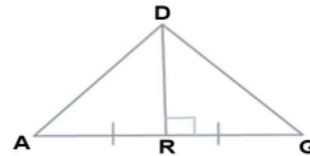
Given: $\overline{WX} \cong \overline{XY}$, $\overline{VX} \cong \overline{ZX}$
 Prove: $\triangle VXW \cong \triangle ZXY$



Given: $\overline{RS} \cong \overline{RQ}$ and $\overline{ST} \cong \overline{QT}$
 Prove: $\triangle QRT \cong \triangle SRT$

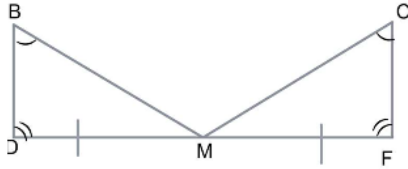


Given: $\overline{DR} \perp \overline{AG}$, $\overline{AR} \cong \overline{GR}$
 Prove: $\triangle DRA \cong \triangle DRG$



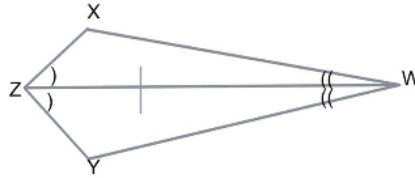
Triangle Congruence Proofs Practice

Given that $\angle B \cong \angle C$, $\angle D \cong \angle F$, M is the midpoint of \overline{DF}
 Prove $\triangle BDM \cong \triangle CFM$



Name _____ Date _____

- Given that \overline{WZ} bisects $\angle XZY$ and $\angle XWY$
- Show that $\triangle WZX \cong \triangle WZY$

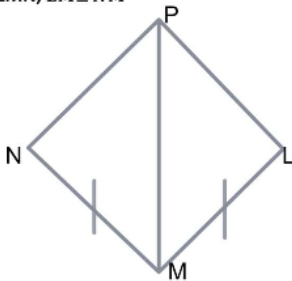


PCTC

\triangle PCTC-corresponding parts of \cong triangles are \cong .

Given: \overline{MP} bisects $\angle LMN$, $\overline{LM} \cong \overline{NM}$

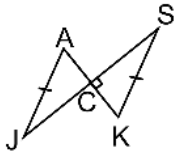
Prove: $\overline{LP} \cong \overline{NP}$



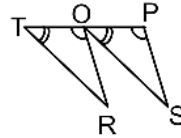
Triangle Congruence Proofs Practice

Name _____ Date _____

Given that \overline{AK} bisects \overline{JS} and $\overline{AJ} \cong \overline{KS}$
 Prove: $\overline{AC} \cong \overline{KC}$

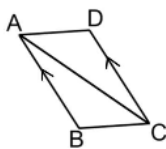


Given: O is the midpoint of \overline{PT} , $\angle RTO \cong \angle SOP$,
 and $\angle TOR \cong \angle OPS$
 Prove: $\overline{RO} \cong \overline{PS}$



Given that $\angle BCA \cong \angle DAC$ and $\overline{AB} \parallel \overline{DC}$.

Prove that $\angle CBA \cong \angle ADC$ by completing the following proof.



Statement	Reason
_____	Given
$\overline{AB} \parallel \overline{DC}$	_____
_____	Reflexive Property
$\angle CAB \cong \angle ACD$	_____
_____	_____
_____	_____

