Name:

Proofs Regents Review!

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2025

Triangle Proofs:

If it is not specified, prove triangles are congruent
To prove triangles are congruent, prove 3 pairs of sides/angles are congruent
To prove segments or angles, use CPCTC
<u>*If you get stuck, make something up and keep on going!</u>

1) Do a mini proof with your givens

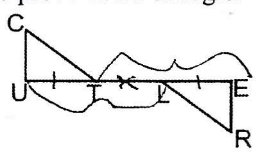
Line bisector creates two congruent segments
Midpoint creates two congruent segments
Angle bisector creates two congruent angles
Perpendicular lines create two congruent right angles
Parallel lines cut by a transversal create congruent alternate interior angles
*Perpendicular bisector is perpendicular and line bisector (1 pair of congruent right angles, 1 pair of congruent segs)
*If segments bisect each other, they are both cut in half (2 pairs of congruent segments)
*A median intersects a segment at its *midpoint*
*An altitude is *perpendicular* to the base

2) Use additional tools:

Vertical Angles are congruent (Look for an X)
Reflexive Property (A side/angle is in both triangles and is congruent to itself)
Isosceles Triangles (In a triangle, congruent angles are opposite congruent sides)
Addition and Subtraction Property (If you need more or less of a shared side)
*You must use three congruent statements to get one congruent statement for the triangles. The two that you are adding/subtracting and the one that you want to prove in the triangle.

7. Given: $\overline{UL} \cong \overline{TE}$
Prove: $\triangle CUT \cong \triangle REL$

Statements	Reasons
(1) $\overline{UL} \cong \overline{TE}$	(1) given
(2) $\overline{TL} \cong \overline{TL}$	(2) reflexive property
(3) $\overline{UT} \cong \overline{LE}$ (or) $UL - TL \cong TE - TL$	(3) subtraction property



Parallelogram Theorems	Circle Theorems (Look for inscribed angles)
A parallelogram/rectangle/rhombus/square has: Two pairs of opposite sides congruent Two pairs of opposite sides parallel Diagonals that bisect each other Opposite angles congruent	**Angles inscribed to the same arc are congruent** **An angle inscribed to a semicircle is a right angle** **A tangent and a radius/diameter form a right angles** All radii/diameters of a circle are congruent Congruent arcs have congruent chords have congruent central angles Parallel Lines intercept congruent arcs Tangents drawn from the same point are congruent
A rectangle/square has: Congruent right angles Congruent diagonals	
A rhombus/square has: Consecutive sides congruent Perpendicular diagonals Diagonals that bisect the angles	

To prove triangles are SIMILAR, prove AA $\cong$ AA
If asked to prove a proportion/multiplication:
1) Prove triangles are similar
2) Corresponding Sides of Similar Triangle are In Proportion (CSSTIP)
3) Cross Products are Equal
Work Backwards!

(3) $\triangle AED \sim \triangle CEB$	(3) AA ≅ AA
(4) $\frac{AE}{ED} = \frac{CE}{EB}$	(4) CSSTIP
(5) $AE \cdot EB = CE \cdot ED$	(5) cross products are equal

Mini Proofs

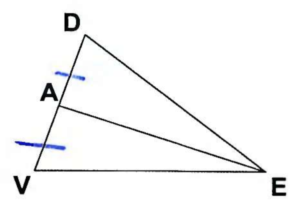
If it is not specified, prove triangles are congruent
To prove triangles are congruent, prove 3 pairs of sides/angles are congruent
To prove segments or angles, use CPCTC
<u>*If you get stuck, make something up and keep on going!</u>

1) Do a mini proof with your givens
Altitude creates congruent right angles
Median creates congruent segments
Line bisector creates congruent segments
Midpoint creates congruent segments
Angle bisector creates congruent angles
Perpendicular lines create congruent right angles
When given parallel lines:
Corresponding angles are congruent OR Alternate interior angles are congruent OR Alternate exterior angles are congruent

2) Use additional tools:
Vertical Angles are congruent (Look for an X)
Reflexive Property (A side/angle is congruent to itself)

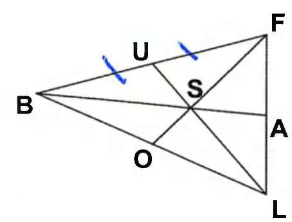
1. Given: A is the midpoint of $\overline{DV}$

Statements	Reasons
① A is the midpoint of $\overline{DV}$	① given
② $\overline{DA} \cong \overline{AV}$	② A midpoint creates two congruent segments



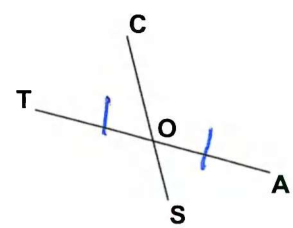
2. Given: U is the midpoint of $\overline{BF}$

Statements	Reasons
① U is the midpoint of $\overline{BF}$	① given
② $\overline{BU} \cong \overline{UF}$	② A midpoint creates two congruent segments



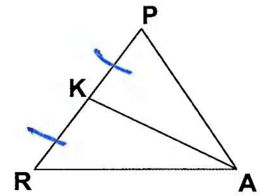
3. Given: $\overline{CS}$ bisects $\overline{TA}$

Statements	Reasons
① $\overline{CS}$ bisects $\overline{TA}$	① given
② $\overline{TO} \cong \overline{OA}$	② A line bisector creates two congruent segments



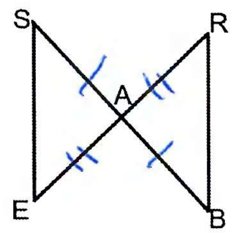
4. Given: $\overline{KA}$ bisects $\overline{PR}$

Statements	Reasons
(1) $\overline{KA}$ bisects $\overline{PR}$	(1) given
(2) $\overline{PK} \cong \overline{KR}$	(2) A line bisector creates two congruent segments



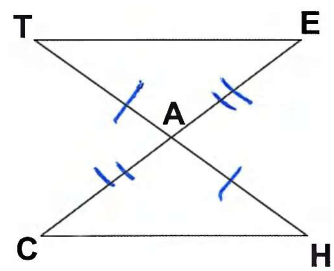
5. Given: $\overline{SB}$ and $\overline{RE}$ bisect each other

Statements	Reasons
(1) $\overline{SB}$ and $\overline{RE}$ bisect each other	(1) given
(2) $\overline{SA} \cong \overline{AB}$ $\overline{EA} \cong \overline{AR}$	(2) A line bisector creates two congruent segments



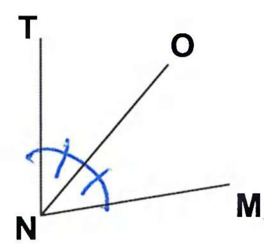
6. Given: $\overline{TH}$ and $\overline{CE}$ bisect each other

Statements	Reasons
(1) $\overline{TH}$ and $\overline{CE}$ bisect each other	(1) given
(2) $\overline{TA} \cong \overline{AH}$ $\overline{CA} \cong \overline{AE}$	(2) A line bisector creates two congruent segments



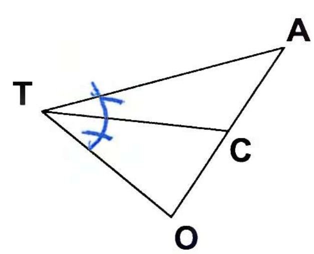
7. Given: $\overline{ON}$ bisects $\angle$ TNM

Statements	Reasons
(1) $\overline{ON}$ bisects $\angle TNM$	(1) given
(2) $\angle TNO \cong \angle MNO$	(2) An angle bisector creates two congruent angles



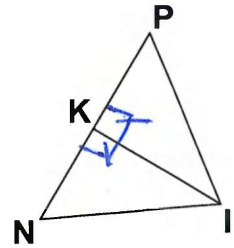
8. Given: $\overline{CT}$ bisects $\angle$ ATO

Statements	Reasons
(1) $\overline{CT}$ bisects $\angle ATO$	(1) given
(2) $\angle ATC \cong \angle OTC$	(2) An angle bisector creates two congruent angles



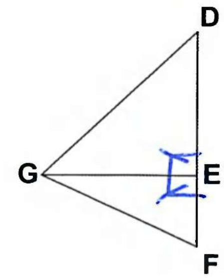
9. Given: $\overline{IK} \perp \overline{PN}$

Statements	Reasons
① $\overline{IK} \perp \overline{PN}$	① given
② $\angle PKI \cong \angle NKI$	② Perpendicular lines form congruent right angles



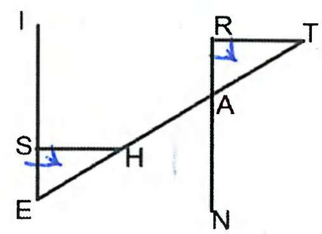
10. Given: $\overline{GE} \perp \overline{DF}$

Statements	Reasons
① $\overline{GE} \perp \overline{DF}$	① given
② $\angle FEG \cong \angle DEG$	② perpendicular lines form congruent right angles



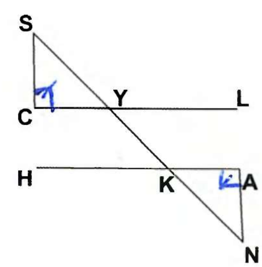
11. Given: $\overline{IE} \perp \overline{SH}$, $\overline{RN} \perp \overline{RT}$

Statements	Reasons
① $\overline{IE} \perp \overline{SH}$, $\overline{RN} \perp \overline{RT}$	① given
② $\angle HSE \cong \angle TRA$	② Perpendicular lines form congruent right angles



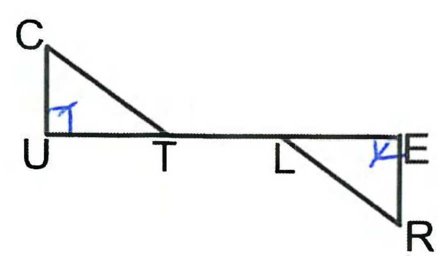
12. Given: $\overline{CL} \perp \overline{CS}$, $\overline{HA} \perp \overline{AN}$

Statements	Reasons
① $\overline{CL} \perp \overline{CS}$, $\overline{HA} \perp \overline{AN}$	① given
② $\angle SCY \cong \angle KAN$	② perpendicular lines form congruent right angles

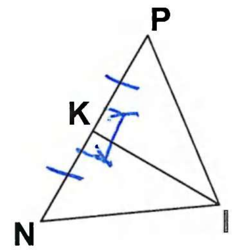


13. Given: $\overline{CU} \perp \overline{UE}$, $\overline{RE} \perp \overline{UE}$

Statements	Reasons
① $\overline{CU} \perp \overline{UE}$, $\overline{RE} \perp \overline{UE}$	① given
② $\angle CUT \cong \angle REL$	② perpendicular lines form congruent right angles

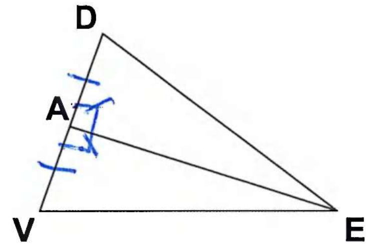


14. $\overline{IK}$ is the perpendicular bisector of $\overline{NP}$



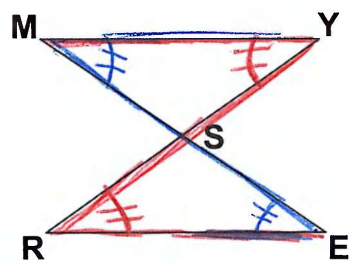
Statements	Reasons
① $\overline{IK}$ is the perpendicular bisector of $\overline{NP}$	① given
② $\angle PKI \cong \angle NKI$	② perpendicular lines form congruent right angles
③ $\overline{PK} \cong \overline{KN}$	③ A line bisector creates two congruent segments

15. $\overline{EA}$ is the perpendicular bisector of $\overline{DV}$



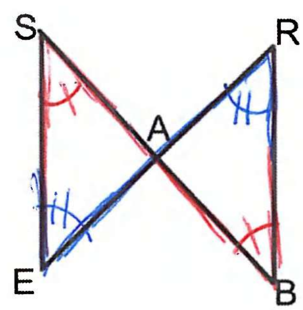
Statements	Reasons
① $\overline{EA}$ is the perpendicular bisector of $\overline{DV}$	① given
② $\angle DAE \cong \angle VAE$	② Perpendicular lines form congruent right angles
③ $\overline{DA} \cong \overline{AV}$	③ A line bisector creates two congruent segments

16. Given: $\overline{MY} \parallel \overline{RE}$



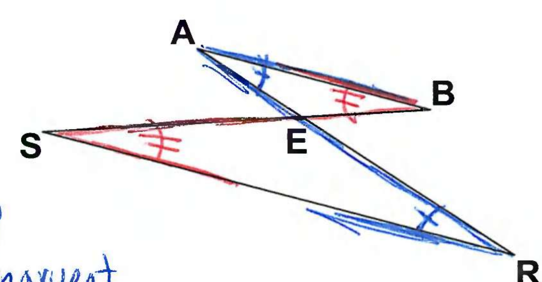
Statements	Reasons
① $\overline{MY} \parallel \overline{RE}$	① given
② $\angle M \cong \angle E$, $\angle Y \cong \angle R$	② Parallel lines cut by a transversal form congruent alternate interior angles

17. Given: $\overline{SE} \parallel \overline{RB}$



Statements	Reasons
① $\overline{SE} \parallel RB$	① given
② $\angle S \cong \angle B$, $\angle E \cong \angle R$	② Parallel lines cut by a transversal form congruent alternate interior angles

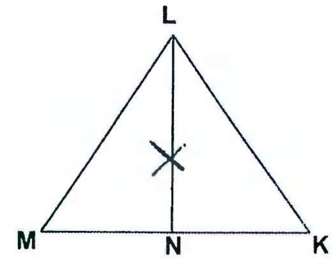
18. Given: $\overline{SR} \parallel \overline{AB}$



Statements	Reasons
① $\overline{SR} \parallel AB$	① given
② $\angle A \cong \angle R$, $\angle S \cong \angle B$	② Parallel lines cut by a transversal create congruent alternate interior angles

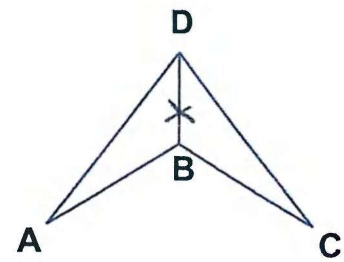
Reflexive Property and Vertical Angles

1. Given: None
   Prove: $\Delta LNM \cong \Delta LNK$



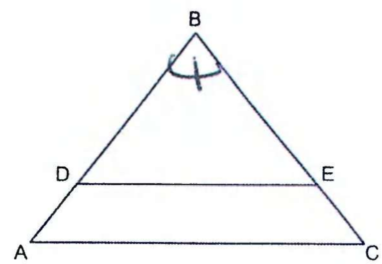
Statements	Reasons
(1) $\overline{LN} \cong \overline{LN}$	(1) Reflexive Property

2. Given: None
   Prove: $\Delta DBA \cong \Delta DBC$



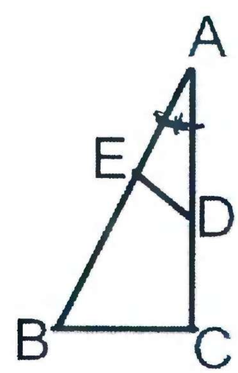
Statements	Reasons
(1) $\overline{DB} \cong \overline{DB}$	(1) Reflexive Property

3. Given: None
   Prove: $\Delta BDE \sim \Delta BAC$



Statements	Reasons
(1) $\angle B \cong \angle B$	(1) Reflexive Property

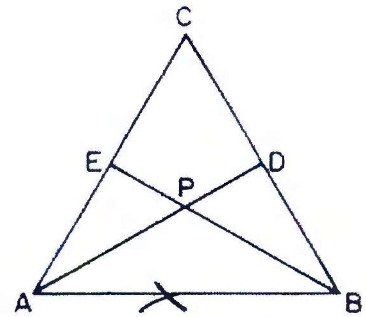
4. Given: None
   Prove: $\Delta ABC \sim \Delta ADE$



Statements	Reasons
(1) $\angle A \cong \angle A$	(1) Reflexive Property

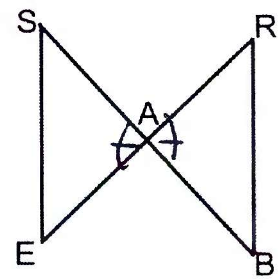
5. Given: None
Prove: $\Delta AEB \cong \Delta BDA$

Statements	Reasons
① $\overline{AB} \cong \overline{AB}$	① Reflexive Property



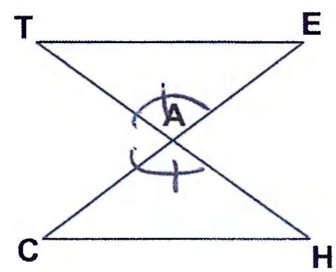
6. Given: None
Prove: $\Delta SAE \cong \Delta RAB$

Statements	Reasons
① $\angle SAE \cong \angle RAB$	① vertical angles are congruent



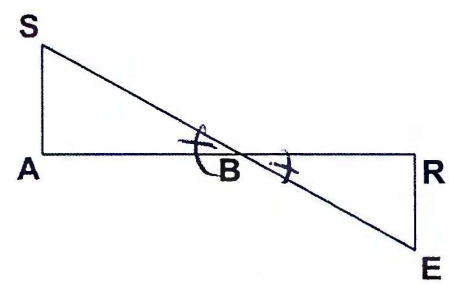
7. Given: None
Prove: $\Delta TAE \cong \Delta CAH$

Statements	Reasons
① $\angle TAE \cong \angle CAH$	① vertical angles are congruent



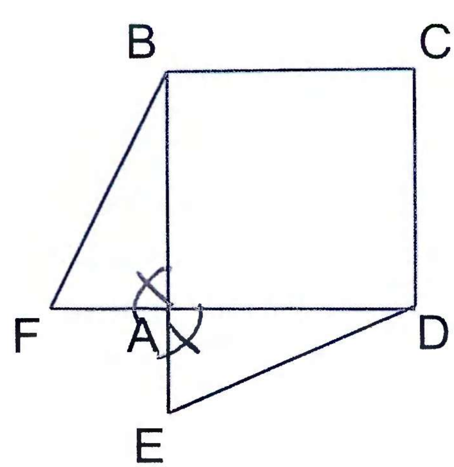
8. Given: None
Prove: $\Delta SBA \cong \Delta EBR$

Statements	Reasons
① $\angle SBA \cong \angle RBE$	① vertical angles are congruent



9. Given: None
Prove: $\Delta BAF \cong \Delta DAE$

Statements	Reasons
① $\angle BAF \cong \angle DAE$	① vertical angles are congruent



Methods for Proving Triangles are Congruent

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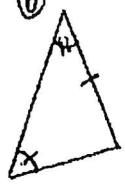
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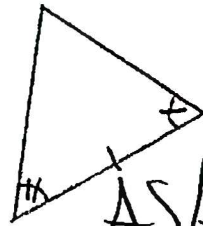
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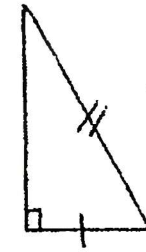
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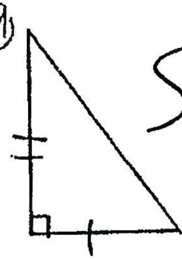
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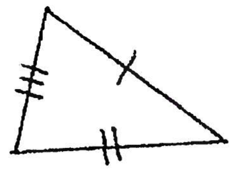
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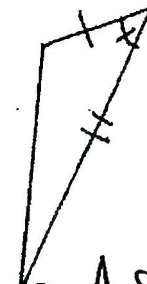
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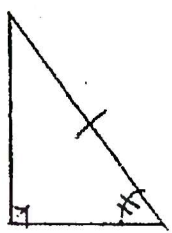
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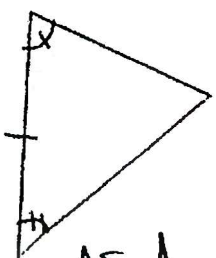
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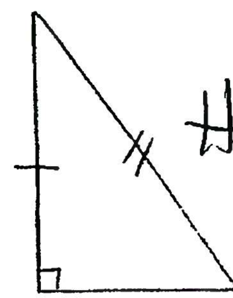
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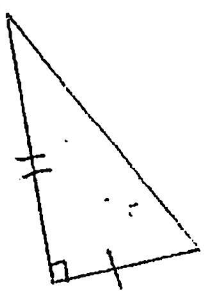
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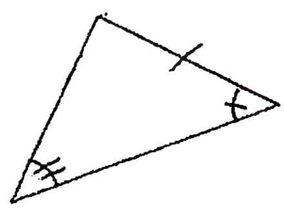
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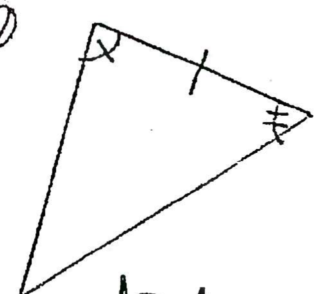
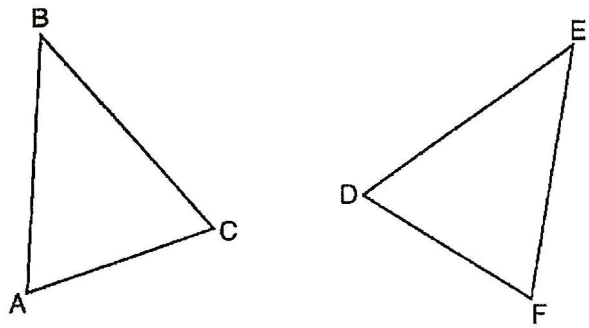

ASA

Congruent Triangle Methods with Sequences of Rigid Motions
If a sequence of rigid motions is performed, the image is CONGRUENT to the original!

1. Which statement is sufficient evidence that ΔDEF is congruent to ΔABC?

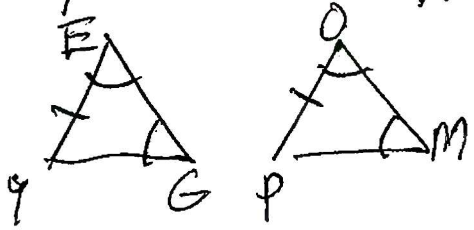
1) $AB = DE$ and $BC = EF$ SS
2) $\angle D \cong \angle A$, $\angle B \cong \angle E$, $\angle C \cong \angle F$ AAA
3) There is a sequence of rigid motions that maps $\overline{AB}$ onto $\overline{DE}$, $\overline{BC}$ onto $\overline{EF}$, and $\overline{AC}$ onto $\overline{DF}$. SSS
4) There is a sequence of rigid motions that maps ~~point~~ A onto ~~point~~ D, $\overline{AB}$ onto $\overline{DE}$, and $\angle B$ onto $\angle E$. SA

this is nothing



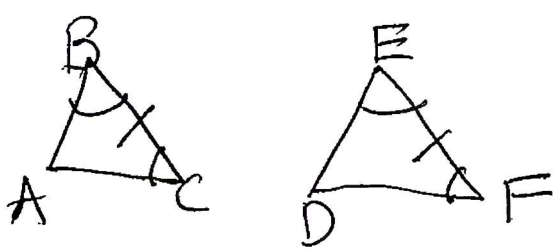
2. Triangles YEG and POM are two distinct non-right triangles such that $\angle G \cong \angle M$. Which statement is sufficient to prove ΔYEG is always congruent to ΔPOM?

1) $\angle E \cong \angle O$ and $\angle Y \cong \angle P$ AAA
2) $\overline{YG} \cong \overline{PM}$ and $\overline{YE} \cong \overline{PO}$ ASS
3) There is a sequence of rigid motions that maps $\angle E$ onto $\angle O$ and $\overline{YE}$ onto $\overline{PO}$. AAS
4) There is a sequence of rigid motions that maps ~~point Y onto point~~ P and $\overline{YG}$ onto $\overline{PM}$. SA



3. In the two distinct acute triangles ABC and DEF, $\angle B \cong \angle E$. Triangles ABC and DEF are congruent when there is a sequence of rigid motions that maps

1) $\angle A$ onto $\angle D$, and $\angle C$ onto $\angle F$ AAA
2) $\overline{AC}$ onto $\overline{DF}$, and $\overline{BC}$ onto $\overline{EF}$ ASS
3) $\angle C$ onto $\angle F$, and $\overline{BC}$ onto $\overline{EF}$ ASA
4) ~~point A onto point~~ D, and $\overline{AB}$ onto $\overline{DE}$ AS

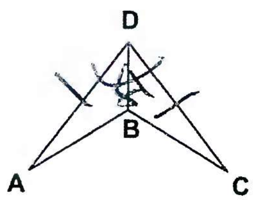


Proving Triangles are Congruent

1. Given: $\overline{BD}$ bisects $\angle ADC$

$\overline{AD} \cong \overline{DC}$

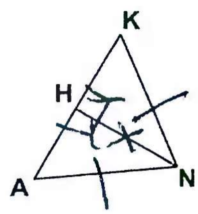
Prove: $\overline{AB} \cong \overline{BC}$



Statements	Reasons
(1) BD bisects ∠ADC	(1) given
(2) ∠ADB ≅ ∠CDB	(2) An angle bisector creates congruent angles
(3) AD ≅ DC	(3) given
(4) DB ≅ DB	(4) Reflexive Property
(5) △ADB ≅ △CDB	(5) SAS
(6) AB ≅ BC	(6) CPCTC

2. Given: $\overline{HN} \perp \overline{KA}$, $\overline{KN} \cong \overline{AN}$

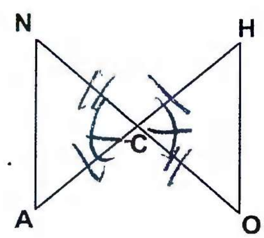
Prove: $\angle HAN \cong \angle HKN$



Statements	Reasons
(1) HN ⊥ KA	(1) given
(2) ∠KHN ≅ ∠AHN	(2) Perpendicular lines form congruent right angles
(3) KN ≅ AN	(3) given
(4) HN ≅ HN	(4) Reflexive Property
(5) △AHN ≅ △KHN	(5) HL
(6) ∠HAN ≅ ∠HKN	(6) CPCTC

3. Given: $\overline{NO}$ and $\overline{HA}$ bisect each other

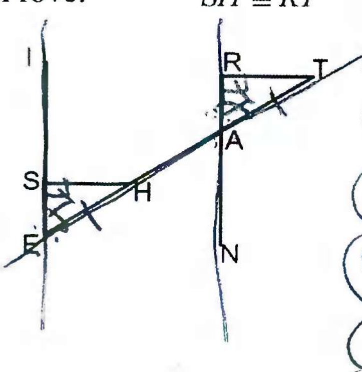
Prove: $\overline{NA} \cong \overline{HO}$



Statements	Reasons
(1) NO and HA bisect each other	(1) given
(2) AC ≅ CH, NC ≅ CO	(2) A line bisector creates congruent segments
(3) ∠NCA ≅ ∠HCO	(3) vertical angles are congruent
(4) △ANC ≅ △HOC	(4) SAS
(5) NA ≅ HO	(5) CPCTC

4. Given: $\overline{IE} \parallel \overline{RN}$, $\overline{TR} \perp \overline{RN}$, $\overline{HS} \perp \overline{IE}$, $\overline{EH} \cong \overline{AT}$

Prove: $\overline{SH} \cong \overline{RT}$



Statements	Reasons
(1) IE ∥ RN	(1) given
(2) ∠TAR ≅ ∠HES	(2) Parallel lines cut by a transversal create congruent corresponding angles
(3) TR ⊥ RN, HS ⊥ IE	(3) given
(4) ∠TRA ≅ ∠HSE	(4) Perpendicular lines form congruent right angles
(5) ~~AHS~~ EH ≅ AT	(5) given
(6) △HSE ≅ △TRA	(6) AAS
(7) SH ≅ RT	(7) CPCTC

To prove triangles are SIMILAR, prove AA ≅ AA

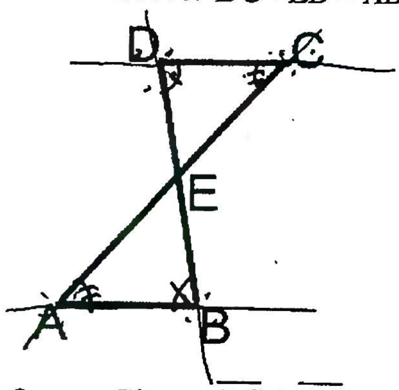
If asked to prove a proportion/multiplication:

1) **Prove triangles are similar**
2) **Corresponding Sides of Similar Triangle are In Proportion (CSSTIP)**
3) **Cross Products are Equal**

Work Backwards!

1. Given $\overline{AB} \parallel \overline{DC}$

Prove: $\overline{DC} \bullet \overline{EB} = \overline{AB} \bullet \overline{DE}$

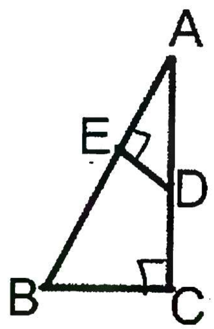


Statements	Reasons
① $\overline{AB} \parallel \overline{DC}$	① given
② $\angle D \cong \angle B$, $\angle C \cong \angle A$	② Parallel lines cut by a transversal create congruent alternate interior angles
③ $\triangle DCE \sim \triangle BAE$	③ AA ≅ AA
④ $\dfrac{\overline{DC}}{\overline{DE}} = \dfrac{\overline{AB}}{\overline{EB}}$	④ CSSTIP
⑤ $\overline{DC} \cdot \overline{EB} = \overline{AB} \cdot \overline{DE}$	⑤ Cross products are equal

2. Given: $\overline{BC} \perp \overline{AC}$

$\overline{DE} \perp \overline{AB}$

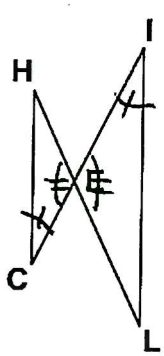
Prove: $\overline{AC} \bullet \overline{AD} = \overline{AE} \bullet \overline{AB}$



Statements	Reasons
① $\overline{BC} \perp \overline{AC}$, $\overline{DE} \perp \overline{AB}$	① given
② $\angle ACB \cong \angle AED$	② Perpendicular lines form congruent right angles
③ $\angle A \cong \angle A$	③ Reflexive Property
④ $\triangle ACB \sim \triangle AED$	④ AA ≅ AA
⑤ $\dfrac{\overline{AC}}{\overline{AB}} = \dfrac{\overline{AE}}{\overline{AD}}$	⑤ CSSTIP
⑥ $\overline{AC} \cdot \overline{AD} = \overline{AE} \cdot \overline{AB}$	⑥ Cross products are equal

3. Given: $\angle HCE \cong \angle LIE$

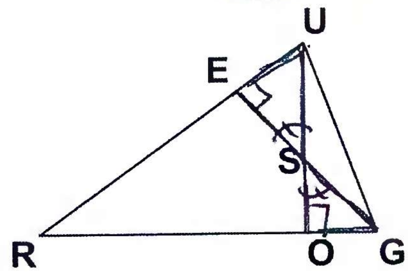
Prove: $\overline{CE} \bullet \overline{IL} = \overline{CH} \bullet \overline{EI}$



Statements	Reasons
① $\angle HCE \cong \angle LIE$	① given
② $\angle HEC \cong \angle IEL$	② vertical angles are congruent
③ $\triangle HCE \sim \triangle LIE$	③ AA ≅ AA
④ $\dfrac{\overline{CE}}{\overline{EI}} = \dfrac{\overline{CH}}{\overline{IL}}$	④ CSSTIP
⑤ $\overline{CE} \cdot \overline{IL} = \overline{CH} \cdot \overline{EI}$	⑤ Cross products are equal

4. Given: $\overline{UO} \perp \overline{RG}$, $\overline{UR} \perp \overline{EG}$

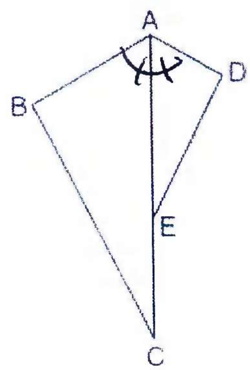
Prove: $\dfrac{\overline{US}}{\overline{SO}} = \dfrac{\overline{EU}}{\overline{OG}}$



Statements	Reasons
① $\overline{UO}\perp\overline{RG}, \overline{UR}\perp\overline{EG}$	① given
② $\angle UES \cong \angle SOG$	② Perpendicular lines form congruent right angles
③ $\angle USE \cong \angle GSO$	③ vertical angles are congruent
④ $\triangle USE \sim \triangle GSO$	④ AA≅AA
⑤ $\dfrac{\overline{US}}{\overline{SO}} = \dfrac{\overline{EU}}{\overline{OG}}$	⑤ CSSTIP

5. Given: $\overline{CA}$ bisects $\angle BAD$, $\angle ABC \cong \angle ADE$

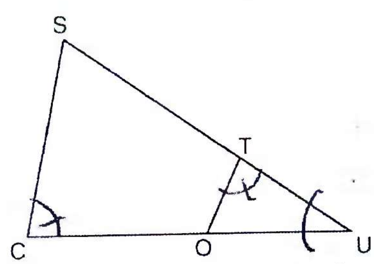
Prove: $\overline{BC} \bullet \overline{AE} = \overline{DE} \bullet \overline{AC}$



Statements	Reasons
① $\overline{CA}$ bisects $\angle BAD$	① given
② $\angle BAC \cong \angle DAE$	② An angle bisector creates 2 ≅ angles
③ $\angle ABC \cong \angle ADE$	③ given
④ $\triangle BAC \sim \triangle DAE$	④ AA≅AA
⑤ $\dfrac{\overline{BC}}{\overline{AC}} = \dfrac{\overline{DE}}{\overline{AE}}$	⑤ CSSTIP
⑥ $\overline{BC} \cdot \overline{AE} = \overline{DE} \cdot \overline{AC}$	⑥ Cross products are equal

6. In $\triangle SCU$ shown below, points T and O are on $\overline{SU}$ and $\overline{CU}$, respectively. Segment OT is drawn so that $\angle C \cong \angle OTU$.

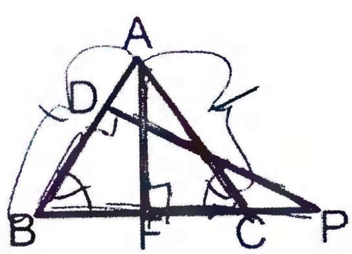
Prove: $\overline{SC} \bullet \overline{OU} = \overline{OT} \bullet \overline{SU}$



Statements	Reasons
① $\angle C \cong \angle OTU$	① given
② $\angle U \cong \angle U$	② Reflexive Property
③ $\triangle SCU \sim \triangle OTU$	③ AA≅AA
④ $\dfrac{\overline{SC}}{\overline{SU}} = \dfrac{\overline{OT}}{\overline{OU}}$	④ CSSTIP
⑤ $\overline{SC} \cdot \overline{OU} = \overline{OT} \cdot \overline{SU}$	⑤ Cross products are equal

7. Given: $\overline{AB} \cong \overline{AC}$, $\overline{AF} \perp \overline{BC}$, $\overline{PD} \perp \overline{AB}$

Prove: $\overline{FC} \bullet \overline{PB} = \overline{DB} \bullet \overline{AC}$



Statements	Reasons
① $\overline{AB} \cong \overline{AC}$	① given
② $\angle B \cong \angle C$	② In a triangle, congruent angles are opposite congruent sides
③ $\overline{AF}\perp\overline{BC}, \overline{PD}\perp\overline{AB}$	③ given
④ $\angle AFC \cong \angle PDB$	④ Perpendicular lines form congruent right angles
⑤ $\triangle FCA \sim \triangle DBP$	⑤ AA≅AA
⑥ $\dfrac{\overline{FC}}{\overline{AC}} = \dfrac{\overline{DB}}{\overline{PB}}$	⑥ CSSTIP
⑦ $\overline{FC} \cdot \overline{PB} = \overline{DB} \cdot \overline{AC}$	⑦ Cross products are equal

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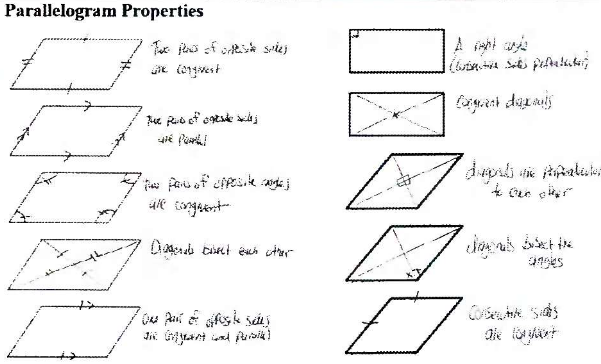
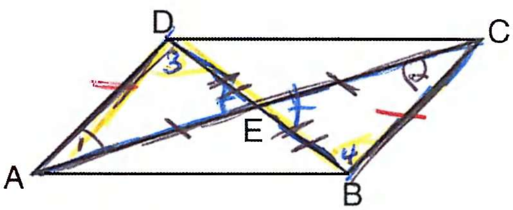
Euclidean Proofs with Parallelogram and Circle Theorems

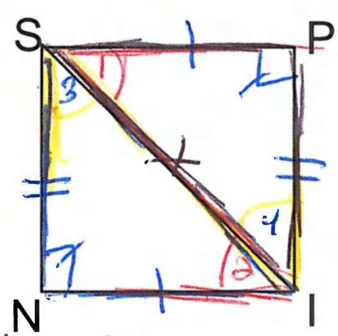
Parallelogram Theorems	Circle Theorems
Parallelogram Properties  Two pairs of opposite sides are congruent Two pairs of opposite sides are parallel Two pairs of opposite angles are congruent Diagonals bisect each other One pair of opposite sides are congruent and parallel A right angle (consecutive sides perpendicular) Congruent diagonals diagonals are perpendicular to each other diagonals bisect the angles Consecutive sides are congruent	**All radii/diameters of a circle are congruent** **Angles inscribed to the same arc are congruent** **An angle inscribed to a semicircle is a right angle** **A tangent and a radius/diameter form a right angles** Congruent arcs have congruent chords have congruent central angles Parallel Lines intercept congruent arcs Tangents drawn from the same point are congruent

1. Given: Parallelogram *ABCD*.
Prove: $\Delta AED \cong \Delta CEB$



Statements	Reasons
(1) Parallelogram ABCD	(1) given
(2) $\overline{AD} \cong \overline{CB}$	(2) A parallelogram has opposite sides congruent
(3) $\angle 1 \cong \angle 2, \angle 3 \cong \angle 4$	(3) A parallelogram has parallel lines cut by a transversal which create ≅ alternate interior angles
(4) $\overline{DE} \cong \overline{EB}, \overline{AE} \cong \overline{EC}$	(4) A parallelogram has diagonals that bisect each other
(5) $\angle DEA \cong \angle CEB$	(5) Vertical angles are congruent
(6) $\Delta AED \cong \Delta CEB$	(6) Take your pick!

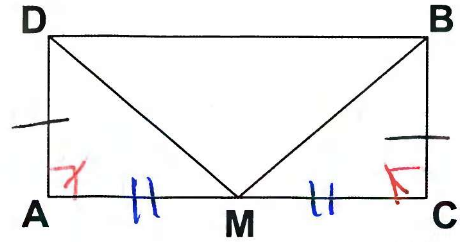
2. Given: SPIN is a square
Prove: $\Delta SNI \cong \Delta SPI$



Statements	Reasons
(1) SPIN is a square	(1) given
(2) $\angle N \cong \angle P$	(2) A square has ≅ right angles or opposite angles congruent
(3) $\angle 1 \cong \angle 2, \angle 3 \cong \angle 4$	(3) A square has parallel lines cut by a transversal which form congruent alternate interior angles
(4) $\overline{SN} \cong \overline{PI}, \overline{SP} \cong \overline{NI}$	(4) A square has opposite sides congruent
(5) $\overline{SI} \cong \overline{SI}$	(5) Reflexive Property
(6) $\Delta SNI \cong \Delta SPI$	(6) Take your pick!

3. Given: ABCD is a rectangle, M is the midpoint of $\overline{AC}$

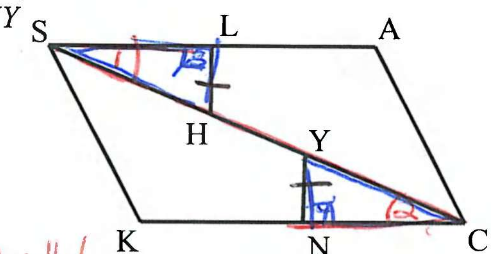
Prove: $\overline{DM} \cong \overline{BM}$



Statements	Reasons
① ABCD is a rectangle	① given
② ∠A ≅ ∠C	② A rectangle has congruent right angles
③ $\overline{DA} \cong \overline{BC}$	③ A rectangle has opposite sides ≅
④ M is the midpoint of $\overline{AC}$	④ given
⑤ $\overline{AM} \cong \overline{MC}$	⑤ A midpoint creates two congruent segments
⑥ △DAM ≅ △BCM	⑥ SAS ≅ SAS
⑦ $\overline{DM} \cong \overline{BM}$	⑦ CPCTC

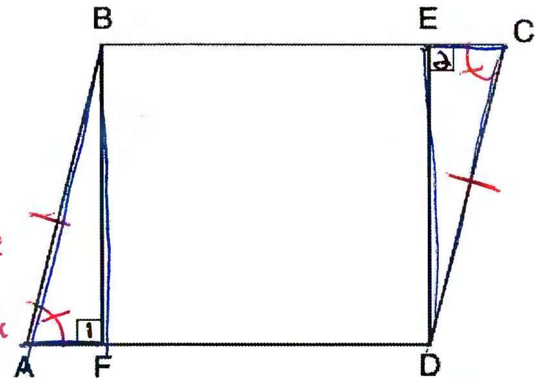
4. Given: SACK is a parallelogram, $\overline{HL} \perp \overline{SA}$, $\overline{YN} \perp \overline{KC}$, $\overline{HL} \cong \overline{NY}$

Prove: $\overline{SL} \cong \overline{CN}$



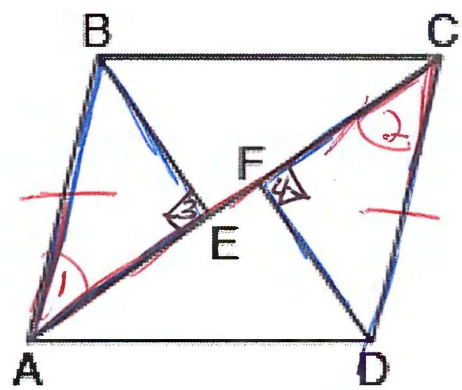
Statements	Reasons
① SACK is a parallelogram	① given
② ∠1 ≅ ∠2	② A parallelogram has parallel lines cut by a transversal which create ≅ alternate interior angles
③ $\overline{HL} \perp \overline{SA}$, $\overline{YN} \perp \overline{KC}$	③ given
④ ∠3 ≅ ∠4	④ Perpendicular lines form congruent right angles
⑤ $\overline{HL} \cong \overline{NY}$	⑤ given
⑥ △SLH ≅ △CNY	⑥ AAS ≅ AAS
⑦ $\overline{SL} \cong \overline{CN}$	⑦ CPCTC

5. Given: Parallelogram *ABCD*, $\overline{BF} \perp \overline{AFD}$, and $\overline{DE} \perp \overline{BEC}$
Prove: $\overline{AF} \cong \overline{EC}$



Statements	Reasons
① Parallelogram ABCD	① given
② $\overline{AB} \cong \overline{DC}$	② A parallelogram has opposite sides congruent
③ $\angle A \cong \angle C$	③ A parallelogram has opposite angles congruent
④ $\overline{BF} \perp \overline{AFD}$, $\overline{DE} \perp \overline{BEC}$	④ given
⑤ $\angle 1 \cong \angle 2$	⑤ perpendicular lines form congruent right angles
⑥ $\triangle AFB \cong \triangle CED$	⑥ AAS ≅ AAS
⑦ $\overline{AF} \cong \overline{EC}$	⑦ CPCTC

6. Given: ABCD is a parallelogram, $\overline{BE} \perp \overline{AC}$, and $\overline{DF} \perp \overline{AC}$.
Prove: $\angle ABE \cong \angle CDF$



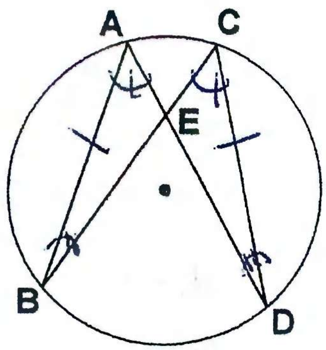
Statements	Reasons
① ABCD is a parallelogram	① given
② $\angle 1 \cong \angle 2$	② A parallelogram has parallel lines cut by a transversal which create congruent alternate interior angles
③ $\overline{AB} \cong \overline{DC}$	③ A parallelogram has opposite sides congruent
④ $\overline{BE} \perp \overline{AC}$, $\overline{DF} \perp \overline{AC}$	④ given
⑤ $\angle 3 \cong \angle 4$	⑤ Perpendicular lines form congruent right angles
⑥ $\triangle BEA \cong \triangle DCF$	⑥ AAS ≅ AAS
⑦ $\angle ABE \cong \angle CDF$	⑦ CPCTC

*Look for inscribed angles

8. Given: Chords $\overline{AD}$ and $\overline{BC}$ of circle O intersect at E, $\overline{AB} \cong \overline{CD}$

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

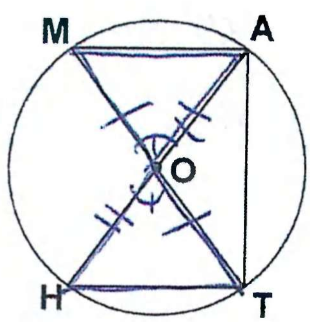
*you could have also used vertical angles



Statements	Reasons
① $\overline{AB} \cong \overline{CD}$	① given
② $\angle BAE \cong \angle DCE$ $\angle ABE \cong \angle CDE$	② Angles inscribed to the same arc are congruent
③ $\triangle BAE \cong \triangle DCE$	③ ASA ≅ ASA
④ $\overline{BC} \cong \overline{AD}$	④ CPCTC

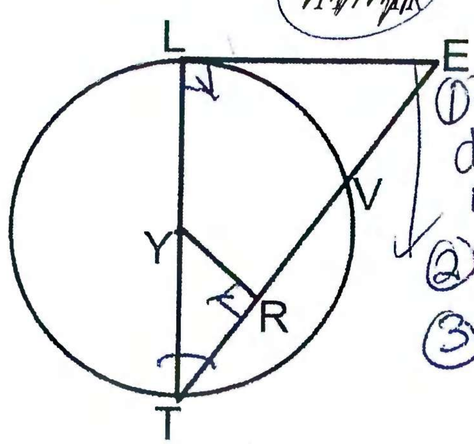
9. Given: Circle O with diameters $\overline{MOT}$ and $\overline{AOH}$.

Prove: $\overline{MA} \cong \overline{HT}$



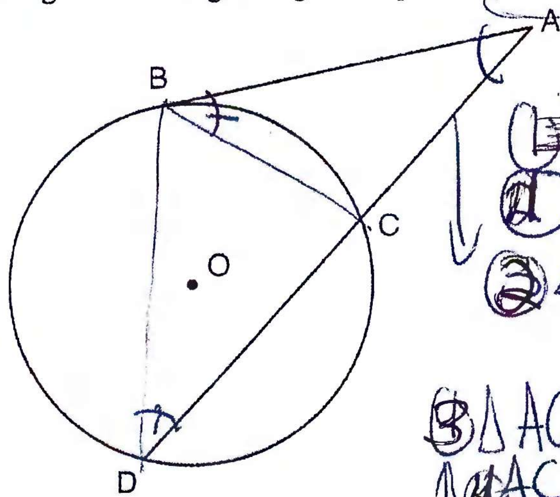
Statements	Reasons
① $\overline{MO} \cong \overline{OT}$, $\overline{AO} \cong \overline{OH}$	① All radii of a circle are ≅
② $\angle MOA \cong \angle HOT$	② vertical angles are ≅
③ $\triangle MOA \cong \triangle TOH$	③ SAS ≅ SAS
④ $\overline{MA} \cong \overline{HT}$	④ CPCTC

9 10. In circle Y, tangent $\overline{LE}$ is drawn to diameter $\overline{TYL}$ and $\overline{YR} \perp \overline{TE}$. Prove that $\cancel{\frac{TE}{TY} = \frac{TL}{TR}}$ work backwards $TE \cdot TR = TL \cdot TY$



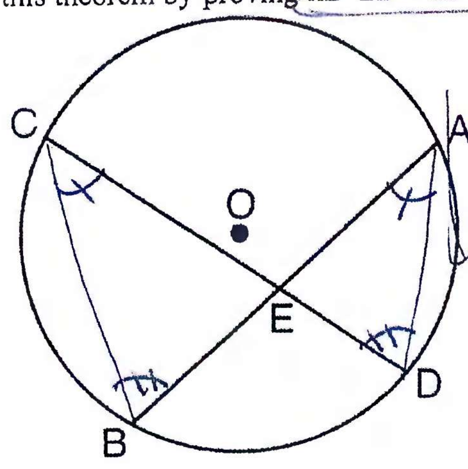
Statements	Reasons
① Tangent LE is drawn to diameter TYL $YR \perp TE$	① given
② $\angle TLE \cong \angle TRY$	② An angle formed by a tangent and diameter and perpendicular lines form congruent right angles
③ $\angle RTY \cong \angle RTY$	③ Reflexive Property
④ $\triangle TLE \sim \triangle TRY$	④ AA ≅ AA
⑤ $\frac{TE}{TY} = \frac{TL}{TR}$	⑤ CSSTP
(6) $TE \cdot TR = TL \cdot TY$	(6) Cross products are equal

11. In the diagram below, secant $\overline{ACD}$ and tangent $\overline{AB}$ are drawn from external point A to circle O.
Prove the theorem: If a secant and a tangent are drawn to a circle from an external point, the product of the lengths of the secant segment and its external segment equals the length of the tangent segment squared. $(AC \cdot AD = AB^2)$ → work backwards



Statements	Reasons
1 ~~$\overline{BC}$, $\overline{BD}$~~	1 ~~Auxiliary lines can be drawn~~
1 $\angle BAC \cong \angle BAC$	1 Reflexive Property
2 $\angle BDC \cong \angle ABC$	2 Angles inscribed to the same arc are $\cong$
3 $\triangle ACB \sim \triangle ABD$	3 $AA \cong AA$
4 $\frac{AC}{AB} = \frac{AB}{AD}$	4 CSSTP
5 $AC \cdot AD = AB^2$	5 Cross products are equal

12. Given: Circle O, chords $\overline{AB}$ and $\overline{CD}$ intersect at E
Theorem: If two chords intersect in a circle, the product of the lengths of the segments of one chord is equal to the product of the lengths of the segments of the other chord. Prove this theorem by proving $AE \cdot EB = CE \cdot ED$. → work backwards



Statements	Reasons
1 ~~$\overline{CB}$, $\overline{AD}$~~	1 ~~Auxiliary lines can be drawn~~
1 $\angle BCE \cong \angle DAE$, $\angle CBE \cong \angle ADE$	1 Angles inscribed to the same arc are $\cong$
2 $\triangle AED \sim \triangle CEB$	2 $AA \cong AA$
3 $\frac{AE}{ED} = \frac{CE}{EB}$	3 CSSTP
4 $AE \cdot EB = CE \cdot ED$	4 Cross products are equal

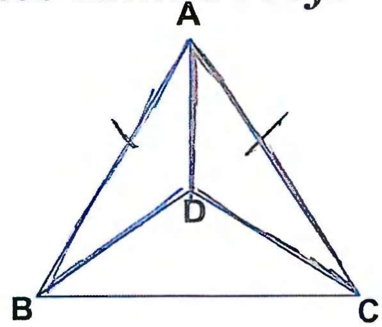
*You could have also used vertical angles

Name Schlansky
Mr. Schlansky

Date ______________
Geometry

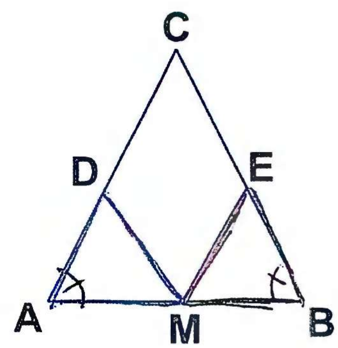
Proving Triangles Isosceles Mini Proofs

1. Given: $\Delta ADB \cong \Delta ADC$
   Prove: ΔBAC is isosceles



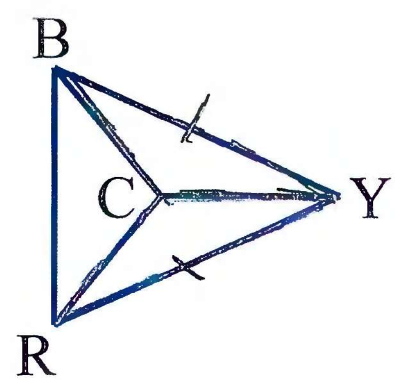
statements	Reasons
① $\Delta ADB \cong \Delta ADC$	① given
② $\overline{AB} \cong \overline{AC}$	② CPCTC
③ ΔBAC is isosceles	③ An isosceles triangle has two congruent sides.

2. Given: $\Delta ADM \cong \Delta BEM$
   Prove: ΔACB is isosceles



statements	Reasons
① $\Delta ADM \cong \Delta BEM$	① given
② $\angle DAM \cong \angle EBM$	② CPCTC
③ ΔACB is isosceles	③ An isosceles triangle has two congruent angles

3. Given: $\Delta YCB \cong \Delta YCR$
   Prove: ΔBYR is isosceles



statements	Reasons
① $\Delta YCB \cong \Delta YCR$	① given
② $\overline{YB} \cong \overline{YR}$	② CPCTC
③ ΔBYR is isosceles	③ An isosceles triangle has two congruent sides

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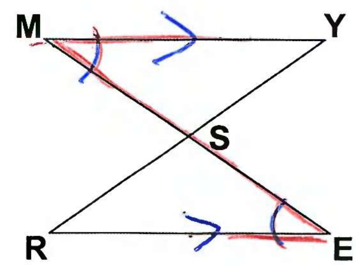
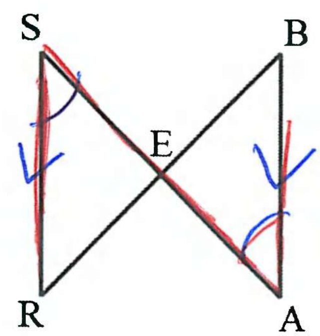
Proving Parallel Mini Proofs (PR2)

1. Given: $\angle M \cong \angle E$



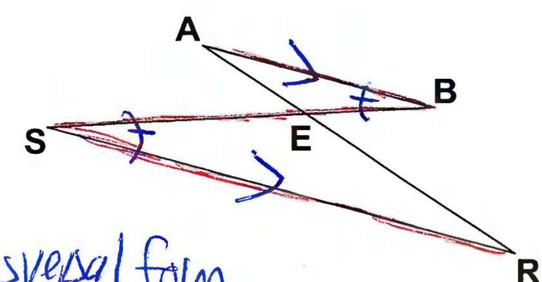
Statements	Reasons
① $\angle M \cong \angle E$	① given
② $\overline{MY} \parallel \overline{RE}$	② Parallel lines cut by a transversal form congruent alternate interior angles

2. Given: $\angle S \cong \angle A$



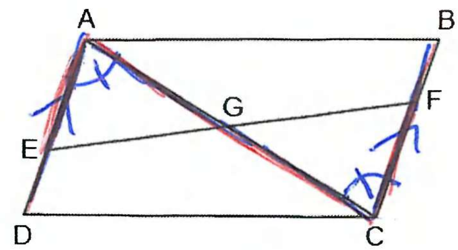
Statements	Reasons
① $\angle S \cong \angle A$	① given
② $\overline{SR} \parallel \overline{BA}$	② Parallel lines cut by a transversal form congruent alternate interior angles

3. Given: $\angle S \cong \angle B$



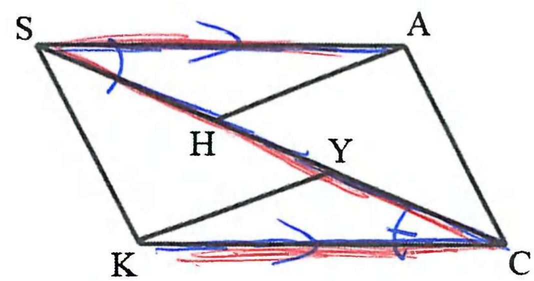
Statements	Reasons
① $\angle S \cong \angle B$	① given
② $\overline{AB} \parallel \overline{SR}$	② Parallel lines cut by a transversal form congruent alternate interior angles

4. Given: $\angle EAG \cong \angle FCG$



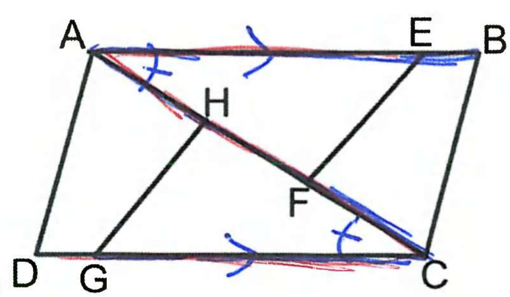
Statements	Reasons
① $\angle EAG \cong \angle FCG$	① given
② $\overline{DA} \parallel \overline{CB}$	② Parallel lines cut by a transversal create congruent alternate interior angles

5. Given: $\angle ASH \cong \angle KCY$



Statements	Reasons
① $\angle ASH \cong \angle KCY$	① given
② $\overline{SA} \parallel \overline{KC}$	② Parallel lines cut by a transversal create congruent alternate interior angles

6. Given: $\angle EAF \cong \angle GCH$



Statements	Reasons
① $\angle EAF \cong \angle GCH$	① given
② ~~AD~~ $AB \parallel DC$	② parallel lines cut by a transversal create congruent alternate interior angles

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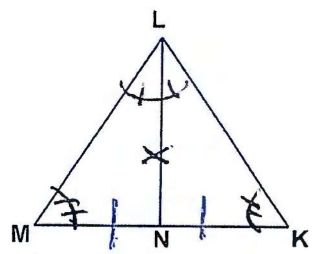
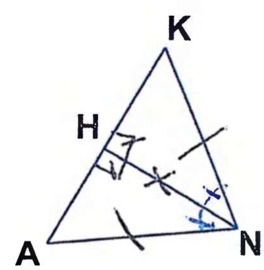
Triangle Proofs Using CPCTC

1. Given: $\overline{LN}$ bisects $\angle KLM$
$\angle LKM \cong \angle LMK$
Prove: N is the midpoint of $\overline{MK}$



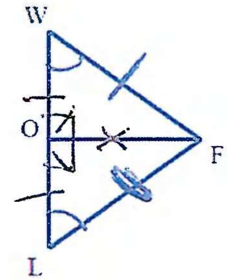
Statements	Reasons
① $\overline{LN}$ bisects $\angle KLM$	① given
② $\angle MLN \cong \angle KLN$	② An angle bisector creates two congruent angles
③ $\angle LKM \cong \angle LMK$	③ given
④ $\overline{LN} \cong \overline{LN}$	④ Reflexive Property
⑤ $\triangle MLN \cong \triangle KLN$	⑤ AAS ≅ AAS
⑥ $\overline{MN} \cong \overline{KN}$	⑥ CPCTC
⑦ N is the midpoint of $\overline{MK}$	⑦ A midpoint creates two congruent segments.

2. Given: $\overline{HN} \perp \overline{KA}$, $\overline{KN} \cong \overline{AN}$
Prove: $\overline{HN}$ bisects $\angle KNA$



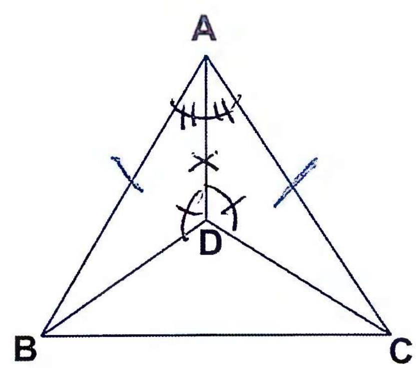
Statements	Reasons
① $\overline{HN} \perp \overline{KA}$	① given
② $\angle KHN \cong \angle AHN$	② Perpendicular lines form congruent right angles.
③ $\overline{KN} \cong \overline{AN}$	③ given
④ $\overline{HN} \cong \overline{HN}$	④ Reflexive Property
⑤ $\triangle KHN \cong \triangle AHN$	⑤ HL ≅ HL
⑥ $\angle KNH \cong \angle ANH$	⑥ CPCTC
⑦ $\overline{HN}$ bisects $\angle KNA$	⑦ An angle bisector creates two congruent angles

3. Given: $\overline{OF}$ is the perpendicular bisector of $\overline{WL}$
Prove: ΔWFL is isosceles



Statements	Reasons
(1) $\overline{OF}$ is the perpendicular bisector of $\overline{WL}$	(1) given
(2) $\overline{WO} \cong \overline{OL}$	(2) A line bisector creates two congruent segments
(3) $\angle WOF \cong \angle LOF$	(3) Perpendicular lines form congruent right angles
(4) $\overline{OF} \cong \overline{OF}$	(4) Reflexive Property
(5) $\Delta WOF \cong \Delta LOF$	(5) SAS ≅ SAS
(6) $\overline{WF} \cong \overline{LF}$ (6) $\angle W \cong \angle L$	(6) CPCTC
(7) ΔWFL is isosceles	(7) An isosceles triangle has two congruent sides

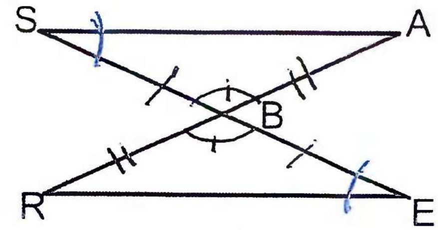
4. Given: $\angle ADB \cong \angle ADC$
$\overline{AD}$ bisects $\angle BAC$
Prove: ΔABC is isosceles



Statements	Reasons
(1) $\angle ADB \cong \angle ADC$	(1) given
(2) $\overline{AD}$ bisects $\angle BAC$	(2) given
(3) $\angle BAD \cong \angle CAD$	(3) An angle bisector creates two congruent angles.
(4) $\overline{AD} \cong \overline{AD}$	(4) Reflexive Property
(5) $\Delta ADB \cong \Delta ADC$	(5) ~~AB#~~ ASA ≅ ASA
(6) $\overline{AB} \cong \overline{AC}$	(6) CPCTC
(7) ΔABC is isosceles	(7) An isosceles triangle has two congruent sides.

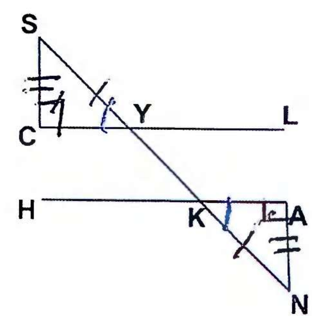
5. Given: $\overline{SE}$ and $\overline{AR}$ bisect each other.

Prove that $\overline{SA} \parallel \overline{RE}$



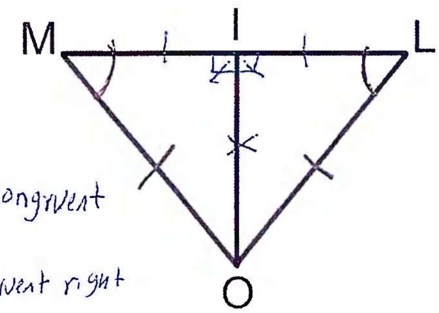
Statements	Reasons
① $\overline{SE}$ and $\overline{AR}$ bisect each other	① given
② $\overline{SB} \cong \overline{BE}$, $\overline{RB} \cong \overline{BA}$	② A line bisector creates two congruent sides
③ $\angle SBA \cong \angle EBR$	③ Vertical angles are congruent
④ $\triangle SBA \cong \triangle EBR$	④ SAS≅SAS
⑤ $\angle S \cong \angle E$	⑤ CPCTC
⑥ $\overline{SA} \parallel \overline{RE}$	⑥ Parallel lines cut by a transversal create congruent alternate interior angles.

6. Given: $\overline{SC} \perp \overline{CL}$, $\overline{HA} \perp \overline{AN}$, $\overline{SY} \cong \overline{KN}$, and $\overline{SC} \cong \overline{AN}$.
Prove $\overline{CL} \parallel \overline{HA}$



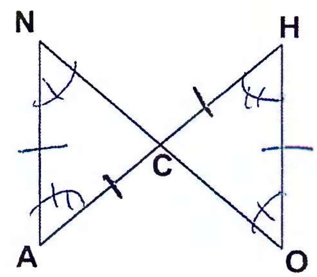
Statements	Reasons
① $\overline{SC} \perp \overline{CL}$, $\overline{HA} \perp \overline{AN}$	① given
② $\angle SCY \cong \angle NAK$	② Perpendicular lines form congruent right angles
③ $\overline{SY} \cong \overline{KN}$	③ given
④ $\overline{SC} \cong \overline{AN}$	④ given
⑤ $\triangle SCY \cong \triangle NAK$	⑤ HL≅HL
⑥ $\angle SYC \cong \angle NKA$	⑥ CPCTC
⑦ $\overline{CL} \parallel \overline{HA}$	⑦ Parallel lines cut by a transversal create congruent alternate exterior angles.

7. Given: $\overline{OI}$ is the perpendicular bisector of $\overline{ML}$
Prove: ΔMLO is isosceles



statements	Reasons
① $\overline{OI}$ is the perpendicular bisector of $\overline{ML}$	① given
② $\overline{MI} \cong \overline{IL}$	② A line bisector creates two congruent segments
③ $\angle MIO \cong \angle LIO$	③ Perpendicular lines create congruent right angles
④ $\overline{IO} \cong \overline{IO}$	④ Reflexive Property
⑤ $\Delta MIO \cong \Delta LIO$	⑤ SAS≅SAS
⑥ $\angle IMO \cong \angle ILO$ or $\overline{MO} \cong \overline{LO}$	⑥ CPCTC
⑦ ΔMLO is isosceles	⑦ An isosceles triangle has two congruent angles

8. Given: $\overline{NA} \parallel \overline{HO}$, $\overline{NA} \cong \overline{HO}$
Prove: $\overline{NO}$ bisects $\overline{HA}$



statements	Reasons
① $\overline{NA} \parallel \overline{HO}$	① given
② $\angle N \cong \angle O$, $\angle A \cong \angle H$	② Parallel lines cut by a transversal create congruent alternate interior angles.
③ $\overline{NA} \cong \overline{HO}$	③ given
④ $\Delta NAC \cong \Delta OHC$	④ ASA≅ASA
⑤ $\overline{AC} \cong \overline{CH}$	⑤ CPCTC
⑥ $\overline{NO}$ bisects $\overline{HA}$	⑥ A line bisector creates two congruent segments

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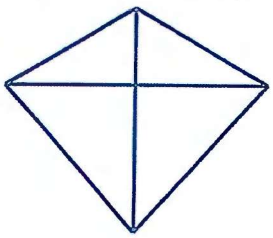
Perpendicular Bisector Multiple Choice

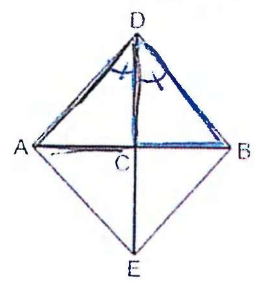
Perpendicular bisector creates
-two pairs of congruent triangles so all of their corresponding parts are congruent due to CPCTC
-two isosceles triangles



The top 2 small triangles are congruent and the top big triangle is isosceles
The bottom 2 small triangles are congruent and the bottom big triangle is isosceles

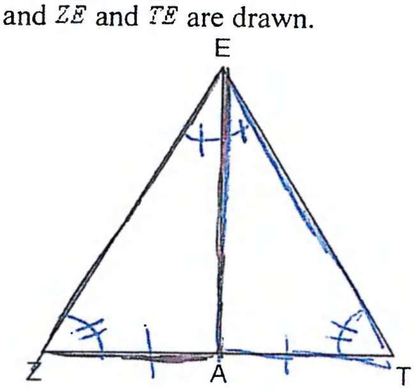
1. In the diagram below of quadrilateral $ADBE$, $\overline{DE}$ is the perpendicular bisector of $\overline{AB}$. Which statement is always true?

1) $\angle ADC \cong \angle BDC$
2) $\angle EAC \cong \angle DAC$
3) $\overline{AD} \cong \overline{BE}$
4) $\overline{AE} \cong \overline{AD}$



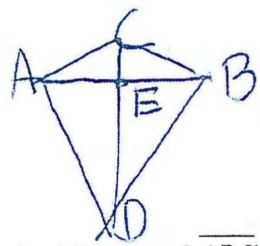
2. Line segment EA is the perpendicular bisector of $\overline{ZT}$, and $\overline{ZE}$ and $\overline{TE}$ are drawn.

Which conclusion can *not* be proven?
1) $\overline{EA}$ bisects angle ZET.
2) Triangle EZT is equilateral.
3) $\overline{EA}$ is a median of triangle EZT.
4) Angle Z is congruent to angle T.



3. Segment CD is the perpendicular bisector of $\overline{AB}$ at E. Which pair of segments does *not* have to be congruent?

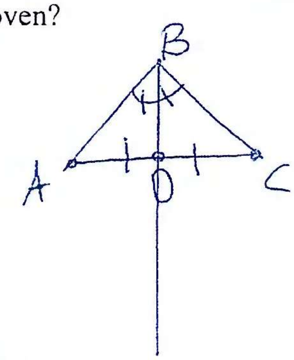
1) $\overline{AD}, \overline{BD}$
2) $\overline{AC}, \overline{BC}$
3) $\overline{AE}, \overline{BE}$
4) $\overline{DE}, \overline{CE}$



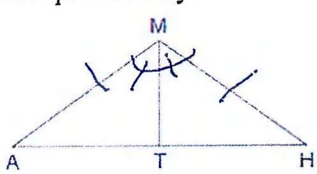
4. In $\triangle ABC$, $\overline{BD}$ is the perpendicular bisector of $\overline{ADC}$. Based upon this information, which statements below can be proven?

I. $\overline{BD}$ is a median.
II. $\overline{BD}$ bisects $\angle ABC$.
III. $\triangle ABC$ is isosceles.

1) I and II, only
2) I and III, only
3) II and III, only
4) I, II, and III

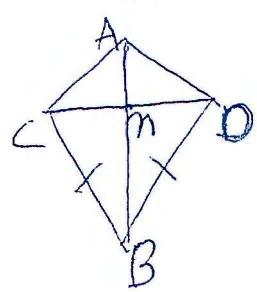


5. In triangle MAH below, $\overline{MT}$ is the perpendicular bisector of $\overline{AH}$.
Which statement is *not* always true?
1) $\triangle MAH$ is isosceles. 2) $\triangle MAT$ is isosceles. 3) $\overline{MT}$ bisects $\angle AMH$. 4) $\angle A$ and $\angle TMH$ are complementary.



6. Segment AB is the perpendicular bisector of $\overline{CD}$ at point M. Which statement is always true?

1) $\overline{CB} \cong \overline{DB}$
2) $\overline{CD} \cong \overline{AB}$
3) $\Delta ACD \cong \Delta BCD$
4) $\Delta ACM \cong \Delta BCM$



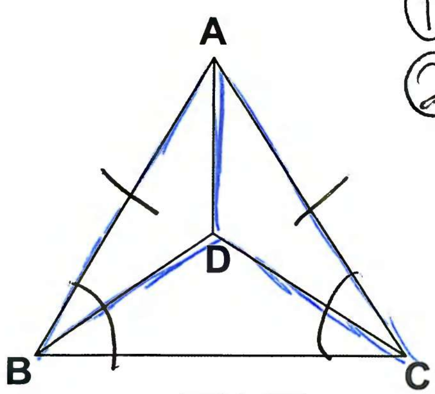
Isosceles Triangle Theorem Mini Proofs

In a triangle, congruent angles are opposite congruent sides

If the given sides/angles are not sides/angles of the triangles you are trying to prove, if they make an isosceles triangle. Conclude the sides/angles opposite the ones you are given.

1. Given: $\angle ABC \cong \angle ACB$

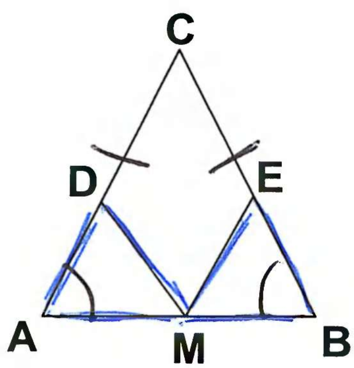
Prove: $\Delta ADB \cong \Delta ADC$



Statements	Reasons
① $\angle ABC \cong \angle ACB$	① given
② $\overline{AB} \cong \overline{AC}$	② Isosceles Triangle theorem

2. Given: $\overline{CA} \cong \overline{CB}$

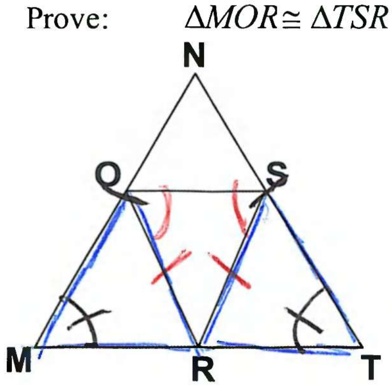
Prove: $\Delta ADM \cong \Delta BEM$



statements	Reasons
① $\overline{CA} \cong \overline{CB}$	① given
② $\angle DAM \cong \angle EBM$	② Isosceles Triangle theorem

3. Given: $\overline{MN} \cong \overline{NT}$, $\angle ROS \cong \angle RSO$

Prove: $\Delta MOR \cong \Delta TSR$



statements	Reasons
① $\overline{MN} \cong \overline{NT}$	① given
② $\angle OMR \cong \angle STR$	② Isosceles Triangle Theorem
③ $\angle ROS \cong \angle RSO$	③ given
④ $\overline{RO} \cong \overline{OS}$	④ isosceles triangle theorem

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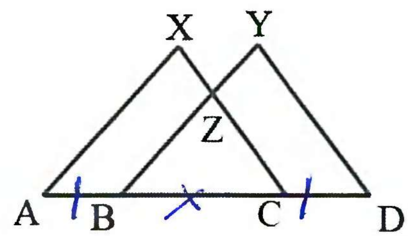
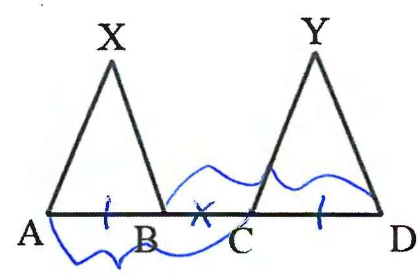
Addition and Subtraction Property Mini Proofs (PR4)

1. Given: $\overline{AB} \cong \overline{CD}$
Prove: $\Delta AXC \cong \Delta BYD$



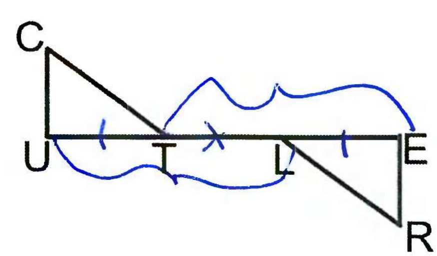
Statements	Reasons
① $\overline{AB} \cong \overline{CD}$	① given
② $\overline{BC} \cong \overline{BC}$	② reflexive property
③ $\overline{AC} \cong \overline{BD}$ or $\overline{AB}+\overline{BC}=\overline{CD}+\overline{BC}$	③ addition property

2. Given: $\overline{AC} \cong \overline{BD}$
Prove: $\Delta AXB \cong \Delta DYC$



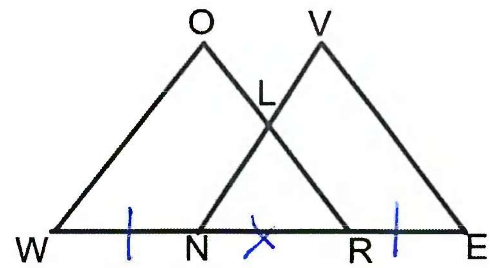
Statements	Reasons
① $\overline{AC} \cong \overline{BD}$	① given
② $\overline{BC} \cong \overline{BC}$	② reflexive property
③ $\overline{AB} \cong \overline{CD}$ or $\overline{AC}-\overline{BC}=\overline{BD}-\overline{BC}$	③ subtraction property

3. Given: $\overline{UL} \cong \overline{TE}$
Prove: $\Delta CUT \cong \Delta REL$



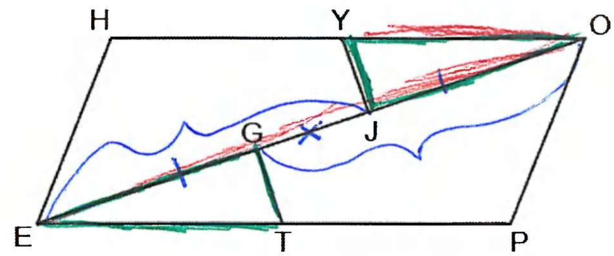
Statements	Reasons
① $\overline{UL} \cong \overline{TE}$	① given
② $\overline{TL} \cong \overline{TL}$	② reflexive property
③ $\overline{UT} \cong \overline{EL}$ or $UL-TL=TE-TL$	③ subtraction property

4. Given: $\overline{WN} \cong \overline{RE}$
Prove: $\Delta WOR \cong \Delta NVE$



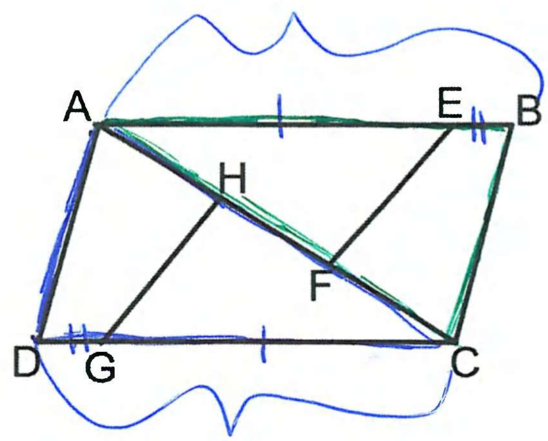
Statements	Reasons
(1) $\overline{WN} \cong \overline{RE}$	(1) given
(2) $\overline{NR} \cong \overline{NR}$	(2) reflexive property
(3) $\overline{WR} \cong \overline{NE}$ or $WN+NR=NR+RE$	(3) addition property

5. Given: $\overline{EJ} \cong \overline{GO}$
Prove: $\Delta TGE \cong \Delta YJO$



Statements	Reasons
(1) $\overline{EJ} \cong \overline{GO}$	(1) given
(2) $\overline{GJ} \cong \overline{GJ}$	(2) reflexive property
(3) $\overline{EG} \cong \overline{JO}$ or $EG-GJ=GO-GJ$	(3) subtraction property

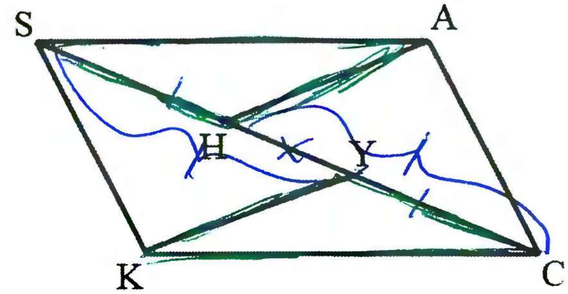
6. Given: $\overline{AE} \cong \overline{GC}$, $\overline{EB} \cong \overline{DG}$
Prove: ~~$\Delta AFE \cong \Delta CHG$~~ $\Delta ABC \cong \Delta CDA$



Statements	Reasons
(1) $\overline{AE} \cong \overline{GC}$	(1) given
(2) $\overline{EB} \cong \overline{DG}$	(2) given
(3) $\overline{AB} \cong \overline{DC}$ or $AE+EB=GC+DG$	(3) addition property

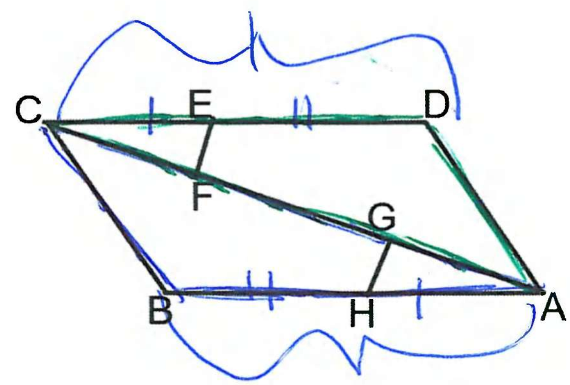
7. Given: $\overline{SY} \cong \overline{HC}$
Prove: $\Delta ASH \cong \Delta KCY$

Statements	Reasons
① $\overline{SY} \cong \overline{HC}$	① given
② $\overline{HY} \cong \overline{HY}$	② reflexive property
③ $\overline{SH} \cong \overline{YC}$ or $\overline{SY} - \overline{HY} = \overline{HC} - \overline{HY}$	③ subtraction property



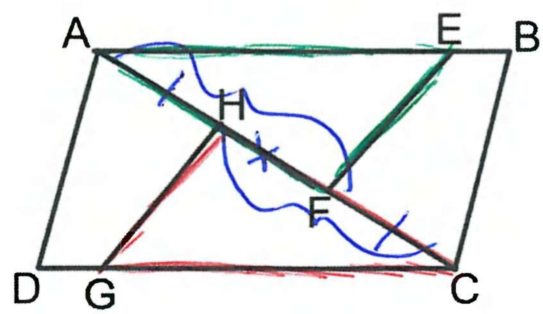
8. Given: $\overline{CE} \cong \overline{AH}$, $\overline{ED} \cong \overline{BH}$
Prove: ~~$\Delta AXC \cong \Delta BYD$~~ $\Delta CDA \cong \Delta ABC$

Statements	Reasons
① $\overline{CE} \cong \overline{AH}$	① given
② $\overline{ED} \cong \overline{BH}$	② given
③ $\overline{CD} \cong \overline{BA}$ or $CE + ED = AH + BH$	③ addition property



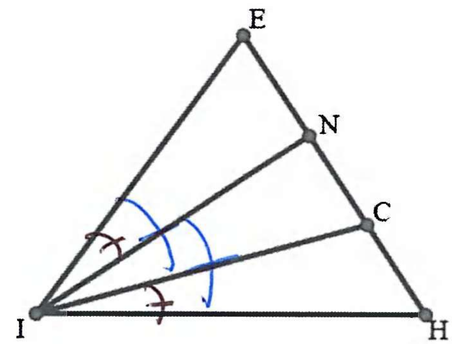
9. Given: $\overline{AH} \cong \overline{FC}$
Prove: $\Delta AFE \cong \Delta CHG$

Statements	Reasons
① $\overline{AH} \cong \overline{FC}$	① given
② $\overline{HF} \cong \overline{HF}$	② reflexive property
③ $\overline{AF} \cong \overline{HC}$ or $AH + HF = FC + HF$	③ addition property



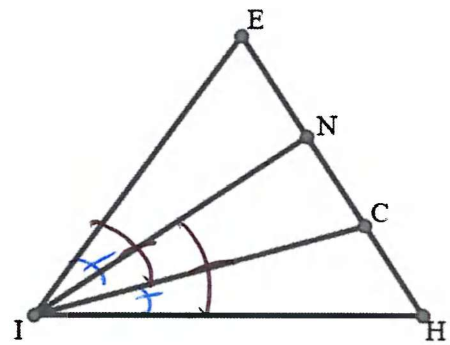
10. Given: $\angle EIN \cong \angle HIC$
Prove: $\angle EIC \cong \angle HIN$

Statements	Reasons
① $\angle EIN \cong \angle HIC$	① given
② $\angle NIC \cong \angle NIC$	② reflexive property
③ $\angle EIC \cong \angle HIN$ or $\angle EIN + \angle NIC = \angle HIC + \angle NIC$	③ addition property



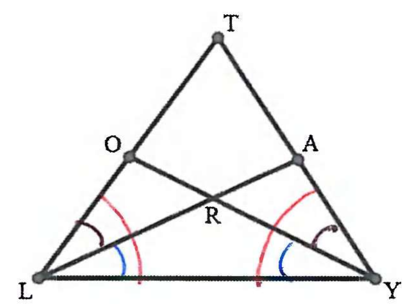
11. Given: $\angle EIC \cong \angle HIN$
Prove: $\angle EIN \cong \angle HIC$

Statements	Reasons
① $\angle EIC \cong \angle HIN$	① given
② $\angle NIC \cong \angle NIC$	② reflexive property
③ $\angle EIN \cong \angle HIC$ or $\angle EIC - \angle NIC = \angle HIN - \angle NIC$	③ subtraction property



12. Given: $\angle TLA \cong \angle TYO$, $\angle ALY \cong \angle OYL$
Prove: $\angle TLY \cong \angle TYL$

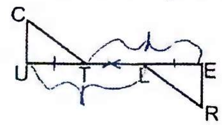
Statements	Reasons
① $\angle TLA \cong \angle TYO$	① given
② $\angle ALY \cong \angle OYL$	② given
③ $\angle TLY \cong \angle TYL$ or $\angle TLA + \angle ALY = \angle TYO + \angle OYL$	③ addition property.



Euclidean Triangle Proofs with Additional Tools

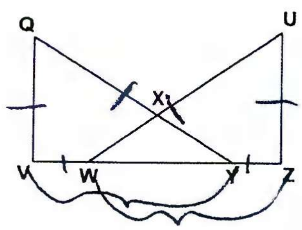
Vertical Angles are congruent (Look for an X)
Reflexive Property (A side/angle is congruent to itself)
Isosceles Triangles (In a triangle, congruent angles are opposite congruent sides)
Addition and Subtraction Property (If you need more or less of a shared side)
*You must use three congruent statements to get one congruent statement for the triangles. The two that you are adding/subtracting and the one that you want to prove in the triangle.

7. Given: $\overline{UL} \cong \overline{TE}$
Prove: $\overline{UT} \cong \overline{LE}$



Statements	Reasons
(1) $\overline{UL} \cong \overline{TE}$	(1) given
(2) $\overline{TL} \cong \overline{TL}$	(2) reflexive property
(3) $\overline{UT} \cong \overline{LE}$ or $\overline{UL} - \overline{TL} = \overline{TE} - \overline{TL}$	(3) subtraction property

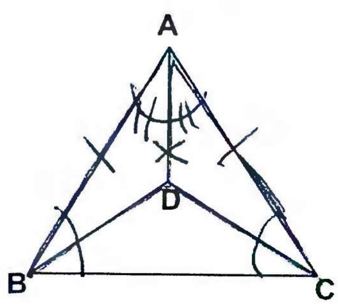
1. Given: $\overline{QV} \cong \overline{UZ}$, $\overline{VW} \cong \overline{YZ}$, $\overline{YQ} \cong \overline{WU}$
Prove: $\angle Q \cong \angle U$



Statements	Reasons
(1) $\overline{QV} \cong \overline{UZ}$	(1) given
(2) $\overline{VW} \cong \overline{YZ}$	(2) given
(3) $\overline{WY} \cong \overline{WY}$	(3) reflexive property
(4) $\overline{VY} \cong \overline{WZ}$ or $\overline{VW} + \overline{WY} = \overline{YZ} + \overline{WY}$	(4) Addition Property
(5) $\overline{YQ} \cong \overline{WU}$	(5) given
(6) $\triangle QVY \cong \triangle UZW$	(6) SSS ≅ SSS
(7) $\angle Q \cong \angle U$	(7) CPCTC

2. Given: $\angle ABC \cong \angle ACB$, $\overline{AD}$ bisects $\angle BAC$

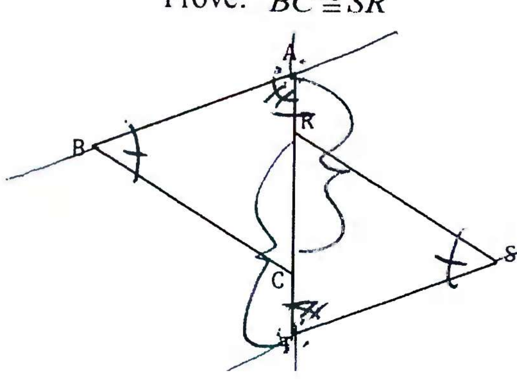
Prove: $\overline{BD} \cong \overline{DC}$



Statements	Reasons
(1) $\angle ABC \cong \angle ACB$	(1) given
(2) $\overline{AB} \cong \overline{AC}$	(2) In a triangle, congruent angles are opposite congruent sides
(3) $\overline{AD}$ bisects $\angle BAC$	(3) given
(4) $\angle BAD \cong \angle CAD$	(4) An angle bisector creates 2 ≅ angles
(5) $\overline{AD} \cong \overline{AD}$	(5) Reflexive Property
(6) $\triangle BAD \cong \triangle CAD$	(6) SAS ≅ SAS
(7) $\overline{BD} \cong \overline{DC}$	(7) CPCTC

3. Given: $\angle B \cong \angle S$, $\overline{AB} \parallel \overline{ST}$, $\overline{AR} \cong \overline{TC}$

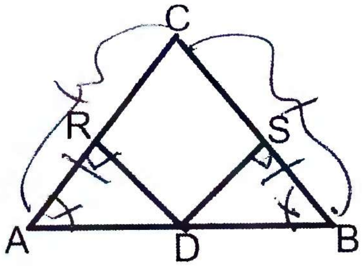
Prove: $\overline{BC} \cong \overline{SR}$



Statements	Reasons
(1) $\angle B \cong \angle S$	(1) given
(2) $\overline{AB} \parallel \overline{ST}$	(2) given
(3) $\angle BAC \cong \angle STR$	(3) Parallel lines cut by a transversal create congruent alternate interior angles
(4) $\overline{AR} \cong \overline{TC}$	(4) given
(5) $\overline{RC} \cong \overline{RC}$	(5) reflexive property
(6) $\overline{AC} \cong \overline{RT}$ or $\overline{AR} + \overline{RC} = \overline{TC} + \overline{RC}$	(6) addition property
(7) $\triangle BAC \cong \triangle STR$	(7) AAS ≅ AAS
	(8) CPCTC

4. Given: In ΔABC, $\overline{CA} \cong \overline{CB}$, $\overline{AR} \cong \overline{BS}$, $\overline{DR} \perp \overline{AC}$, and $\overline{DS} \perp \overline{BC}$

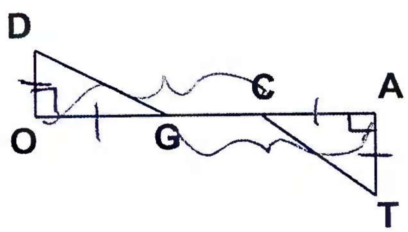
Prove: $\overline{DR} \cong \overline{DS}$



statements	Reasons
① $\overline{CA} \cong \overline{CB}$	① given
② $\angle A \cong \angle B$	② In a triangle, congruent angles are opposite congruent sides
③ $\overline{AR} \cong \overline{BS}$	③ given
④ $\overline{DR} \perp \overline{AC}$, $\overline{DS} \perp \overline{BC}$	④ given
⑤ $\angle DRA \cong \angle BSD$	⑤ Perpendicular lines form congruent right angles.
⑥ $\Delta ARD \cong \Delta BSD$	⑥ ASA ≅ ASA
⑦ $\overline{DR} \cong \overline{DS}$	⑦ CPCTC

5. Given: $\overline{DO} \perp \overline{OA}$, $\overline{TA} \perp \overline{OA}$, $\overline{DO} \cong \overline{TA}$, $\overline{OC} \cong \overline{AG}$

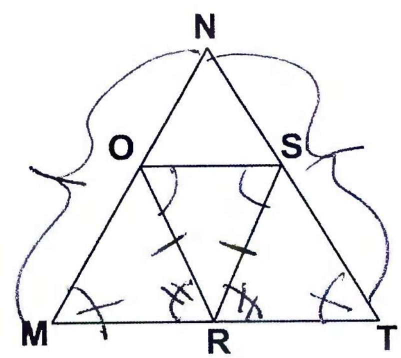
Prove: $\overline{DG} \cong \overline{TC}$



statements	Reasons
① $\overline{DO} \perp \overline{OA}$, $\overline{TA} \perp \overline{OA}$	① given
② $\angle DOG \cong \angle TAC$	② Perpendicular lines form congruent right angles
③ $\overline{DO} \cong \overline{TA}$	③ given
④ $\overline{OC} \cong \overline{AG}$	④ given
⑤ $\overline{GC} \cong \overline{GC}$	⑤ reflexive property
⑥ $\overline{OG} \cong \overline{CA}$ or $\overline{OC} - \overline{GC} = \overline{AG} - \overline{GC}$	⑥ subtraction property
⑦ $\Delta DOG \cong \Delta TAC$	⑦ SAS ≅ SAS
⑧ $\overline{DG} \cong \overline{TC}$	⑧ CPCTC

6. Given: $\overline{MN} \cong \overline{NT}$, $\angle ROS \cong \angle RSO$, $\angle ORM \cong \angle SRT$

Prove: $\Delta MOR \cong \Delta TSR$



statements	Reasons
① $\overline{MN} \cong \overline{TN}$	① given
② $\angle M \cong \angle T$	② In a triangle, congruent angles are opposite congruent sides
③ $\angle ROS \cong \angle RSO$	③ given
④ $\overline{OR} \cong \overline{SR}$	④ In a triangle, congruent angles are opposite congruent sides
⑤ $\angle ORM \cong \angle SRT$	⑤ given
⑥ $\Delta MOR \cong \Delta TSR$	⑥ AAS ≅ AAS

A parallelogram has parallel lines cut by a transversal which forms congruent alternate interior angles

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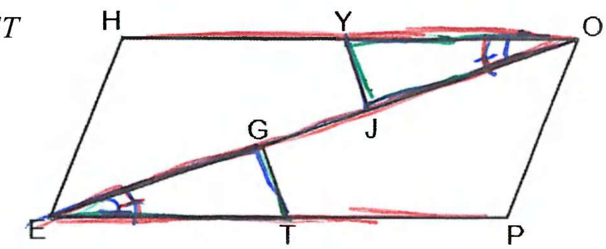
Geometry

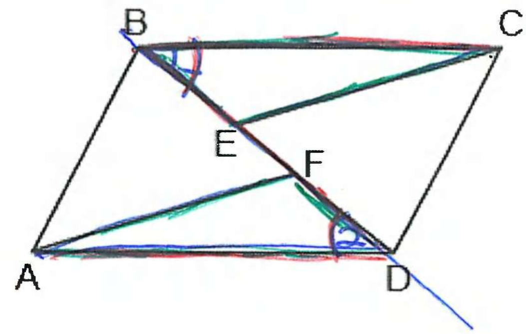
Proving Alternate Interior Angles Given Parallelogram Mini Proofs (PR1)

1. Given *HOPE* is a parallelogram, prove $\Delta JOY \cong \Delta GET$



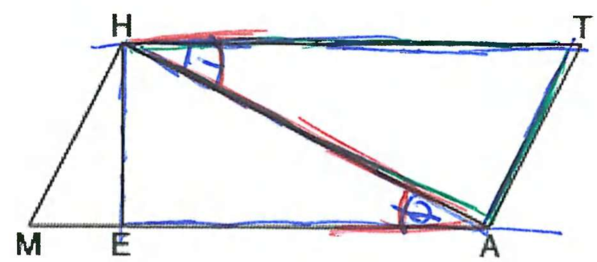
Statements	Reasons
① HOPE is a P-gram	① given
② $\angle 1 \cong \angle 2$	② A parallelogram has parallel lines cut by a transversal which forms congruent alternate interior angles.

2. Given *ABCD* is a parallelogram, prove $\Delta BCE \cong \Delta DAF$



Statements	Reasons
① ABCD is a P-gram	① given
② $\angle 1 \cong \angle 2$	② A parallelogram has parallel lines cut by a transversal which forms congruent alternate interior angles

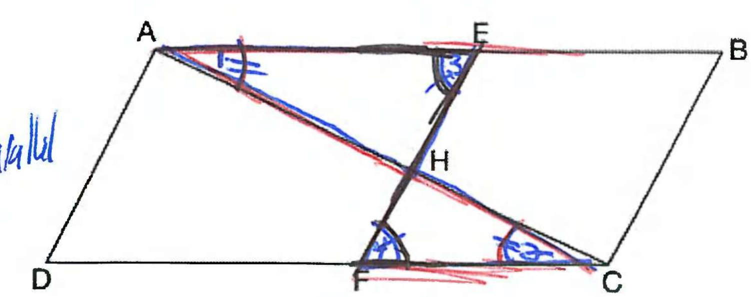
3. Given *MATH* is a parallelogram, prove $\Delta HAT \sim \Delta AEH$



Statements	Reasons
① MATH is a P-gram	① given
② $\angle 1 \cong \angle 2$	② A parallelogram has parallel lines cut by a transversal which forms congruent alternate interior angles

4. Given *ABCD* is a parallelogram, prove $\Delta AEH \sim \Delta CFH$

Statements	Reasons
① ABCD is a P-gram	① given
② $\angle 1 \cong \angle 2$, $\angle 3 \cong \angle 4$	② A parallelogram has parallel lines cut by a transversal which forms congruent alternate interior angles



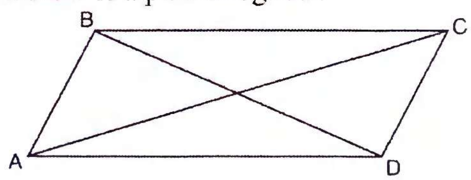
Euclidean Parallelogram Proofs/Parallelogram Properties

To prove parallelograms: Always prove parallelogram first. You will probably have to use congruent triangles with CPCTC to get at least one of the properties.

1. Quadrilateral $ABCD$ with diagonals $\overline{AC}$ and $\overline{BD}$ is shown in the diagram below.

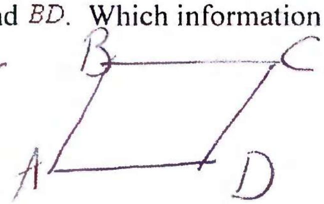
Which information is *not* enough to prove $ABCD$ is a parallelogram?

1) $\overline{AB} \cong \overline{CD}$ and $\overline{AB} \parallel \overline{DC}$
2) $\overline{AB} \cong \overline{CD}$ and $\overline{BC} \cong \overline{DA}$
3) $\overline{AB} \cong \overline{CD}$ and $\overline{BC} \parallel \overline{AD}$
4) $\overline{AB} \parallel \overline{DC}$ and $\overline{BC} \parallel \overline{AD}$



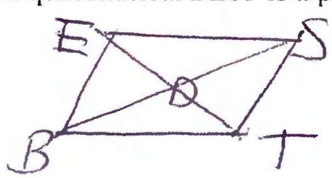
2. Quadrilateral $ABCD$ has diagonals $\overline{AC}$ and $\overline{BD}$. Which information is *not* sufficient to prove $ABCD$ is a parallelogram?

1) $\overline{AC}$ and $\overline{BD}$ bisect each other.
2) $\overline{AB} \cong \overline{CD}$ and $\overline{BC} \cong \overline{AD}$
3) $\overline{AB} \cong \overline{CD}$ and $\overline{AB} \parallel \overline{CD}$
4) $\overline{AB} \cong \overline{CD}$ and $\overline{BC} \parallel \overline{AD}$

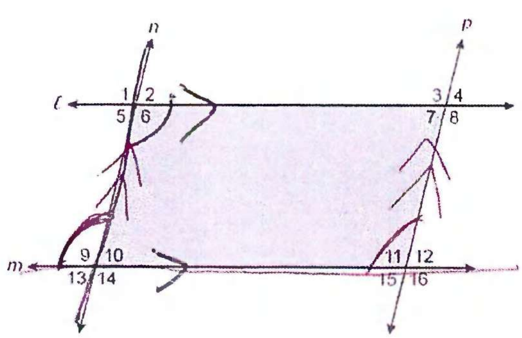


3. Quadrilateral $BEST$ has diagonals that intersect at point D. Which statement would *not* be sufficient to prove quadrilateral $BEST$ is a parallelogram?

1) $\overline{BD} \cong \overline{SD}$ and $\overline{ED} \cong \overline{TD}$
2) $\overline{BE} \cong \overline{ST}$ and $\overline{ES} \cong \overline{TB}$
3) $\overline{ES} \cong \overline{TB}$ and $\overline{BE} \parallel \overline{TS}$
4) $\overline{ES} \parallel \overline{BT}$ and $\overline{BE} \parallel \overline{TS}$



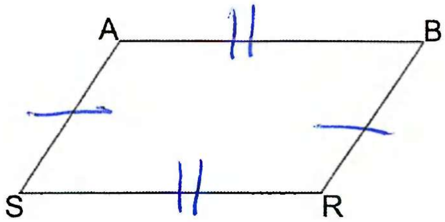
4. In the diagram below, lines ℓ and m intersect lines n and p to create the shaded quadrilateral as shown.



Which congruence statement would be sufficient to prove the quadrilateral is a parallelogram?

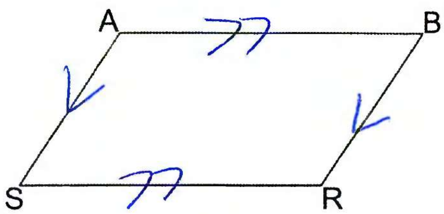
1) $\angle 1 \cong \angle 6$ and $\angle 9 \cong \angle 14$
2) $\angle 5 \cong \angle 10$ and $\angle 6 \cong \angle 9$
3) $\angle 5 \cong \angle 7$ and $\angle 10 \cong \angle 15$
4) $\angle 6 \cong \angle 9$ and $\angle 9 \cong \angle 11$

5. Given: $\overline{SA} \cong \overline{BR}$, $\overline{AB} \cong \overline{SR}$
Prove: SABR is a parallelogram



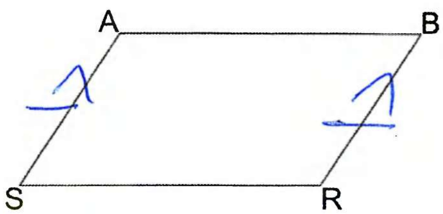
Statements	Reasons
① $\overline{SA} \cong \overline{BR}$, $\overline{AB} \cong \overline{SR}$	① given
② SABR is a parallelogram	② A parallelogram has two pairs of opposite sides congruent

6. Given: $\overline{SA} \parallel \overline{BR}$, $\overline{AB} \parallel \overline{SR}$
Prove: SABR is a parallelogram



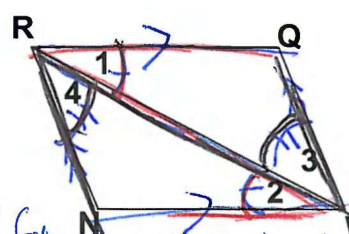
Statements	Reasons
① $\overline{SA} \parallel \overline{BR}$, $\overline{AB} \parallel \overline{SR}$	① given
② SABR is a parallelogram	② A parallelogram has two pairs of opposite sides parallel

7. Given: $\overline{SA} \cong \overline{BR}$, $\overline{SA} \parallel \overline{BR}$
Prove: SABR is a parallelogram



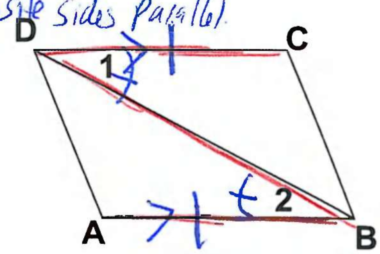
Statements	Reasons
① $\overline{SA} \cong \overline{BR}$, $\overline{SA} \parallel \overline{BR}$	① given
② SABR is a parallelogram	② A parallelogram has one pair of opposite sides congruent and parallel

8. Given: $\angle 1 \cong \angle 2$, $\angle 3 \cong \angle 4$
Prove: NRQW is a parallelogram



Statements	Reasons
① $\angle 1 \cong \angle 2$, $\angle 3 \cong \angle 4$	① given
② $\overline{RQ} \parallel NW$, $RN \parallel QW$	② Parallel lines cut by a transversal form congruent alternate interior angles
③ NRQW is a parallelogram	③ A parallelogram ~~is~~ has two pairs of opposite sides parallel

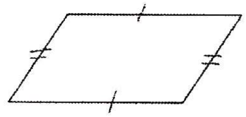
9. Given: $\overline{AB} \cong \overline{CD}$, $\angle 1 \cong \angle 2$
Prove: ABCD is a parallelogram



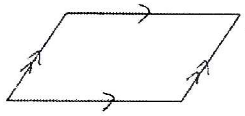
Statements	Reasons
① $AB \cong CD$	① given
② $\angle 1 \cong \angle 2$	② given
③ $\overline{DC} \parallel \overline{AB}$	③ Parallel lines cut by a transversal form congruent alternate interior angles
④ ABCD is a parallelogram	④ A parallelogram has 1 pair of opposite sides congruent and parallel

PART IV PARALLELOGRAM PROOFS!

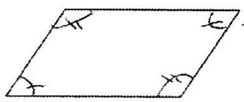
1) Prove the parallelogram (Pages 36-37). You may need to prove sides are parallel using alternate interior angles (Pages 20-21)



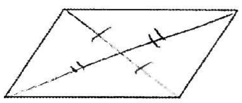
Two pairs of opposite sides are congruent



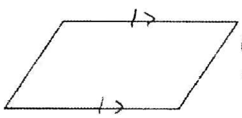
Two pairs of opposite sides are parallel



Two pairs of opposite angles are congruent



Diagonals bisect each other



One pair of opposite sides are congruent and parallel.

2) Use the parallelogram to prove corresponding parts of triangles are congruent (Pages 14-16). **Expect to prove alternate interior angles are congruent! (Page 35).** Opposite sides are congruent is also very common.

If proving sides/angles:	If proving multiplication
3) **Expect to use addition/subtraction property (Pages 29-31).** 4) State the triangles are congruent 5) State the sides/angles with reason CPCTC	3) Expect to use perpendicular lines form congruent right angles. **4) Work backwards to similar triangles (Pages 12-13)**

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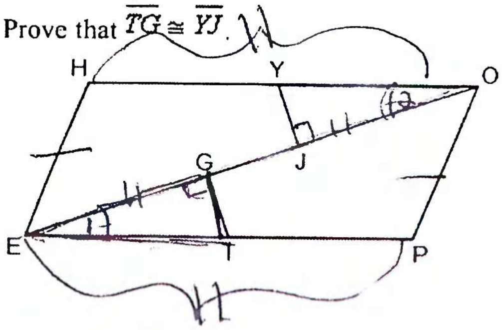
Geometry

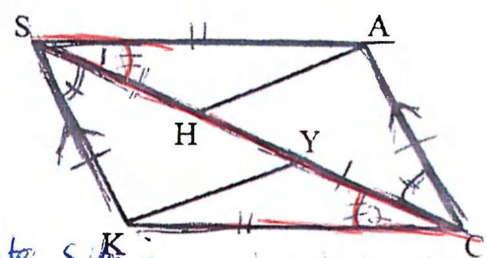
Parallelogram Proofs Part IV

1. In quadrilateral *HOPE* below, $\overline{EH} \cong \overline{OP}$, $\overline{EP} \cong \overline{OH}$, $\overline{EJ} \cong \overline{OG}$, and $\overline{TG}$ and $\overline{YJ}$ are perpendicular to diagonal $\overline{EO}$ at points *G* and *J*, respectively. Prove that $\overline{TG} \cong \overline{YJ}$.



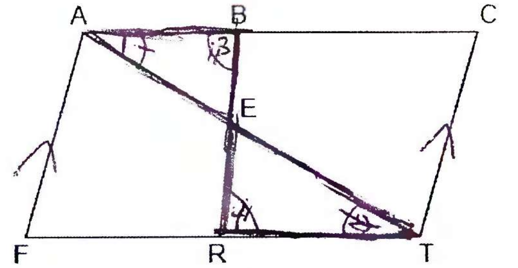
Statements	Reasons
1) $\overline{EH} \cong \overline{OP}$; $\overline{EP} \cong \overline{OH}$	1) given
2) HOPE is a p-gram	2) A parallelogram has two pairs of opposite sides congruent
3) $\angle 1 \cong \angle 2$	3) A parallelogram has parallel lines cut by a transversal which create congruent alternate interior angles
4) $\overline{EJ} \cong \overline{OG}$	4) given
5) $\overline{GJ} \cong \overline{GJ}$	5) reflexive property
6) $\overline{EG} \cong \overline{OJ}$ or $EJ - GJ = OG - GJ$	6) subtraction property
7) $\overline{TG} \perp \overline{EO}$, $\overline{YJ} \perp \overline{EO}$	7) given
8) $\angle TGE \cong \angle YJO$	8) Perpendicular lines form congruent right angles
9) $\triangle TGE \cong \triangle YJO$	9) ASA ≅ ASA
10) $\overline{TG} \cong \overline{YJ}$	10) CPCTC

2. In quadrilateral SACK, $\angle KSY \cong \angle ACH$, $\overline{SK} \cong \overline{AC}$, $\overline{SY} \cong \overline{CH}$. Prove $\angle SAH \cong \angle CKY$



Statements	Reasons
1) $\angle KSY \cong \angle ACH$	1) given
2) $\overline{SK} \parallel \overline{AC}$	2) Parallel lines cut by a transversal create congruent alternate interior angles
3) $\overline{SK} \cong \overline{AC}$	3) given
4) SACK is a p-gram	4) A parallelogram has 1 pair of opposite sides congruent and parallel
5) $\angle 1 \cong \angle 2$	5) A P-gram has parallel lines cut by a transversal which creates ≅ alternate interior angles
6) $\overline{SY} \cong \overline{CH}$	6) given
7) $\overline{HY} \cong \overline{HY}$	7) reflexive property
8) $\overline{HS} \cong \overline{YC}$ or $SY - HY = CH - HY$	8) subtraction property
9) $\overline{SA} \cong \overline{KC}$	9) A parallelogram has opposite sides congruent
10) $\triangle ASH \cong \triangle KCY$	10) SAS ≅ SAS
11) $\angle SAH \cong \angle CKY$	11) CPCTC

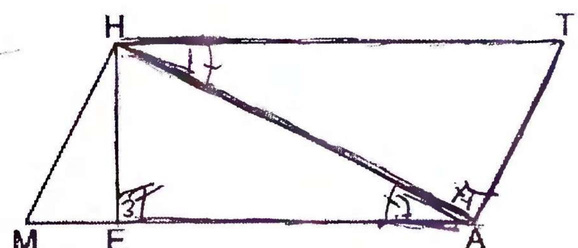
3. In the diagram below of quadrilateral $FACT$, $\overline{BR}$ intersects diagonal $\overline{AT}$ at E, $\overline{AF} \parallel \overline{CT}$, and $\overline{AF} \cong \overline{CT}$. Prove $(AB)(TE) = (AE)(TR)$



statements	Reasons
① $\overline{AF} \parallel \overline{CT}, \overline{AF} \cong \overline{CT}$	① given
② FACT is a parallelogram	② A p-gram has 1 pair of opposite sides ≅ and ∥
③ $\angle 1 \cong \angle 2, \angle 3 \cong \angle 4$	③ A parallelogram has parallel lines cut by a transversal creating congruent alternate interior angles
④ $\triangle ABE \sim \triangle TRE$	④ AA ≅ AA
⑤ $\frac{AB}{TR} = \frac{AE}{TE}$	⑤ CSSTIP
⑥ $(AB)(TE) = (AE)(TR)$	⑥ cross products are equal

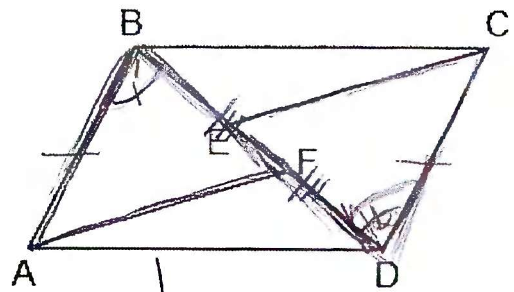
*you could have done vertical angles

4. Given: Quadrilateral $MATH$, $\overline{HM} \cong \overline{AT}$, $\overline{HT} \cong \overline{AM}$, $\overline{HE} \perp \overline{MEA}$, and $\overline{HA} \perp \overline{AT}$.
Prove: $TA \bullet HA = HE \bullet TH$



statements	Reasons
① $\overline{HM} \cong \overline{AT}, \overline{HT} \cong \overline{AM}$	① given
② MATH is a parallelogram	② A p-gram has 2 pairs of opposite sides congruent
③ $\angle 1 \cong \angle 2$	③ A parallelogram has parallel lines cut by a transversal that create congruent alternate interior angles
④ $\overline{HE} \perp \overline{MEA}, \overline{HA} \perp \overline{AT}$	④ given
⑤ $\angle 3 \cong \angle 4$	⑤ Perpendicular lines form congruent right angles
⑥ $\triangle AHT \cong \triangle EAH$	⑥ AA ≅ AA
⑦ $\frac{TA}{TH} = \frac{HE}{HA}$	⑦ CSSTIP
⑧ $TA \cdot HA = HE \cdot TH$	⑧ cross products are equal

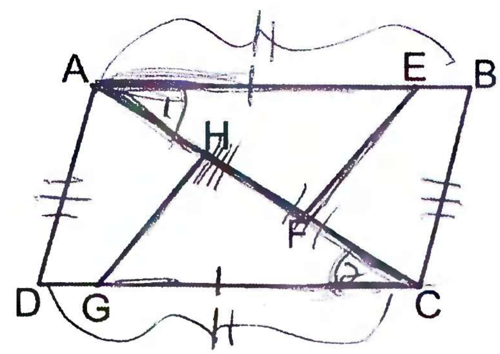
5. In the diagram of quadrilateral *ABCD* below, $\overline{AB} \cong \overline{CD}$, and $\overline{AB} \parallel \overline{CD}$. Segments *CE* and *AF* are drawn to diagonal $\overline{BD}$ such that $\overline{BE} \cong \overline{DF}$. Prove: $\angle BAF \cong \angle DCE$.



Statements	Reasons
① $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$	① given
② ABCD is a p-gram	② A p-gram has 1 pair of opposite sides congruent and parallel
③ $\angle 1 \cong \angle 2$	③ Parallelogram has parallel lines cut by a transversal which create congruent alt int ∠s
④ $\overline{AB} \cong \overline{CD}$	④ A parallelogram has opposite sides congruent
⑤ $\overline{BE} \cong \overline{DF}$	⑤ given
⑥ $\overline{EF} \cong \overline{EF}$	⑥ reflexive property
⑦ $\overline{BF} \cong \overline{ED}$ or $BE+EF=DF+EF$	⑦ addition property
~~⑧ △ABE≅△~~	~~⑧ △ABF≅△~~
~~△ABE≅△DCE~~	
⑧ △ABF≅△CDE	⑧ SAS≅SAS
⑨ ∠BAF≅∠DCE	⑨ CPCTC

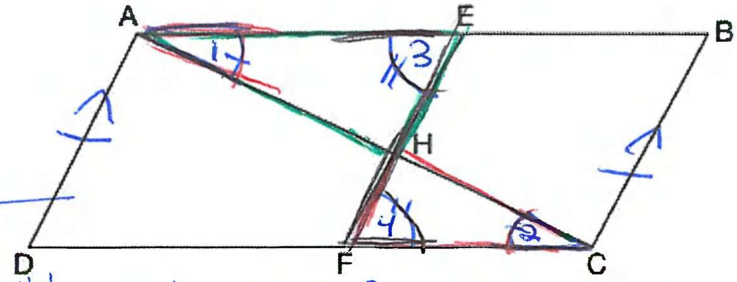
6. Given: $\overline{AE} \cong \overline{CG}$, $\overline{BE} \cong \overline{DG}$, $\overline{AH} \cong \overline{CF}$, $\overline{AD} \cong \overline{CB}$

Prove: $\overline{EF} \cong \overline{GH}$



Statements	Reasons
① $\overline{AE} \cong \overline{CG}$	① given
② $\overline{BE} \cong \overline{DG}$	② given
③ $\overline{AB} \cong \overline{DC}$ or $AE+BE=CG+DG$	③ addition property
④ $\overline{AD} \cong \overline{CB}$	④ given
⑤ ABCD is a parallelogram	⑤ A parallelogram has 2 pairs of opposite sides congruent
⑥ $\angle 1 \cong \angle 2$	⑥ A parallelogram has parallel lines cut by a transversal that form ≅ alt interior angles
⑦ $\overline{AH} \cong \overline{CF}$	⑦ given
⑧ $\overline{HF} \cong \overline{HF}$	⑧ reflexive property
⑨ $AF \cong HC$ or $AH+HF=CF+HF$	⑨ addition property
⑩ △EAF≅△GCH	⑩ SAS≅SAS
⑪ $\overline{EF} \cong \overline{GH}$	⑪ CPCTC

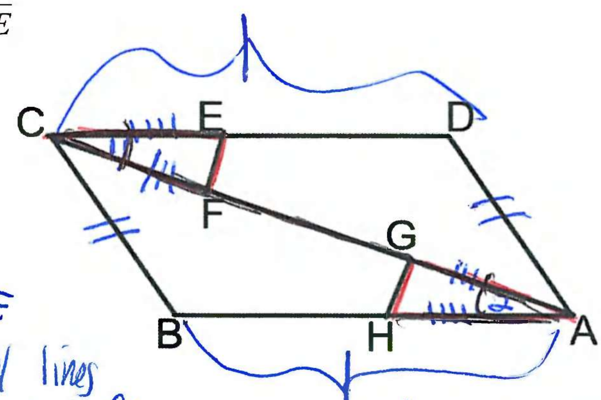
7. Given: Quadrilateral $ABCD$, $\overline{AC}$ and $\overline{EF}$ intersect at H, $\overline{AD} \parallel \overline{BC}$ and $\overline{AD} \cong \overline{BC}$. Prove: $(EH)(CH) = (FH)(AH)$



statements	Reasons
① $\overline{AD} \parallel \overline{BC}, \overline{AD} \cong \overline{BC}$	① given
② ABCD is a parallelogram	② A Parallelogram has 1 pair of opposite sides ≅ and ∥
③ $\angle 1 \cong \angle 2, \angle 3 \cong \angle 4$	③ A parallelogram has parallel lines cut by a transversal which creates ≅ alternate interior angles
④ $\triangle EAH \sim \triangle FCH$	④ AA≅AA
⑤ $\frac{EH}{AH} = \frac{FH}{CH}$	⑤ CSSTP
⑥ $(EH)(CH) = (FH)(AH)$	⑥ Cross products are equal

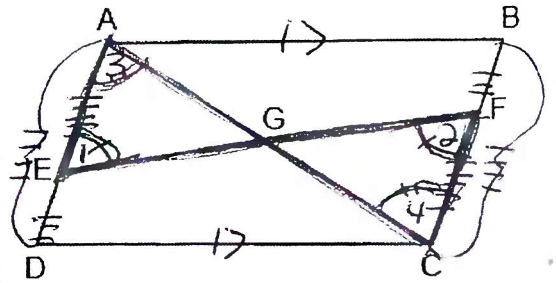
8. Given: $\overline{AB} \cong \overline{DC}$, $\overline{AD} \cong \overline{BC}$, $\overline{AF} \cong \overline{GC}$, $\overline{BH} \cong \overline{DE}$

Prove: $\overline{EF} \cong \overline{GH}$



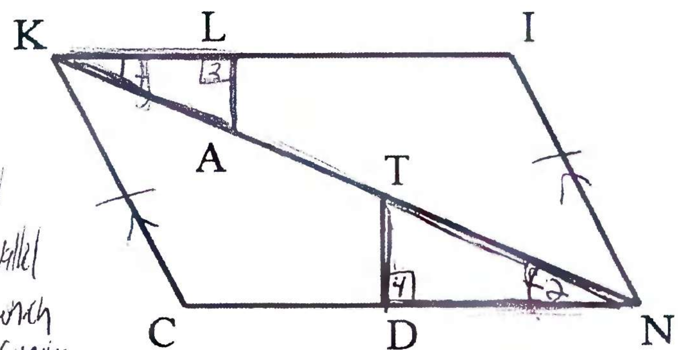
statements	Reasons
① $\overline{AB} \cong \overline{DC}, \overline{AD} \cong \overline{BC}$	① given
② ABCD is a parallelogram	② A P-gram has 2 pairs of opposite sides ≅
③ $\angle 1 \cong \angle 2$	③ A P-gram has parallel lines cut by a transversal which form ≅ alternate interior angles.
④ $\overline{AF} \cong \overline{GC}$	④ given
⑤ $\overline{FG} \cong \overline{FG}$	⑤ reflexive property
⑥ $\overline{CF} \cong \overline{GA}$ or $AF - FG = GC - FG$	⑥ subtraction property
⑦ $\overline{BH} \cong \overline{DE}$	⑦ given
⑧ $\overline{HA} \cong \overline{CE}$ or $\overline{AB} - \overline{BH} = \overline{DC} - \overline{DE}$	⑧ subtraction property
⑨ $\triangle ECF \cong \triangle HAG$	⑨ SAS≅SAS
⑩ $\overline{EF} \cong \overline{GH}$	⑩ CPCTC

9. Given: Quadrilateral $ABCD$, $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$, diagonal $\overline{AC}$ intersects $\overline{EF}$ at G, and $\overline{DE} \cong \overline{BF}$. Prove: G is the midpoint of $\overline{EF}$.



Statements	Reasons
① $\overline{AB} \cong \overline{CD}$, $\overline{AB} \parallel \overline{CD}$	① given
② ABCD is a parallelogram	② A parallelogram has 1 pair of opposite sides ≅ and ∥
③ $\angle 1 \cong \angle 2$, $\angle 3 \cong \angle 4$	③ A p-gram has parallel lines cut by a transversal which create congruent alternate interior angles
④ $\overline{DE} \cong \overline{BF}$	④ given
⑤ $\overline{AD} \cong \overline{BC}$	⑤ A p-gram has opposite sides congruent
⑥ $\overline{AE} \cong \overline{FC}$ or ~~AD-DE~~ $AD - DE = BC - BF$	⑥ subtraction property
⑦ $\triangle AEG \cong \triangle CFG$	⑦ ASA ≅ ASA
⑧ $\overline{EG} \cong \overline{GF}$	⑧ CPCTC
⑨ G is the midpoint of EF	⑨ A midpoint creates 2 congruent segments

10. Given: $\overline{KC} \parallel \overline{IN}$, $\overline{KC} \cong \overline{IN}$, $\overline{AL} \perp \overline{KI}$, $\overline{TD} \perp \overline{CN}$. Prove $KL \bullet NT = DN \bullet KA$



Statements	Reasons
① $\overline{KC} \parallel \overline{IN}$, $\overline{KC} \cong \overline{IN}$	① given
② KINC is a p-gram ~~has 1 pair of opposite sides con~~	② A P-gram has 1 pair of opposite sides congruent and parallel
③ $\angle 1 \cong \angle 2$	③ A parallelogram has parallel lines cut by a transversal which form congruent alternate interior angles
④ $\overline{AL} \perp \overline{KI}$, $\overline{TD} \perp \overline{CN}$	④ given
⑤ $\angle 3 \cong \angle 4$	⑤ Perpendicular lines form congruent right angles
⑥ $\triangle KLA \sim \triangle NDT$	⑥ AA ≅ AA
⑦ $\dfrac{KL}{KA} = \dfrac{DN}{NT}$	⑦ CSSTIP
⑧ $\overline{KL} \cdot \overline{NT} = \overline{DN} \cdot \overline{KA}$	⑧ cross products are equal

Proving Rectangles/Rhombuses/Squares MC and Mini Proofs

To prove a rectangle:
1) Prove it is a parallelogram
2) Prove one of the two rectangle pictures

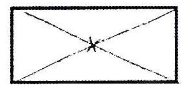
To prove a rhombus:
1) Prove it is a parallelogram
2) Prove one of the three rhombus pictures

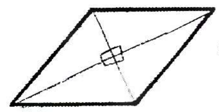
To prove a square:
1) Prove it is a parallelogram
2) Prove one of the two rectangle pictures AND one of the two rhombus pictures.

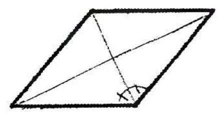
To prove a rectangle is a square:
Prove one of the three rhombus pictures

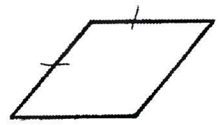
To prove a rhombus is a square:
Prove one of the two rectangle pictures


A right angle (consecutive sides perpendicular)


Congruent diagonals


diagonals are perpendicular to each other


diagonals bisect the angles


Consecutive sides are congruent

1. A parallelogram must be a rhombus when its
1) Diagonals are congruent.
2) Opposite sides are parallel.
3) Diagonals are perpendicular.
4) Opposite angles are congruent.

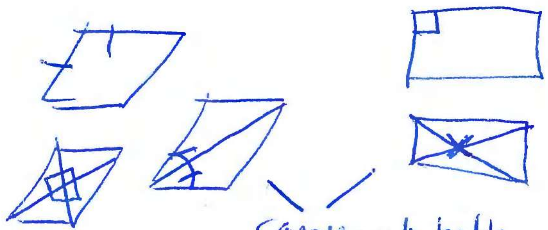
2. A parallelogram must be a rectangle when its
1) diagonals are perpendicular
2) diagonals are congruent
3) opposite sides are parallel
4) opposite sides are congruent

3. A rectangle must be a square when its
1) angles are right angles
2) diagonals are congruent
3) consecutive sides are congruent
4) opposite sides are parallel

4. A rhombus must be a square when
1) its consecutive sides are congruent
2) it has a right angle
3) its opposite angles are congruent
4) its diagonals are perpendicular to each other

5. A parallelogram must be a rhombus when its
1) diagonals bisect its angles
2) opposite angles are congruent
3) angles are right angles
4) opposite sides are parallel

6. A rhombus must be a square when its
1) diagonals bisect its angles
2) opposite angles are congruent
3) diagonals are congruent
4) opposite sides are parallel



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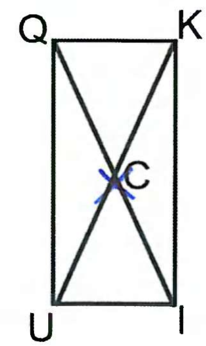
Square needs both

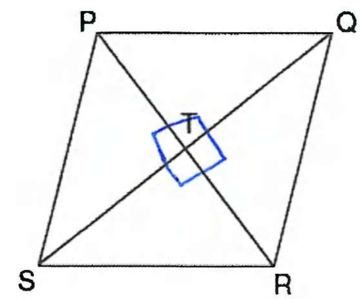
Proving Rectangles/Rhombuses/Squares Mini Proofs

7. Given: *QUIK* is a parallelogram, $\overline{QI} \cong \overline{KU}$ ~~$\angle QUI \cong \angle KIU$~~
Prove: *QUIK* is a rectangle



Statements	Reasons
(1) QUIK is a Pgram	(1) given
(2) $\overline{QI} \cong \overline{KU}$	(2) given
(3) QUIK is a rectangle	(3) A rectangle is a parallelogram with congruent diagonals

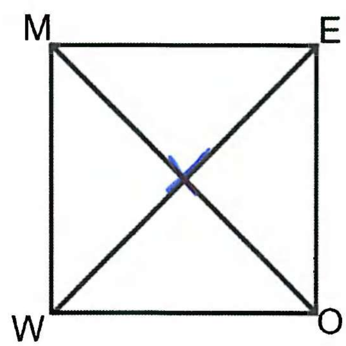
8. Given: *PQRS* is a parallelogram, $\overline{PR} \perp \overline{SQ}$.
Prove: *PQRS* is a rhombus



Statements	Reasons
(1) PQRS is a Pgram	(1) given
(2) $PR \perp SQ$	(2) given
(3) PQRS is a rhombus	(3) A rhombus is a parallelogram with perpendicular diagonals

has rhombus, needs rectangle

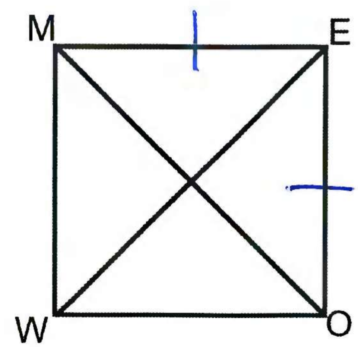
9. Given: *MEOW* is a rhombus, $\overline{MO} \cong \overline{WE}$
Prove: MEOW is a square



Statements	Reasons
(1) MEOW is a rhombus	(1) given
(2) $\overline{MO} \cong \overline{WE}$	(2) given
(3) MEOW is a square	(3) A square is a rhombus with congruent diagonals

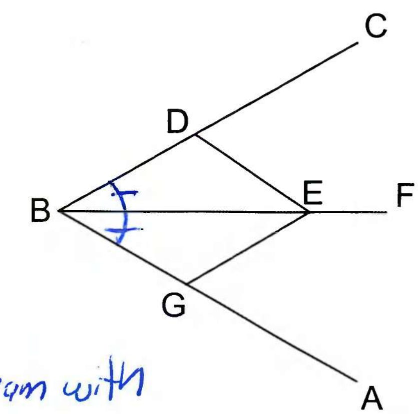
has rectangle, needs rhombus

10 ~~9~~. Given: $MEOW$ is a rectangle, $\overline{ME} \cong \overline{EO}$
Prove: $MEOW$ is a square



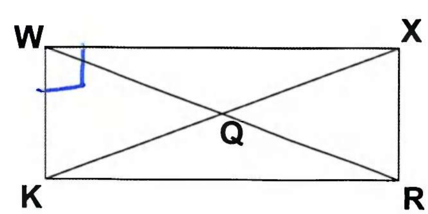
Statements	Reasons
(1) MEOW is a rectangle	(1) given
(2) $\overline{ME} \cong \overline{EO}$	(2) given
(3) MEOW is a square	(3) A square is a rectangle with congruent consecutive sides

11 ~~5~~. Given: $DEGB$ is a parallelogram, $\overline{BF}$ bisects $\angle$CBA
Prove: $DEGB$ is a rhombus



Statements	Reasons
(1) DEGB is a parallelogram	(1) given
(2) $\overline{BF}$ bisects $\angle CBA$	(2) given
(3) DEGB is a rhombus	(3) A rhombus is a parallelogram with diagonals that bisect its angles

12 ~~6~~. Given: $WXRK$ is a parallelogram, $\overline{KW} \perp \overline{WX}$
Prove: $WXRK$ is a rectangle



Statements	Reasons
(1) WXRK is a p-gram	(1) given
(2) $\overline{KW} \perp \overline{WX}$	(2) given
(3) $\angle KWX$ is a right angle	(3) Perpendicular lines form right angles
(4) WXRK is a rectangle	(4) A rectangle is a parallelogram with a right angle

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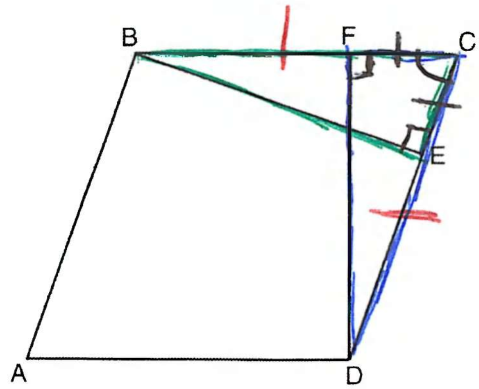
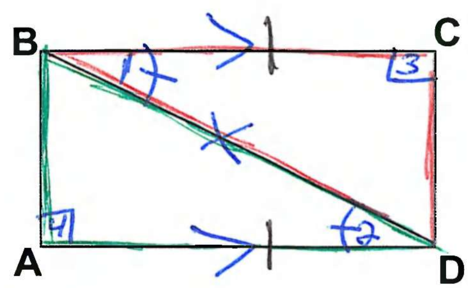
Proving All Parallelograms Part IV

1. In the diagram of parallelogram *ABCD* below, $\overline{BE} \perp \overline{CED}$, $\overline{DF} \perp \overline{BFC}$, $\overline{CE} \cong \overline{CF}$.
Prove *ABCD* is a rhombus.



Statements	Reasons
(1) ABCD is a p-gram	(1) given
(2) $\overline{BE} \perp \overline{CED}$, $\overline{DF} \perp \overline{BFC}$	(2) given
(3) $\angle DFC \cong \angle BEC$	(3) Perpendicular lines form congruent right angles
(4) $\overline{CE} \cong \overline{CF}$	(4) given
(5) $\angle C \cong \angle C$	(5) Reflexive Property
(6) $\triangle BCE \cong \triangle DCF$	(6) ASA $\cong$ ASA
(7) $\overline{BC} \cong \overline{CD}$	(7) CPCTC
(8) ABCD is a rhombus	(8) A rhombus is a parallelogram with consecutive sides $\cong$

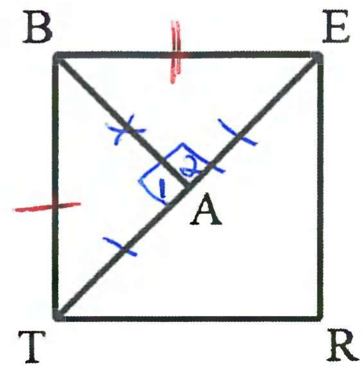
2. Given: $\overline{BC} \parallel \overline{AD}$, $\overline{BA} \perp \overline{AD}$, $\overline{BC} \perp \overline{CD}$
Prove: *ABCD* is a rectangle



Statements	Reasons
(1) $\overline{BC} \parallel \overline{AD}$	(1) given
(2) $\angle 1 \cong \angle 2$	(2) Parallel lines cut by a transversal creates $\cong$ alternate interior angles
(3) $\overline{BA} \perp \overline{AD}$, $\overline{BC} \perp \overline{CD}$	(3) given
(4) $\angle 3 \cong \angle 4$	(4) Perpendicular lines create congruent right angles
(5) $\overline{BD} \cong \overline{BD}$	(5) reflexive property
(6) $\triangle BAD \cong \triangle DCB$	(6) AAS $\cong$ AAS
(7) $\overline{BC} \cong \overline{AD}$	(7) CPCTC
(8) ABCD is a p-gram	(8) A parallelogram has 1 pair of opposite sides $\cong$ and $\parallel$
(9) $\angle 4$ is a right angle	(9) Perpendicular lines form right angles
(10) ABCD is a rectangle	(10) A rectangle is a parallelogram with a right angle

have rectangle, need rhombus property

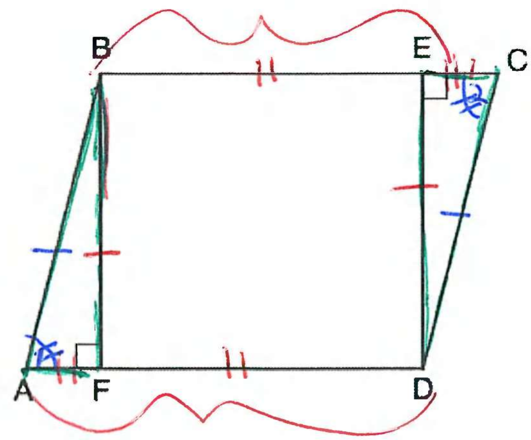
3. Given: *BERT* is a rectangle, $\overline{BA}$ is the perpendicular bisector of $\overline{TE}$.
Prove *BERT* is a square.



Statements	Reasons
(1) BERT is a rectangle	(1) given
(2) $\overline{BA}$ is the perpendicular bisector of $\overline{TE}$	(2) given
(3) $\overline{TA} \cong \overline{AE}$	(3) A line bisector creates two congruent segments
(4) $\angle 1 \cong \angle 2$	(4) perpendicular lines form congruent right angles
(5) $\overline{BA} \cong \overline{BA}$	(5) reflexive property
(6) $\triangle BAT \cong \triangle BAE$	(6) SAS≅SAS
(7) $\overline{BE} \cong \overline{BT}$	(7) CPCTC
(8) BERT is a square	(8) A square is a rectangle with consecutive sides ≅

need BEDF is parallelogram first

4. Given: Parallelogram *ABCD*, $\overline{BF} \perp \overline{AFD}$, and $\overline{DE} \perp \overline{BEC}$
Prove: *BEDF* is a rectangle



Statements	Reasons
(1) ABCD is a parallelogram	(1) given
(2) $\angle 1 \cong \angle 2$	(2) A parallelogram has opposite angles congruent
(3) $\overline{AB} \cong \overline{DC}$	(3) A parallelogram has opposite sides congruent.
(4) $\overline{BF} \perp \overline{AFD}$, $\overline{DE} \perp \overline{BEC}$	(4) given
(5) $\angle BFA \cong \angle DEC$	(5) Perpendicular lines form congruent right angles
(6) $\triangle BFA \cong \triangle DEC$	(6) AAS≅AAS
(7) $\overline{BF} \cong \overline{ED}$	(7) CPCTC
(8) $\overline{BC} \cong \overline{AD}$	(8) A p-gram has opposite sides congruent
(9) $\overline{EC} \cong \overline{AF}$	(9) CPCTC
(10) $\overline{BE} \cong \overline{FD}$ or $BC - EC = AD - AF$	(10) subtraction property
(11) BEDF is a parallelogram	(11) A parallelogram has 2 pairs of opposite sides ≅
(12) $\angle BFA$ is a right angle	(12) Perpendicular lines form right angles
(13) BEDF is a rectangle	(13) A rectangle is a parallelogram with a right angle