Honors Math 3

# 5.2 Proofs (Parallel Lines and Triangles)

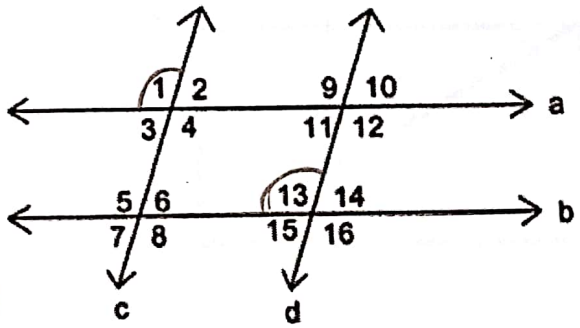
Unit 5

*EQ: How can we prove lines to be parallel and prove triangles to be congruent?*

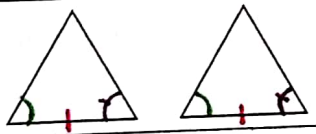
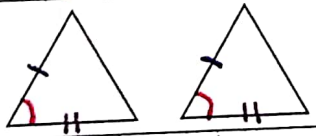
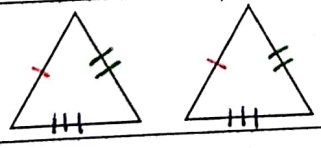
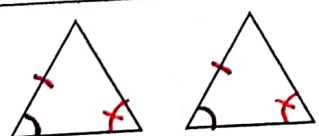
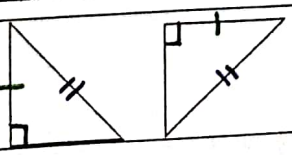
| What can we use to Prove? | | |
|---|---|---|
| Definition of Vertical Angles | Linear Pair Postulate | Definition of Midpoint |
| Definition of Supplementary Angles | Corresponding Angle Postulate | Definition of Bisect |
| Definition of Parallel Lines | Alternate Exterior Angle Theorem | Substitution Property |
| Definition of Perpendicular Lines | Alternate Interior Angle Theorem | Angle Addition Postulate |
| Reflexive Property (AB = AB) | Transitive Property (a = b, b = c, then a = c) | Segment Addition Postulate |

**Example 1:** **Given:** $a \parallel b$ and $c \parallel d$
**Prove:** $\angle 1 \cong \angle 13$

| Statements | Reasons |
|---|---|
| 1. a ∥ b and c ∥ d | 1. Given |
| 2. ∠1 ≅ ∠5 | 2. Corresponding Angle Postulate |
| 3. ∠5 ≅ ∠13 | 3. Corresponding Angle Postulate |
| 4. ∠1 ≅ ∠13 | 4. Transitive Property |

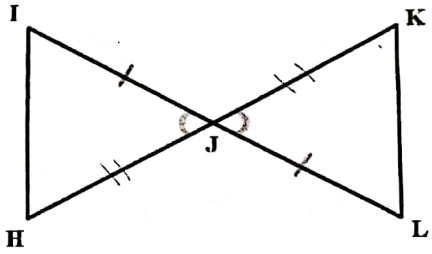



## Triangle Congruence

| Name: | Picture | Definition |
|---|---|---|
| Angle-Side-Angle (ASA) |  | Two pairs of congruent angles & one pair of congruent sides |
| Side-Angle-Side (SAS) |  | Two pairs of congruent sides & one pair of congruent angles |
| Side-Side-Side (SSS) |  | Three pairs of congruent sides |
| Angle-Angle-Side (AAS) |  | Two pairs of congruent angles and one pair of congruent sides |
| Hypotenuse-Leg (HL) |  | With a right triangle Hypotenuse and one side are respectively equal |

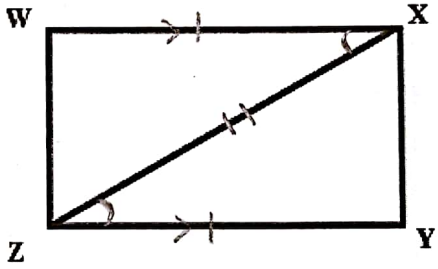
**The Donkey Theorem:**
You can't travel (AAA) by Donkey (SSA) to triangle congruence!

**Example 2:** Given: J is the midpoint of IL.
J is the midpoint of HK.
Prove: $\Delta IJH \cong \Delta LJK$




| Statement: | Reason: |
|---|---|
| J is the midpoint of IL<br>J is the midpoint of HK | Given |
| $\overline{IJ} \cong \overline{JL}$ | Definition of Midpoint |
| $\overline{HJ} \cong \overline{JK}$ | Definition of Midpoint |
| $\angle HJI \cong \angle LJK$ | Definition of Vertical Angles |
| $\Delta IJH \cong \Delta LJK$ | SAS |
| | |

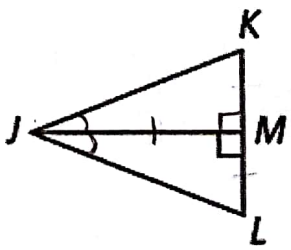
**You Try!** Given: $WX \parallel YZ$, $WX \cong YZ$
Prove: $\Delta WXZ \cong \Delta YZX$
*(Hint: It should take anywhere from 4-5 steps)*




| Statement: | Reason: |
|---|---|
| $WX \parallel YZ$, $WX \cong YZ$ | Given |
| $\angle WXZ \cong \angle YZX$ | Alternate Interior Angle Theorem |
| $\overline{ZX} \cong \overline{ZX}$ | Reflexive Property of congruency |
| $\Delta WXZ \cong \Delta YZX$ | SAS |
| | |

**You Try!. Given:** $\overline{JM}$ **bisects** $\angle J$.
$\overline{JM} \perp \overline{KL}$

**Prove:** $\Delta JMK \cong \Delta JML$




| Statement: | Reason: |
|---|---|
| $\overline{JM}$ bisects $\angle J$<br>$\overline{JM} \perp \overline{KL}$ | Given |
| $\angle KJM \cong \angle LJM$ | Definition of Bisect |
| $\overline{JM} \cong \overline{JM}$ | Reflexive Property |
| $\angle JML \cong \angle JMK$ | Definition of Perpendicular lines |
| $\Delta JMK \cong \Delta JML$ | ASA |

# Homework 5.2: Triangle Proofs

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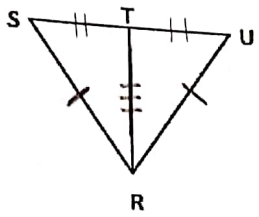
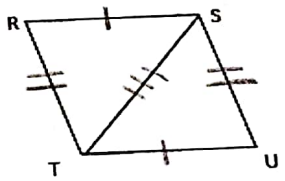
Name: _____

1. Given: $RS \cong RU$, $RT$ bisects $SU$
Prove: $\Delta RST \cong \Delta RUT$



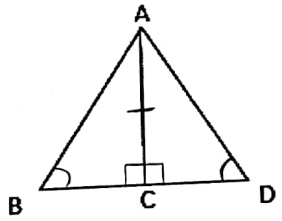

| Statement | Reason |
|---|---|
| RS ≅ RU, RT bisects SU | Given |
| ST ≅ TU | Definition of Bisect |
| TR ≅ TR | Reflexive Property |
| ΔRST ≅ ΔRUT | SSS |

2. Given: $RS \cong UT$, $RT \cong SU$
Prove: $\Delta RST \cong \Delta UTS$



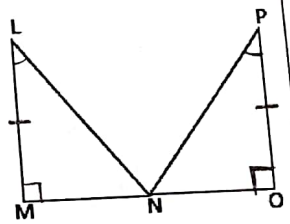

| Statement | Reason |
|---|---|
| RS ≅ UT<br>RT ≅ SU | Given |
| ST ≅ ST | Reflexive Property |
| ΔRST ≅ ΔUTS | SSS |

3. Given: $\measuredangle B \cong \measuredangle D$
$AC$ is perpendicular to $BD$
Prove: $\Delta ABC \cong \Delta ADC$



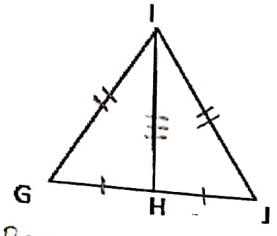

| Statement | Reason |
|---|---|
| ∠B ≅ ∠D<br>AC is perpendicular to BD | Given |
| ∠C ≅ ∠C | Definition of Perpendicular lines |
| AC ≅ AC | Reflexive Property |
| ΔABC ≅ ΔADC | AAS |

4. Given: $LM \cong PO, \measuredangle L \cong \measuredangle P$,
$\measuredangle M$ & $\measuredangle O$ are 90°
Prove: $\Delta LMN \cong \Delta PON$



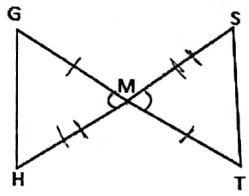

| Statement | Reason |
|---|---|
| LM ≅ PO<br>∠L ≅ ∠P<br>∠M & ∠O are 90° | Given |
| ΔLMN ≅ ΔPON | ASA |

5. Given: $H$ is the midpoint of $GJ$, $GI \cong IJ$
Prove: $\Delta GHI \cong \Delta JHI$



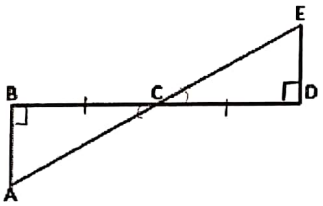

| Statement | Reason |
|---|---|
| H is midpoint of GJ<br>$GI \cong IJ$ | Given |
| $GH \cong HJ$ | Definition of Midpoint |
| $IH \cong IH$ | Reflexive Property |
| $\Delta GHI \cong \Delta JHI$ | SSS |
| | |

6. Given: $M$ is the midpoint of $GT$,
$M$ is the midpoint of $HS$
Prove: $\Delta GMH \cong \Delta TMS$



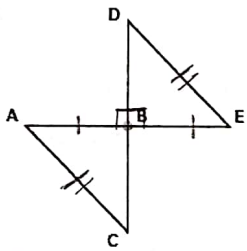

| Statement | Reason |
|---|---|
| M is the midpoint of GT<br>M is the midpoint of HS | Given |
| $GM \cong MT$ | Definition of Midpoint |
| $HM \cong MS$ | Definition of Midpoint |
| $\angle GMH \cong \angle SMT$ | Definition of Vertical Angles |
| $\Delta GMH \cong \Delta TMS$ | SAS |

7. Given: $< B$ & $< D$ are $90°$, $AE$ bisects $BD$
Prove: $\Delta ABC \cong \Delta EDC$




| Statement | Reason |
|---|---|
| $\angle B$ & $\angle D$ are $90°$<br>AE bisects BD | Given |
| $BC \cong CD$ | Definition of Bisect |
| $\angle BCA \cong \angle DCE$ | Definition of Vertical Angles |
| $\Delta ABC \cong \Delta EDC$ | ASA |
| | |

8. Given: $DC \perp AE$, $DE \cong AC$,
$B$ is the midpoint of $AE$
Prove: $\Delta BDE \cong \Delta BCA$




| Statement | Reason |
|---|---|
| $DC \perp AE$<br>$DE \cong AC$<br>B is the midpoint of AE | Given |
| $\angle ABD \cong \angle EBD$ | Definition of Perpendicular lines |
| $\angle DBE \cong \angle ABC$ | Definition of Vertical Angles |
| $AB \cong BE$ | Definition of Midpoint |
| $\Delta BDE \cong \Delta BCA$ | HL |