Side-Side-Side Triangle Congruence (SSS)

This unit, we will be writing proofs about shapes and their relationships to one another. The first shape relationship that we are going to discuss is triangle congruence.

There are 5 properties that are used to prove triangles congruent: **SSS**, SAS, ASA, AAS, and HL. Today, we are going to discuss **SSS**. Side-Side-Side means that if the three sides of a triangle are congruent to the three sides on another triangle, then the triangles are congruent. So, if the sides are all the same, then the triangles are the same.

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| **Side-Side-Side (SSS) Triangle Congruence** | **Example proof using SSS** |
| **Setup steps:** Side1 on Triangle1 is congruent to Side1 on Triangle2 Side2 on Triangle1 is congruent to  Side2 on Triangle2 Side3 on Triangle1 is congruent to  Side3 on Triangle2**Resulting step:** The triangles are congruent by **SSS**. |

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| Given: $\overbar{AB}≅\overbar{DF}, \overbar{BC}≅\overbar{FE}, \overbar{CA}≅\overbar{ED}$ Prove: $△ABC≅△DFE$ |
| Statements | Reasons |
| $$\overbar{AB}≅\overbar{DF}$$ | Given |
| $$\overbar{BC}≅\overbar{FE}$$ | Given |
| $$\overbar{CA}≅\overbar{ED}$$ | Given |
| $$△ABC≅△DFE$$ | Side-Side-Side (SSS) |

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Fill in the reasons on the proofs below, using any of our properties from the previous unit, as well as the new property that proves triangle congruence: SSS.

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| 1. |  | 2. |
| Given:  Prove: $△MLK≅△QPN$ |  | Given: $\overbar{AE}≅\overbar{FJ}, \overbar{EC}≅\overbar{JH}, \overbar{CA}≅\overbar{HF}$ Prove: $△AEC≅△FJH$ |
| Statements | Reasons |  | Statements | Reasons |
| $$\overbar{ML}≅\overbar{QP}, \overbar{LK}≅\overbar{PN}, $$$$\overbar{KM}≅\overbar{NQ}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$\overbar{AE}≅\overbar{FJ}, \overbar{EC}≅\overbar{JH}, $$$$\overbar{CA}≅\overbar{HF}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$△MLK≅△QPN$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$△AEC≅△FJH$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

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| 3. |  | 4. |
| Given: $R is the midpoint of \overbar{MQ}$ Careful! *Given* will only be used twice in this proof.Prove: $△MNR≅△QPR$ |  | Given:  Prove: $△TSV≅△VWT$Careful! *Given* will only be used twice in this proof. |
| Statements | Reasons |  | Statements | Reasons |
| $$R is the midpoint of \overbar{MQ}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$\overbar{TS}≅\overbar{VW}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$\overbar{MR}≅\overbar{QR}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$\overbar{SV}≅\overbar{WT}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$\overbar{MN}≅\overbar{QP}, \overbar{NR}≅\overbar{PR}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$\overbar{TV}≅\overbar{TV}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$△MNR≅△QPR$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$△TSV≅△VWT$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

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| 5. |  | 6. |
| Given:  Prove: $△BCD≅△GFE$ |  | Given: $H is the midpoint of \overbar{GK}$ Prove: $△GLH≅△KLH$ |
| Statements | Reasons |  | Statements | Reasons |
| $$BC=14, GF=14, $$$$CD=5, FE=5, $$$$DB=11, EG=11$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$\overbar{GL}≅\overbar{KL}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$14=14$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$\overbar{LH}≅\overbar{LH}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$BC=GF$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$H is the midpoint of \overbar{GK}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$\overbar{BC}≅\overbar{GF}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$\overbar{GH}≅\overbar{KH}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$5=5$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$△GLH≅△KLH$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$CD=FE$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |  |  |
| $$\overbar{CD}≅\overbar{FE}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |  |  |
| $$11=11$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |  |
| $$DB=EG$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| $$\overbar{DB}≅\overbar{EG}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| $$△BCD≅△GFE$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |

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| 7. |  | **PROOF 7 Continued** |
| Given: $x=2$  Prove: $△GHJ≅△LKM$ |  | $$KM=7\left(2\right)-9$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$KM=5$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$5=5$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$HJ=KM$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| Statements | Reasons |  | $$\overbar{HJ}≅\overbar{KM}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$GH=2x, HJ=4x-3, $$$$JG=3x-3, LK=2x, $$$$KM=7x-9, $$$$ML=x+1, \& x=2$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$JG=3\left(2\right)-3$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$JG=3$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$2x=2x$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$ML=(2)+1$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$GH=LK$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$ML=3$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$\overbar{GH}≅\overbar{LK}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$3=3$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$HJ=4(2)-3$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$JG=ML$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$HJ=5$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$\overbar{JG}≅\overbar{ML}$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
|  |  |  | $$△GHJ≅△LKM$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

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| Given: *B* is the midpoint of $\overbar{AE}$ & $x=3$ Prove: $△ABC≅△EBD$ |
| Statements | Reasons |
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