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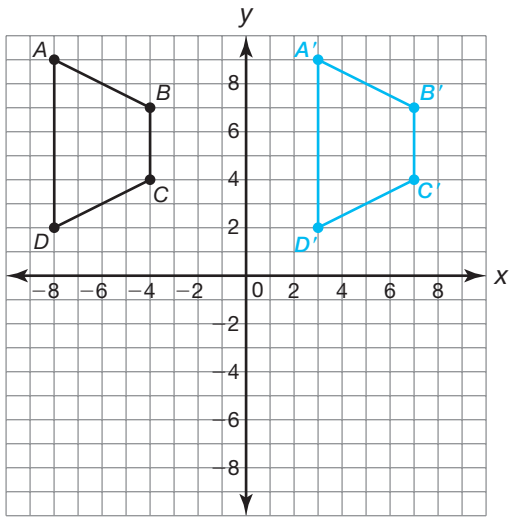
We Like to Move It!

Translating, Rotating, and Reflecting Geometric Figures

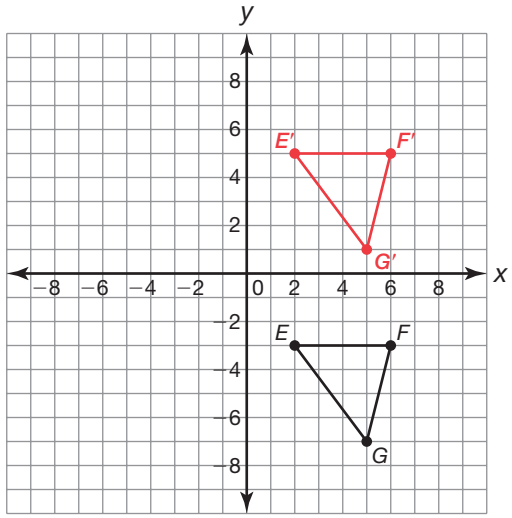
Problem Set

Transform each given geometric figure on the coordinate plane as described.

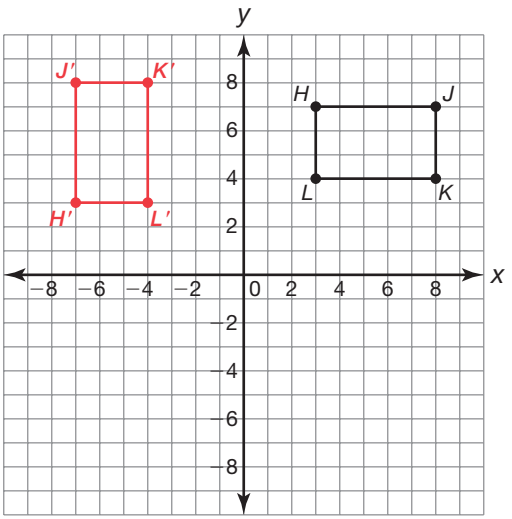
1. Translate trapezoid *ABCD* 11 units to the right.



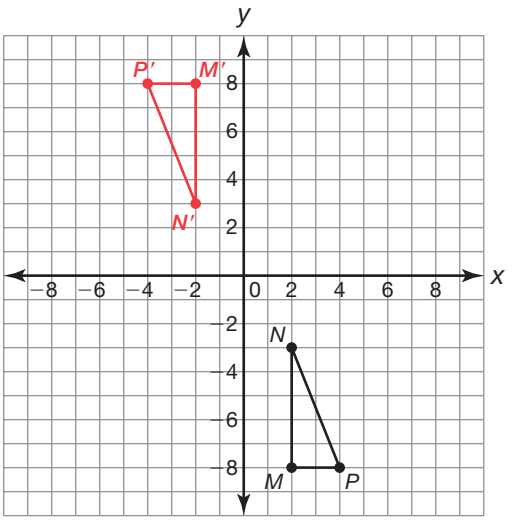
2. Translate triangle *EFG* 8 units up.



3. Rotate rectangle *HJKL* 90° counterclockwise about the origin.



4. Rotate triangle *MNP* 180° counterclockwise about the origin.



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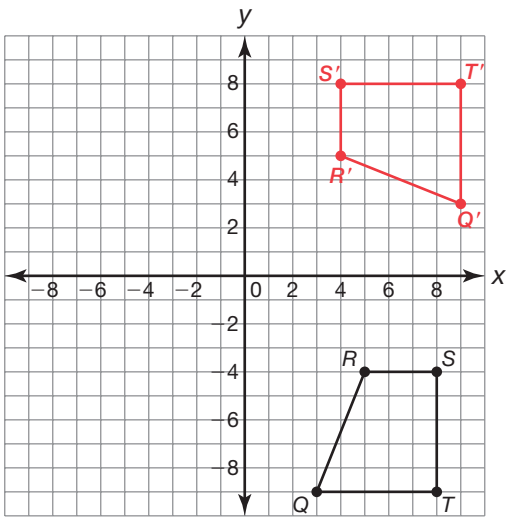
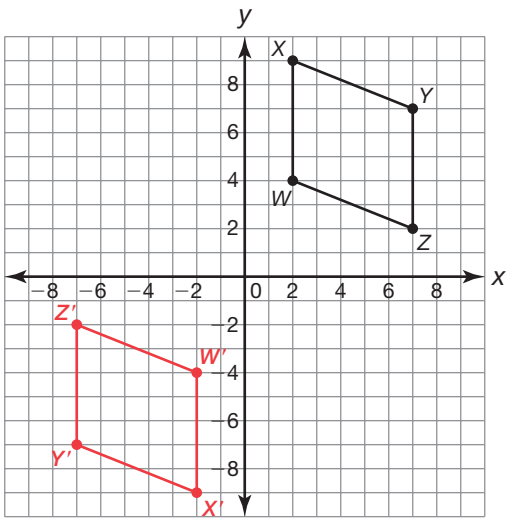
5. Rotate trapezoid *QRST* 90° counterclockwise about the origin.



6. Rotate parallelogram *WXYZ* 180° counterclockwise about the origin.



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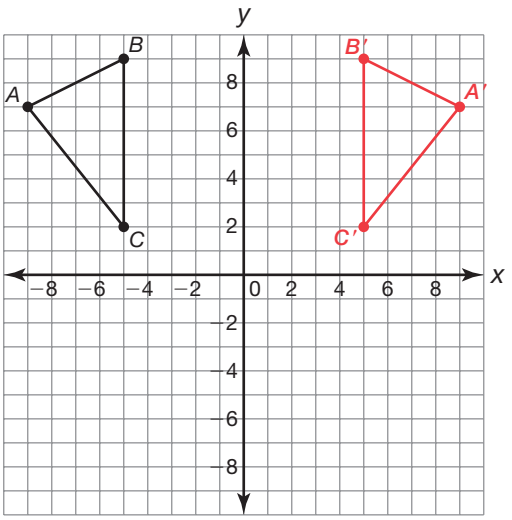
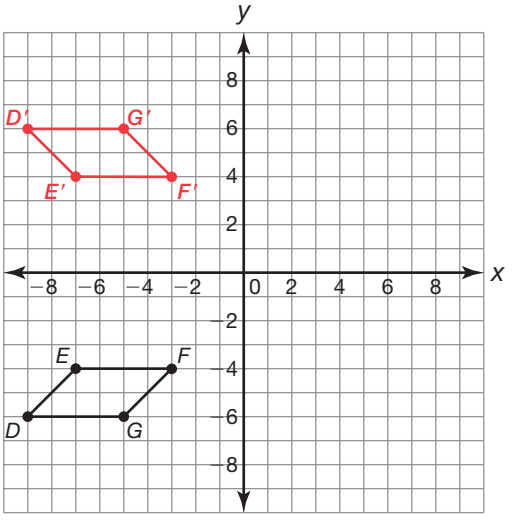
7. Reflect triangle *ABC* over the *y*-axis.



8. Reflect parallelogram *DEFG* over the *x*-axis.



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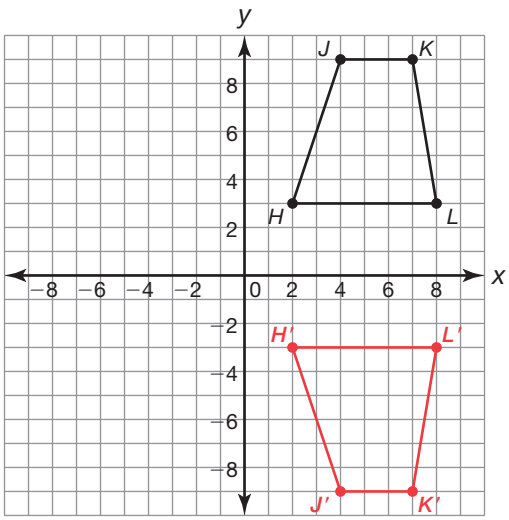
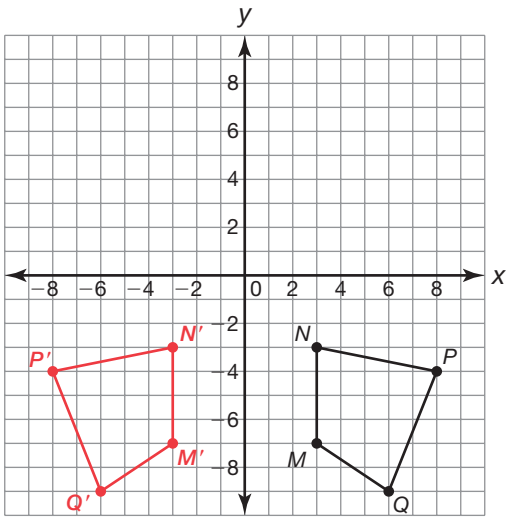
9. Reflect trapezoid *HJKL* over the *x*-axis.



10. Reflect quadrilateral *MNPQ* over the *y*-axis.



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Determine the coordinates of each translated image without graphing.

11. The vertices of triangle *ABC* are *A* (5, 3), *B* (2, 8), and *C* (−4, 5). Translate the triangle 6 units to the left to form triangle *A′ B′ C′*.

The vertices of triangle *A′ B′ C′* are *A′* (−1, 3), *B′* (−4, 8), and *C′* (−10, 5).

12. The vertices of rectangle *DEFG* are *D* (−7, 1), *E* (−7, 8), *F* (1, 8), and *G* (1, 1). Translate the rectangle 10 units down to form rectangle *D′ E′ F′ G′*.

The vertices of rectangle *D′ E′ F′ G′* are *D′* (−7, −9), *E′* (−7, −2), *F′* (1, −2), and *G′* (1, −9).

13. The vertices of parallelogram *HJKL* are *H* (2, −6), *J* (3, −1), *K* (7, −1), and *L* (6, −6). Translate the parallelogram 7 units up to form parallelogram *H′ J′ K′ L′*.

The vertices of parallelogram *H′ J′ K′ L′* are *H′* (2, 1), *J′* (3, 6), *K′* (7, 6), and *L′* (6, 1).

14. The vertices of trapezoid *MNPQ* are *M* (−6, −5), *N* (0, −5), *P* (−1, 2), and *Q* (−4, 2). Translate the trapezoid 4 units to the right to form trapezoid *M′ N′ P′ Q′*.

The vertices of trapezoid *M′ N′ P′ Q′* are *M′* (−2, −5), *N′* (4, −5), *P′* (3, 2), and *Q′* (0, 2).

15. The vertices of triangle *RST* are *R* (0, 3), *S* (2, 7), and *T* (3, −1). Translate the triangle 5 units to the left and 3 units up to form triangle *R′ S′ T′*.

The vertices of triangle *R′ S′ T′* are *R′* (−5, 6), *S′* (−3, 10), and *T′* (−2, 2).

16. The vertices of quadrilateral *WXYZ* are *W* (−10, 8), *X* (−2, −1), *Y* (0, 0), and *Z* (3, 7). Translate the quadrilateral 5 units to the right and 8 units down to form quadrilateral *W′ X′ Y′ Z′*.

The vertices of quadrilateral *W′ X′ Y′ Z′* are *W′* (−5, 0), *X′* (3, −9), *Y′* (5, −8), and *Z′* (8, −1).

Determine the coordinates of each rotated image without graphing.

17. The vertices of triangle *ABC* are *A* (5, 3), *B* (2, 8), and *C* (−4, 5). Rotate the triangle about the origin 90° counterclockwise to form triangle *A′ B′ C′*.

The vertices of triangle *A′ B′ C′* are *A′* (−3, 5), *B′* (−8, 2), and *C′* (−5, −4).

18. The vertices of rectangle *DEFG* are *D* (−7, 1), *E* (−7, 8), *F* (1, 8), and *G* (1, 1). Rotate the rectangle about the origin 180° counterclockwise to form rectangle *D′ E′ F′ G′*.

The vertices of rectangle *D′ E′ F′ G′* are *D′* (7, −1), *E′* (7, −8), *F′* (−1, −8), and *G′* (−1, −1).

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19. The vertices of parallelogram *HJKL* are *H* (2, −6), *J* (3, −1), *K* (7, −1), and *L* (6, −6). Rotate the parallelogram about the origin 90° counterclockwise to form parallelogram *H′ J′ K′ L′*.

The vertices of parallelogram *H′ J′ K′ L′* are *H′* (6, 2), *J′* (1, 3), *K′* (1, 7) and *L′* (6, 6).

20. The vertices of trapezoid *MNPQ* are *M* (−6, −5), *N* (0, −5), *P* (−1, 2), and *Q* (−4, 2). Rotate the trapezoid about the origin 180° counterclockwise to form trapezoid *M′ N′ P′ Q′*.

The vertices of trapezoid *M′ N′ P′ Q′* are *M′* (6, 5), *N′* (0, 5), *P′* (1, −2), and *Q′* (4, −2).

21. The vertices of triangle *RST* are *R* (0, 3), *S* (2, 7), and *T* (3, −1). Rotate the triangle about the origin 90° counterclockwise to form triangle *R′ S′ T′*.

The vertices of triangle *R′ S′ T′* are *R′* (−3, 0), *S′* (−7, 2), and *T′* (1, 3).

22. The vertices of quadrilateral *WXYZ* are *W* (−10, 8), *X* (−2, −1), *Y* (0, 0), and *Z* (3, 7). Rotate the quadrilateral about the origin 180° counterclockwise to form quadrilateral *W′ X′ Y′ Z′*.

The vertices of quadrilateral *W′ X′ Y′ Z′* are *W′* (10, −8), *X′* (2, 1), *Y′* (0, 0), and *Z′* (−3, −7).

Determine the coordinates of each reflected image without graphing.

23. The vertices of triangle *ABC* are *A* (5, 3), *B* (2, 8), and *C* (−4, 5). Reflect the triangle over the *x*-axis to form triangle *A′ B′ C′*.

The vertices of triangle *A′ B′ C′* are *A′* (5, −3), *B′* (2, −8), and *C′* (−4, −5).

24. The vertices of rectangle *DEFG* are *D* (−7, 1), *E* (−7, 8), *F* (1, 8), and *G* (1, 1). Reflect the rectangle over the *y*-axis to form rectangle *D′ E′ F′ G′*.

The vertices of rectangle *D′ E′ F′ G′* are *D′* (7, 1), *E′* (7, 8), *F′* (−1, 8), and *G′* (−1, 1).

25. The vertices of parallelogram *HJKL* are *H* (2, −6), *J* (3, −1), *K* (7, −1), and *L* (6, −6). Reflect the parallelogram over the *x*-axis to form parallelogram *H′ J′ K′ L′*.

The vertices of parallelogram *H′ J′ K′ L′* are *H′* (2, 6), *J′* (3, 1), *K′* (7, 1), and *L′* (6, 6).

26. The vertices of trapezoid *MNPQ* are *M* (−6, −5), *N* (0, −5), P (−1, 2), and *Q* (−4, 2). Reflect the trapezoid over the *y*-axis to form trapezoid *M′ N′ P′ Q′*.

The vertices of trapezoid *M′ N′ P′ Q′* are *M′* (6, −5), *N′* (0, −5), *P′* (1, 2), and *Q′* (4, 2).

27. The vertices of triangle *RST* are *R* (0, 3), *S* (2, 7), and *T* (3, −1). Reflect the triangle over the *x*-axis to form triangle *R′ S′ T′*.

The vertices of triangle *R′ S′ T′* are *R′* (0, −3), *S′* (2, −7), and *T′* (3, 1).

28. The vertices of quadrilateral *WXYZ* are *W* (−10, 8), *X* (−2, −1), *Y* (0, 0), and *Z* (3, 7). Reflect the quadrilateral over the *y*-axis to form quadrilateral *W′ X′ Y′ Z′*.

The vertices of quadrilateral *W′ X′ Y′ Z′* are *W′* (10, 8), *X′* (2, −1), *Y′* (0, 0), and *Z′* (−3, 7).

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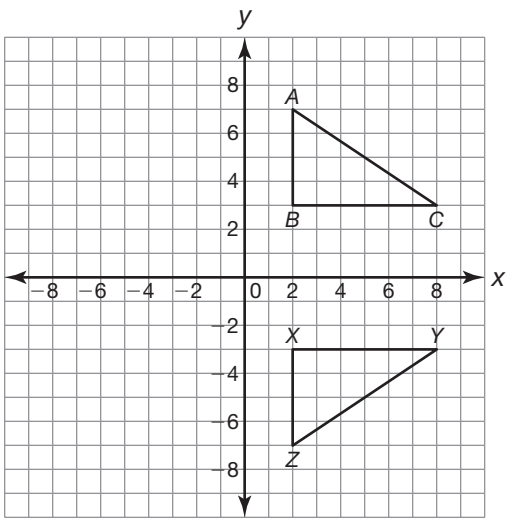
Hey, Haven't I Seen You Before?
Congruent Triangles

Problem Set

Identify the transformation used to create $\triangle XYZ$ on each coordinate plane. Identify the congruent angles and the congruent sides. Then, write a triangle congruence statement.

1.

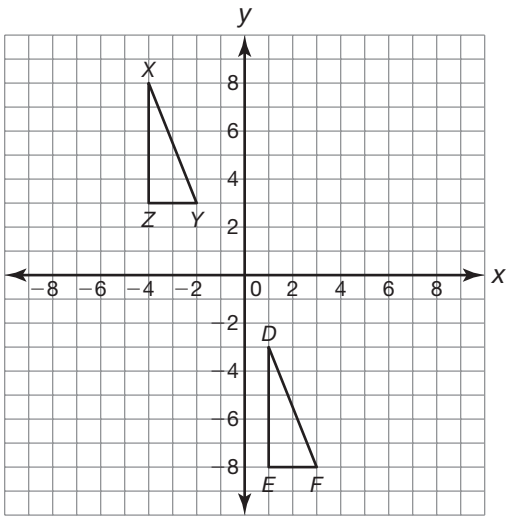


Triangle *BCA* was reflected over the *x*-axis to create triangle *XYZ*.

$\overline{BC} \cong \overline{XY}$, $\overline{CA} \cong \overline{YZ}$, and $\overline{BA} \cong \overline{XZ}$; $\angle B \cong \angle X$, $\angle C \cong \angle Y$, and $\angle A \cong \angle Z$.

$\triangle BCA \cong \triangle XYZ$

2.

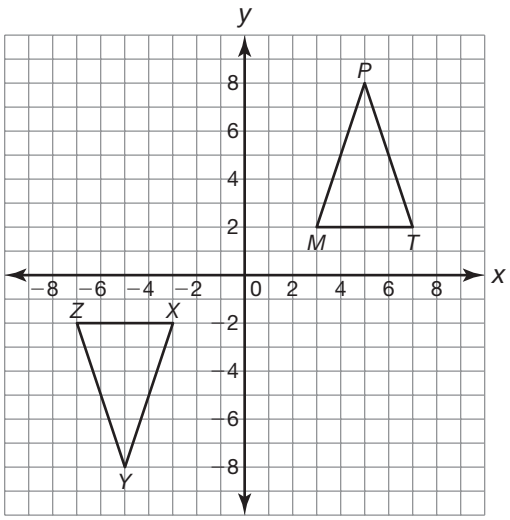


Triangle *DFE* was translated 5 units to the left and 11 units up to create triangle *XYZ*.

$\overline{DF} \cong \overline{XY}$, $\overline{FE} \cong \overline{YZ}$, and $\overline{DE} \cong \overline{XZ}$; $\angle D \cong \angle X$, $\angle F \cong \angle Y$, and $\angle E \cong \angle Z$.

$\triangle DFE \cong \triangle XYZ$

3.

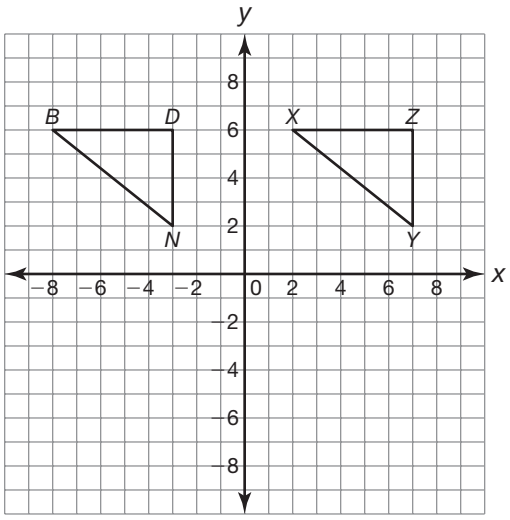


Triangle *MPT* was rotated 180° counterclockwise or clockwise about the origin to create triangle *XYZ*.

$\overline{MP} \cong \overline{XY}$, $\overline{PT} \cong \overline{YZ}$, and $\overline{MT} \cong \overline{XZ}$; $\angle M \cong \angle X$, $\angle P \cong \angle Y$, and $\angle T \cong \angle Z$.

$\triangle MPT \cong \triangle XYZ$

4.



Triangle *BND* was translated 10 units to the right to create triangle *XYZ*.

$\overline{BN} \cong \overline{XY}$, $\overline{ND} \cong \overline{YZ}$, and $\overline{BD} \cong \overline{XZ}$; $\angle B \cong \angle X$, $\angle N \cong \angle Y$, and $\angle D \cong \angle Z$.

$\triangle BND \cong \triangle XYZ$

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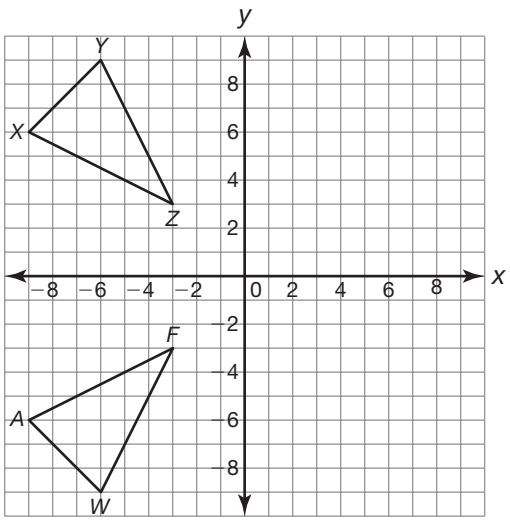
5.

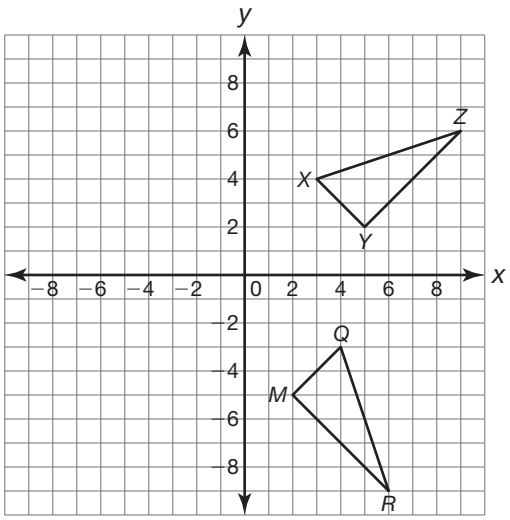


Triangle *AWF* was reflected over the *x*-axis to create triangle *XYZ*.

$\overline{AW} \cong \overline{XY}$, $\overline{WF} \cong \overline{YZ}$, and $\overline{AF} \cong \overline{XZ}$; $\angle A \cong \angle X$, $\angle W \cong \angle Y$, and $\angle F \cong \angle Z$.

$\triangle AWF \cong \triangle XYZ$

6.

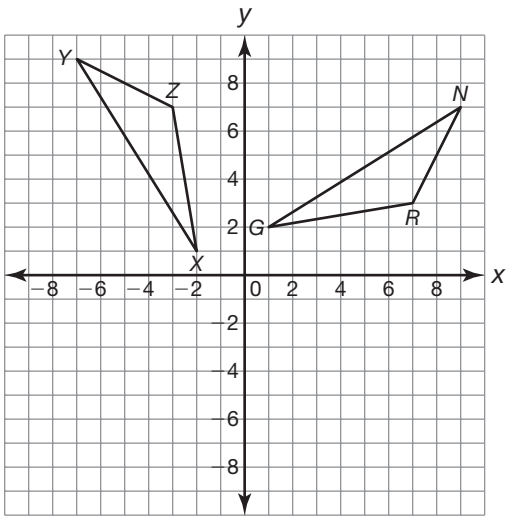


Triangle *QMR* was rotated 90° counterclockwise about the origin to create triangle *XYZ*.

$\overline{QM} \cong \overline{XY}$, $\overline{MR} \cong \overline{YZ}$, and $\overline{QR} \cong \overline{XZ}$; $\angle Q \cong \angle X$, $\angle M \cong \angle Y$, and $\angle R \cong \angle Z$.

$\triangle QMR \cong \triangle XYZ$

7.

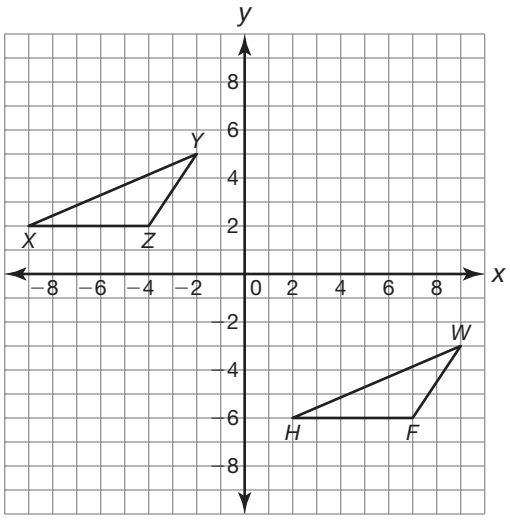


Triangle *GNR* was rotated 90° counterclockwise about the origin to create triangle *XYZ*.

$\overline{GN} \cong \overline{XY}$, $\overline{NR} \cong \overline{YZ}$, and $\overline{GR} \cong \overline{XZ}$; $\angle G \cong \angle X$, $\angle N \cong \angle Y$, and $\angle R \cong \angle Z$.

$\triangle GNR \cong \triangle XYZ$

8.



Triangle *HWF* was translated 11 units to the left and 8 units up to create triangle *XYZ*.

$\overline{HW} \cong \overline{XY}$, $\overline{WF} \cong \overline{YZ}$, and $\overline{HF} \cong \overline{XZ}$; $\angle H \cong \angle X$, $\angle W \cong \angle Y$, and $\angle F \cong \angle Z$.

$\triangle HWF \cong \triangle XYZ$

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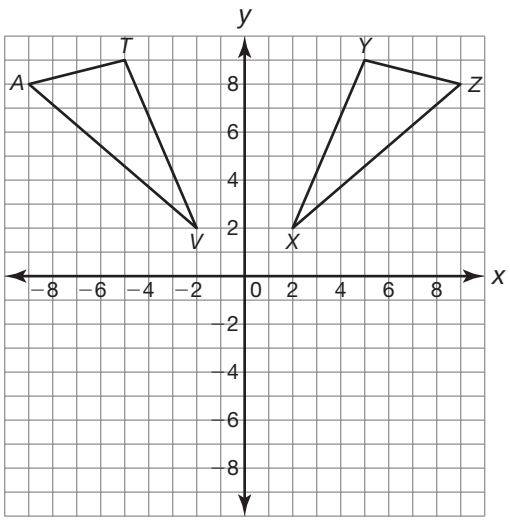
9.

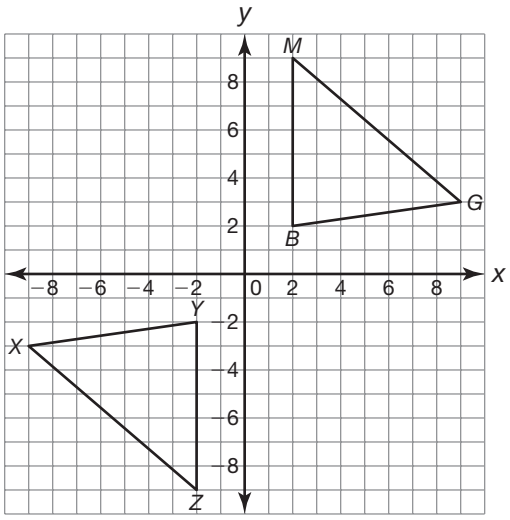


Triangle *VTA* was reflected over the *y*-axis to create triangle *XYZ*.

$\overline{VT} \cong \overline{XY}$, $\overline{TA} \cong \overline{YZ}$, and $\overline{VA} \cong \overline{XZ}$; $\angle V \cong \angle X$, $\angle T \cong \angle Y$, and $\angle A \cong \angle Z$.

$\triangle VTA \cong \triangle XYZ$

10.



Triangle *GBM* was rotated 180° clockwise or counterclockwise about the origin to create triangle *XYZ*.

$\overline{GB} \cong \overline{XY}$, $\overline{BM} \cong \overline{YZ}$, and $\overline{GM} \cong \overline{XZ}$; $\angle G \cong \angle X$, $\angle B \cong \angle Y$, and $\angle M \cong \angle Z$.

$\triangle GBM \cong \triangle XYZ$

5

List the corresponding sides and angles, using congruence symbols, for each pair of triangles represented by the given congruence statement.

11. $\triangle JPM \cong \triangle TRW$

$\overline{JP} \cong \overline{TR}$, $\overline{PM} \cong \overline{RW}$, and $\overline{JM} \cong \overline{TW}$; $\angle J \cong \angle T$, $\angle P \cong \angle R$, and $\angle M \cong \angle W$.

12. $\triangle AEU \cong \triangle BCD$

$\overline{AE} \cong \overline{BC}$, $\overline{EU} \cong \overline{CD}$, and $\overline{AU} \cong \overline{BD}$; $\angle A \cong \angle B$, $\angle E \cong \angle C$, and $\angle U \cong \angle D$.

13. $\triangle LUV \cong \triangle MTH$

$\overline{LU} \cong \overline{MT}$, $\overline{UV} \cong \overline{TH}$, and $\overline{LV} \cong \overline{HM}$; $\angle L \cong \angle M$, $\angle U \cong \angle T$, and $\angle V \cong \angle H$.

14. $\triangle RWB \cong \triangle VCQ$

$\overline{RW} \cong \overline{VC}$, $\overline{WB} \cong \overline{CQ}$, and $\overline{RB} \cong \overline{VQ}$; $\angle R \cong \angle V$, $\angle W \cong \angle C$, and $\angle B \cong \angle Q$.

15. $\triangle TOM \cong \triangle BEN$

$\overline{TO} \cong \overline{BE}$, $\overline{OM} \cong \overline{EN}$, and $\overline{TM} \cong \overline{BN}$; $\angle T \cong \angle B$, $\angle O \cong \angle E$, and $\angle M \cong \angle N$.

16. $\triangle JKL \cong \triangle RST$

$\overline{JK} \cong \overline{RS}$, $\overline{KL} \cong \overline{ST}$, and $\overline{JL} \cong \overline{RT}$; $\angle J \cong \angle R$, $\angle K \cong \angle S$, and $\angle L \cong \angle T$.

17. $\triangle CAT \cong \triangle SUP$

$\overline{CA} \cong \overline{SU}$, $\overline{AT} \cong \overline{UP}$, and $\overline{CT} \cong \overline{SP}$; $\angle C \cong \angle S$, $\angle A \cong \angle U$, and $\angle T \cong \angle P$.

18. $\triangle TOP \cong \triangle GUN$

$\overline{TO} \cong \overline{GU}$, $\overline{OP} \cong \overline{UN}$, and $\overline{TP} \cong \overline{GN}$; $\angle T \cong \angle G$, $\angle O \cong \angle U$, and $\angle P \cong \angle N$.

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It's All About the Sides
Side-Side-Side Congruence Theorem

Vocabulary

Define the term in your own words.

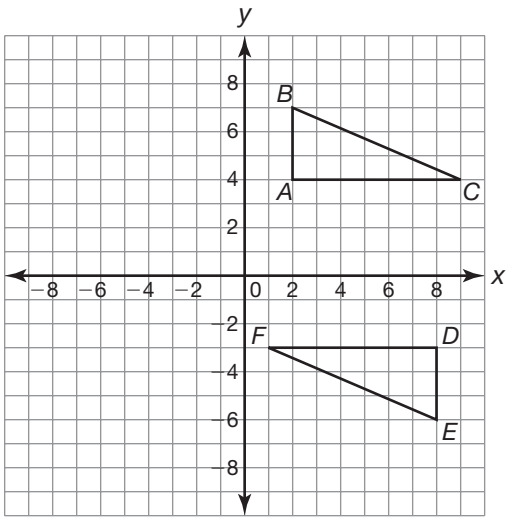
1. Side-Side-Side (SSS) Congruence Theorem

   The Side-Side-Side (SSS) Congruence Theorem states that if three sides of one triangle are congruent to the corresponding sides of another triangle, then the triangles are congruent.

Problem Set

Determine whether each pair of given triangles are congruent by SSS. Use the Distance Formula and a protractor when necessary.

1.



$AB = DE = 3$

$AC = DF = 7$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$BC = \sqrt{(9 - 2)^2 + (4 - 7)^2}$

$BC = \sqrt{7^2 + (-3)^2}$

$BC = \sqrt{49 + 9}$

$BC = \sqrt{58} \approx 7.62$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$EF = \sqrt{(1 - 8)^2 + (-3 - (-6))^2}$

$EF = \sqrt{(-7)^2 + 3^2}$

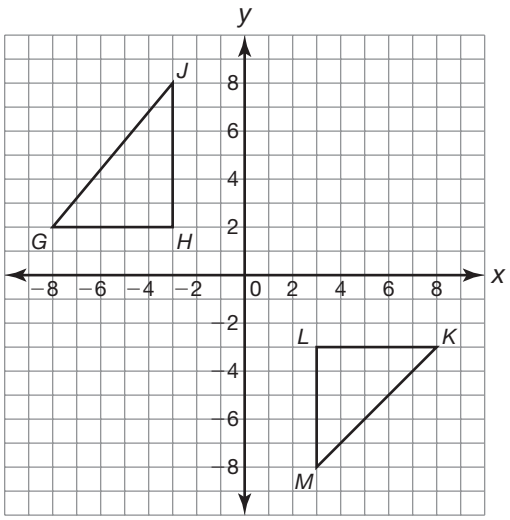
$EF = \sqrt{49 + 9}$

$EF = \sqrt{58} \approx 7.62$

$BC = EF$

The triangles are congruent by the SSS Congruence Theorem.

2.



$GH = KL = 5$

$HJ = 6, LM = 5, HJ \neq LM$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$GJ = \sqrt{(-3 - (-8))^2 + (8 - 2)^2}$

$GJ = \sqrt{5^2 + 6^2}$

$GJ = \sqrt{25 + 36}$

$GJ = \sqrt{61} \approx 7.81$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$KM = \sqrt{(3 - 8)^2 + (-8 - (-3))^2}$

$KM = \sqrt{(-5)^2 + (-5)^2}$

$KM = \sqrt{25 + 25}$

$KM = \sqrt{50} \approx 7.07$

$GJ \neq KM$

The triangles are not congruent.

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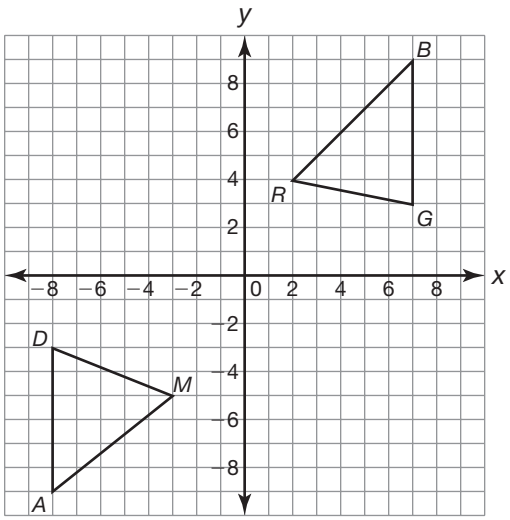
3.



$AD = BG = 6$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$DM = \sqrt{(-3 - (-8))^2 + (-5 - (-3))^2}$

$DM = \sqrt{5^2 + (-2)^2}$

$DM = \sqrt{25 + 4}$

$DM = \sqrt{29} \approx 5.39$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$GR = \sqrt{(2 - 7)^2 + (4 - 3)^2}$

$GR = \sqrt{(-5)^2 + 1^2}$

$GR = \sqrt{25 + 1}$

$GR = \sqrt{26} \approx 5.10$

$DM \neq GR$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$AM = \sqrt{(-3 - (-8))^2 + (-5 - (-9))^2}$

$AM = \sqrt{5^2 + 4^2}$

$AM = \sqrt{25 + 16}$

$AM = \sqrt{41} \approx 6.40$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$BR = \sqrt{(2 - 7)^2 + (4 - 9)^2}$

$BR = \sqrt{(-5)^2 + (-5)^2}$

$BR = \sqrt{25 + 25}$

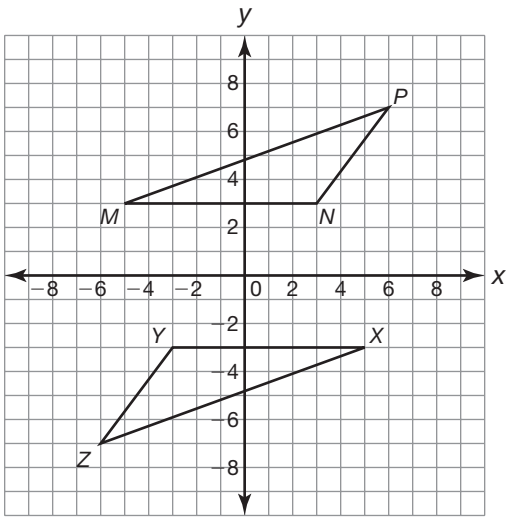
$BR = \sqrt{50} \approx 7.07$

$AM \neq BR$

The triangles are not congruent.

5

4.



$MN = XY = 8$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$NP = \sqrt{(6 - 3)^2 + (7 - 3)^2}$

$NP = \sqrt{3^2 + 4^2}$

$NP = \sqrt{9 + 16}$

$NP = \sqrt{25} = 5$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$YZ = \sqrt{(-6 - (-3))^2 + (-7 - (-3))^2}$

$YZ = \sqrt{(-3)^2 + (-4)^2}$

$YZ = \sqrt{9 + 16}$

$YZ = \sqrt{25} = 5$

$NP = YZ$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$MP = \sqrt{(6 - (-5))^2 + (7 - 3)^2}$

$MP = \sqrt{11^2 + 4^2}$

$MP = \sqrt{121 + 16}$

$MP = \sqrt{137} \approx 11.70$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$XZ = \sqrt{(-6 - 5)^2 + (-7 - (-3))^2}$

$XZ = \sqrt{(-11)^2 + (-4)^2}$

$XZ = \sqrt{121 + 16}$

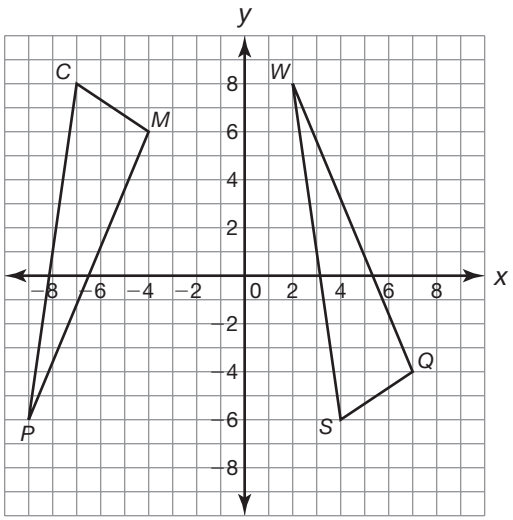
$XZ = \sqrt{137} \approx 11.70$

$MP = XZ$

The triangles are congruent by the SSS Congruence Theorem.

Name _____ Date _____

5.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$CP = \sqrt{(-9 - (-7))^2 + (-6 - 8)^2}$

$CP = \sqrt{(-2)^2 + (-14)^2}$

$CP = \sqrt{4 + 196}$

$CP = \sqrt{200} \approx 14.14$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$SW = \sqrt{(2 - 4)^2 + (8 - (-6))^2}$

$SW = \sqrt{(-2)^2 + (14)^2}$

$SW = \sqrt{4 + 196}$

$SW = \sqrt{200} \approx 14.14$

$CP = SW$

The triangles are congruent by the SSS Congruence Theorem.

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$CM = \sqrt{(-4 - (-7))^2 + (6 - 8)^2}$

$CM = \sqrt{3^2 + (-2)^2}$

$CM = \sqrt{9 + 4}$

$CM = \sqrt{13} \approx 3.61$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$SQ = \sqrt{(7 - 4)^2 + (-4 - (-6))^2}$

$SQ = \sqrt{3^2 + 2^2}$

$SQ = \sqrt{9 + 4}$

$SQ = \sqrt{13} \approx 3.61$

$CM = SQ$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$MP = \sqrt{(-9 - (-4))^2 + (-6 - 6)^2}$

$MP = \sqrt{(-5)^2 + (-12)^2}$

$MP = \sqrt{25 + 144}$

$MP = \sqrt{169} = 13$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$QW = \sqrt{(2 - 7)^2 + (8 - (-4))^2}$

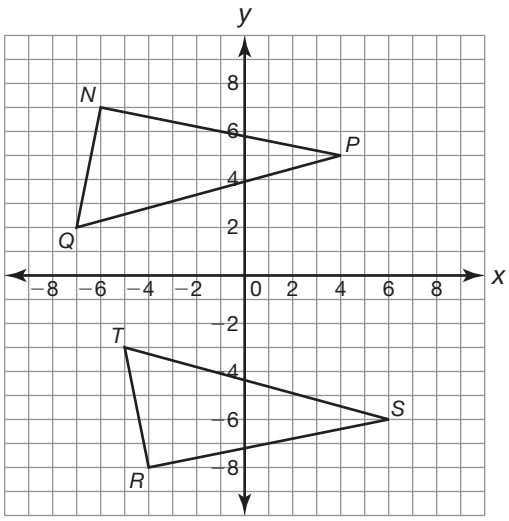
$QW = \sqrt{(-5)^2 + 12^2}$

$QW = \sqrt{25 + 144}$

$QW = \sqrt{169} = 13$

$MP = QW$

6.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$NQ = \sqrt{(-7 - (-6))^2 + (2 - 7)^2}$

$NQ = \sqrt{(-1)^2 + (-5)^2}$

$NQ = \sqrt{1 + 25}$

$NQ = \sqrt{26} \approx 5.10$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$RT = \sqrt{(-5 - (-4))^2 + (-3 - (-8))^2}$

$RT = \sqrt{(-1)^2 + 5^2}$

$RT = \sqrt{1 + 25}$

$RT = \sqrt{26} \approx 5.10$

$NQ = RT$

The triangles are congruent by the SSS Congruence Theorem.

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$NP = \sqrt{(4 - (-6))^2 + (5 - 7)^2}$

$NP = \sqrt{10^2 + (-2)^2}$

$NP = \sqrt{100 + 4}$

$NP = \sqrt{104} \approx 10.20$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$RS = \sqrt{(6 - (-4))^2 + (-6 - (-8))^2}$

$RS = \sqrt{10^2 + 2^2}$

$RS = \sqrt{100 + 4}$

$RS = \sqrt{104} \approx 10.20$

$NP = RS$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$PQ = \sqrt{(-7 - 4)^2 + (2 - 5)^2}$

$PQ = \sqrt{(-11)^2 + (-3)^2}$

$PQ = \sqrt{121 + 9}$

$PQ = \sqrt{130} \approx 14.40$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$ST = \sqrt{(-5 - 6)^2 + (-3 - (-6))^2}$

$ST = \sqrt{(-11)^2 + 3^2}$

$ST = \sqrt{121 + 9}$

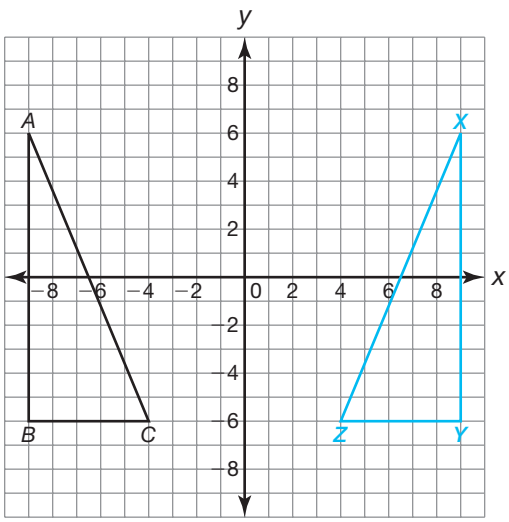
$ST = \sqrt{130} \approx 14.40$

$PQ = ST$

Name _____ Date _____

Perform the transformation described on each given triangle. Then, verify that the triangles are congruent by SSS. Use the Distance Formula and a protractor when necessary.

7. Reflect $\triangle ABC$ over the y-axis to form $\triangle XYZ$. Verify that $\triangle ABC \cong \triangle XYZ$ by SSS.



$AB = XY = 12$

$BC = YZ = 5$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$AC = \sqrt{(-4 - (-9))^2 + (-6 - 6)^2}$

$AC = \sqrt{5^2 + (-12)^2}$

$AC = \sqrt{25 + 144}$

$AC = \sqrt{169} = 13$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$XZ = \sqrt{(4 - 9)^2 + (-6 - 6)^2}$

$XZ = \sqrt{(-5)^2 + (-12)^2}$

$XZ = \sqrt{25 + 144}$

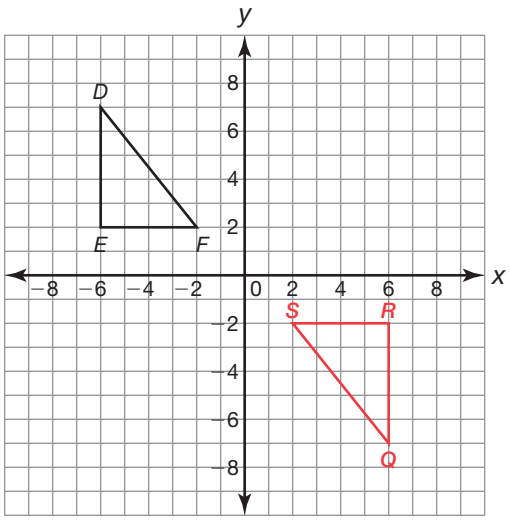
$XZ = \sqrt{169} = 13$

$AC = XZ$

The triangles are congruent by the SSS Congruence Theorem.

5

8. Rotate $\triangle DEF$ 180° clockwise about the origin to form $\triangle QRS$. Verify that $\triangle DEF \cong \triangle QRS$ by SSS.



$DE = QR = 5$

$EF = RS = 4$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$DF = \sqrt{(-2 - (-6))^2 + (2 - 7)^2}$

$DF = \sqrt{4^2 + (-5)^2}$

$DF = \sqrt{16 + 25}$

$DF = \sqrt{41} \approx 6.4$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$QS = \sqrt{(2 - 6)^2 + (-2 - (-7))^2}$

$QS = \sqrt{(-4)^2 + 5^2}$

$QS = \sqrt{16 + 25}$

$QS = \sqrt{41} \approx 6.4$

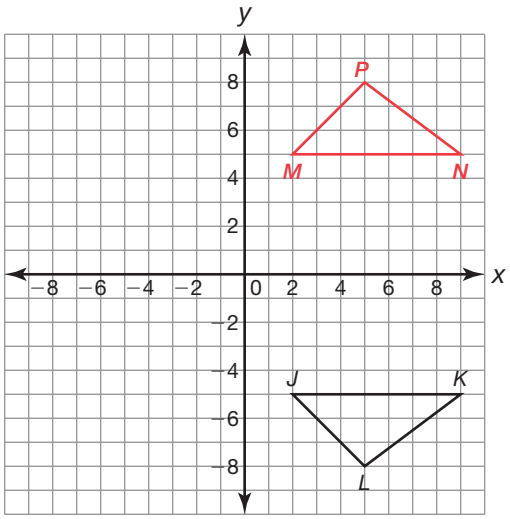
$DF = QS$

The triangles are congruent by the SSS Congruence Theorem.

5

Name _____ Date _____

9. Reflect △*JKL* over the *x*-axis to form △*MNP*. Verify that △*JKL* ≅ △*MNP* by SSS.



$JK = MN = 7$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$KL = \sqrt{(5 - 9)^2 + (-8 - (-5))^2}$

$KL = \sqrt{(-4)^2 + (-3)^2}$

$KL = \sqrt{16 + 9}$

$KL = \sqrt{25} = 5$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$NP = \sqrt{(5 - 9)^2 + (8 - 5)^2}$

$NP = \sqrt{(-4)^2 + 3^2}$

$NP = \sqrt{16 + 9}$

$NP = \sqrt{25} = 5$

$KL = NP$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$JL = \sqrt{(5 - 2)^2 + (-8 - (-5))^2}$

$JL = \sqrt{3^2 + (-3)^2}$

$JL = \sqrt{9 + 9}$

$JL = \sqrt{18} \approx 4.24$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$MP = \sqrt{(5 - 2)^2 + (8 - 5)^2}$

$MP = \sqrt{3^2 + 3^2}$

$MP = \sqrt{9 + 9}$

$MP = \sqrt{18} \approx 4.24$

$JL = MP$

The triangles are congruent by the SSS Congruence Theorem.

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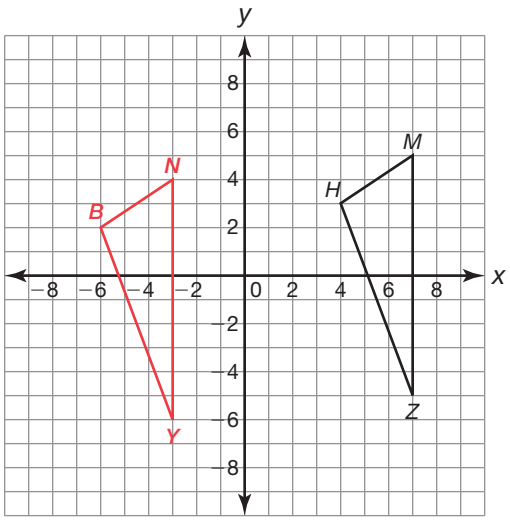
10. Translate $\triangle HMZ$ 10 units to the left and 1 unit down to form $\triangle BNY$. Verify that $\triangle HMZ \cong \triangle BNY$ by SSS.



$MZ = NY = 10$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$HM = \sqrt{(7 - 4)^2 + (5 - 3)^2}$

$HM = \sqrt{3^2 + 2^2}$

$HM = \sqrt{9 + 4}$

$HM = \sqrt{13} \approx 3.61$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$BN = \sqrt{(-3 - (-6))^2 + (4 - 2)^2}$

$BN = \sqrt{3^2 + 2^2}$

$BN = \sqrt{9 + 4}$

$BN = \sqrt{13} \approx 3.61$

$HM = BN$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$HZ = \sqrt{(7 - 4)^2 + (-5 - 3)^2}$

$HZ = \sqrt{3^2 + (-8)^2}$

$HZ = \sqrt{9 + 64}$

$HZ = \sqrt{73} \approx 8.54$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$BY = \sqrt{(-3 - (-6))^2 + (-6 - 2)^2}$

$BY = \sqrt{3^2 + (-8)^2}$

$BY = \sqrt{9 + 64}$

$BY = \sqrt{73} \approx 8.54$

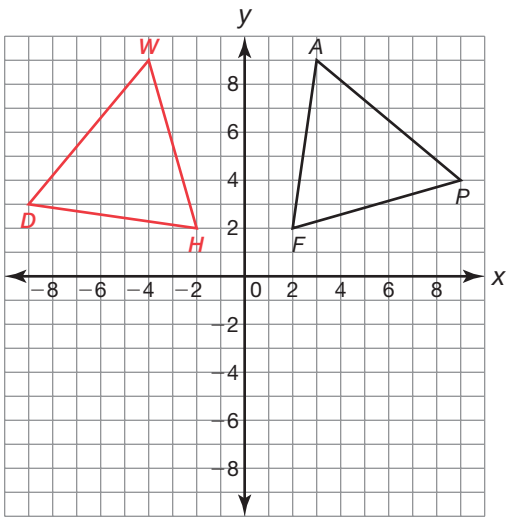
$HZ = BY$

The triangles are congruent by the SSS Congruence Theorem.

5

Name _____ Date _____

11. Rotate $\triangle AFP$ 90° counterclockwise about the origin to form $\triangle DHW$. Verify that $\triangle AFP \cong \triangle DHW$ by SSS.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$AP = \sqrt{(9 - 3)^2 + (4 - 9)^2}$

$AP = \sqrt{6^2 + (-5)^2}$

$AP = \sqrt{36 + 25}$

$AP = \sqrt{61} \approx 7.81$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$DW = \sqrt{(-4 - (-9))^2 + (9 - 3)^2}$

$DW = \sqrt{5^2 + 6^2}$

$DW = \sqrt{25 + 36}$

$DW = \sqrt{61} \approx 7.81$

$AP = DW$

The triangles are congruent by the SSS Congruence Theorem.

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$AF = \sqrt{(2 - 3)^2 + (2 - 9)^2}$

$AF = \sqrt{(-1)^2 + (-7)^2}$

$AF = \sqrt{1 + 49}$

$AF = \sqrt{50} \approx 7.07$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$DH = \sqrt{(-2 - (-9))^2 + (2 - 3)^2}$

$DH = \sqrt{7^2 + (-1)^2}$

$DH = \sqrt{49 + 1}$

$DH = \sqrt{50} \approx 7.07$

$AF = DH$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$FP = \sqrt{(9 - 2)^2 + (4 - 2)^2}$

$FP = \sqrt{7^2 + 2^2}$

$FP = \sqrt{49 + 4}$

$FP = \sqrt{53} \approx 7.28$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$HW = \sqrt{(-4 - (-2))^2 + (9 - 2)^2}$

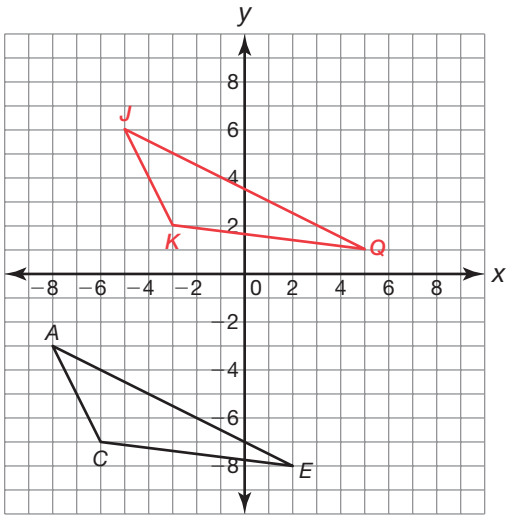
$HW = \sqrt{(-2)^2 + 7^2}$

$HW = \sqrt{4 + 49}$

$HW = \sqrt{53} \approx 7.28$

$FP = HW$

12. Translate $\triangle ACE$ 3 units to the right and 9 units up to form $\triangle JKQ$. Verify that $\triangle ACE \cong \triangle JKQ$ by SSS.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$AE = \sqrt{(2 - (-8))^2 + (-8 - (-3))^2}$

$AE = \sqrt{10^2 + (-5)^2}$

$AE = \sqrt{100 + 25}$

$AE = \sqrt{125} \approx 11.18$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$JQ = \sqrt{(5 - (-5))^2 + (1 - 6)^2}$

$JQ = \sqrt{10^2 + (-5)^2}$

$JQ = \sqrt{100 + 25}$

$JQ = \sqrt{125} \approx 11.18$

$AE = JQ$

The triangles are congruent by the SSS Congruence Theorem.

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$AC = \sqrt{(-6 - (-8))^2 + (-7 - (-3))^2}$

$AC = \sqrt{2^2 + (-4)^2}$

$AC = \sqrt{4 + 16}$

$AC = \sqrt{20} \approx 4.47$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$JK = \sqrt{(-3 - (-5))^2 + (2 - 6)^2}$

$JK = \sqrt{2^2 + (-4)^2}$

$JK = \sqrt{4 + 16}$

$JK = \sqrt{20} \approx 4.47$

$AC = JK$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$CE = \sqrt{(2 - (-6))^2 + (-8 - (-7))^2}$

$CE = \sqrt{8^2 + (-1)^2}$

$CE = \sqrt{64 + 1}$

$CE = \sqrt{65} \approx 8.06$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$KQ = \sqrt{(5 - (-3))^2 + (1 - 2)^2}$

$KQ = \sqrt{8^2 + (-1)^2}$

$KQ = \sqrt{64 + 1}$

$KQ = \sqrt{65} \approx 8.06$

$CE = KQ$

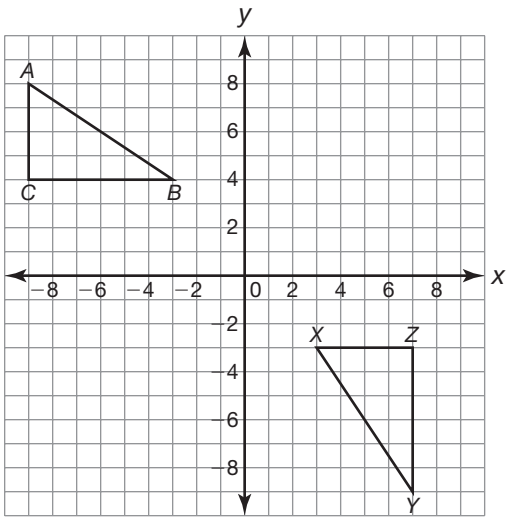
Name _____ Date _____

Make Sure the Angle Is Included
Side-Angle-Side Congruence Theorem

Vocabulary

Describe how to prove the given triangles are congruent. Use the *Side-Angle-Side Congruence Theorem* in your answer.

1.



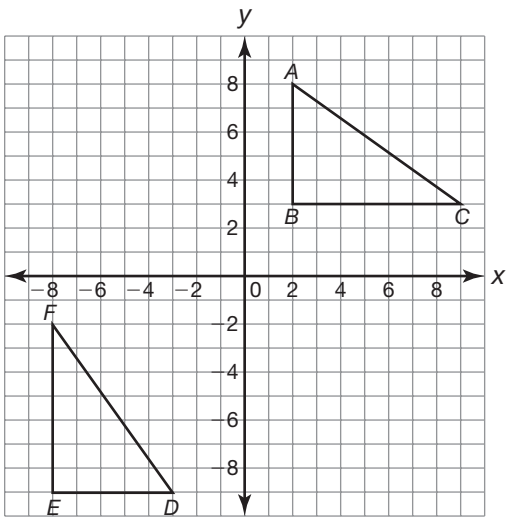
The Side-Angle-Side Congruence Theorem states that if two sides and the included angle of one triangle are congruent to the corresponding two sides and the included angle of a second triangle, then the triangles are congruent. In the triangles shown, $AC = XZ = 4$, and $BC = YZ = 6$. The included angle ($\angle C$) between $\overline{AC}$ and $\overline{BC}$ is congruent to the included angle ($\angle Z$) between $\overline{XZ}$ and $\overline{YZ}$, because $m\angle C = m\angle Z = 90°$. Therefore, $\triangle ABC \cong \triangle XYZ$ according to the SAS Congruence Theorem.

5

Problem Set

Determine whether each pair of given triangles are congruent by SAS. Use the Distance Formula and a protractor when necessary.

1. Determine whether $\triangle ABC$ is congruent to $\triangle DEF$ by SAS.



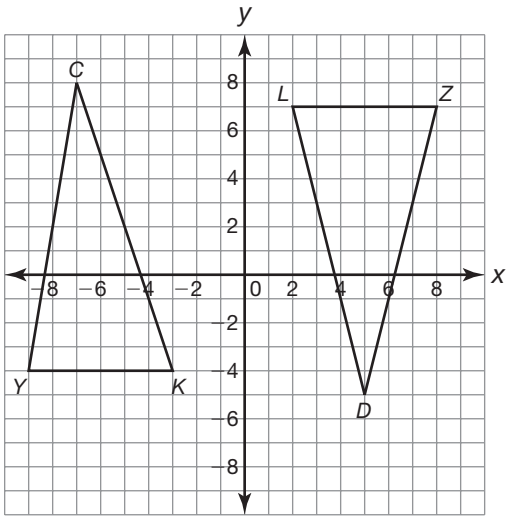
$AB = DE = 5$

$BC = EF = 7$

$m\angle B = m\angle E = 90°$

The triangles are congruent by the SAS Congruence Theorem.

2. Determine whether $\triangle CKY$ is congruent to $\triangle DLZ$ by SAS.



$KY = LZ = 6$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$CY = \sqrt{(-9 - (-7))^2 + (-4 - 8)^2}$

$CY = \sqrt{(-2)^2 + (-12)^2}$

$CY = \sqrt{4 + 144}$

$CY = \sqrt{148} \approx 12.17$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$DZ = \sqrt{(8 - 5)^2 + (7 - (-5))^2}$

$DZ = \sqrt{3^2 + (12)^2}$

$DZ = \sqrt{9 + 144}$

$DZ = \sqrt{153} \approx 12.37$

$CY \neq DZ$

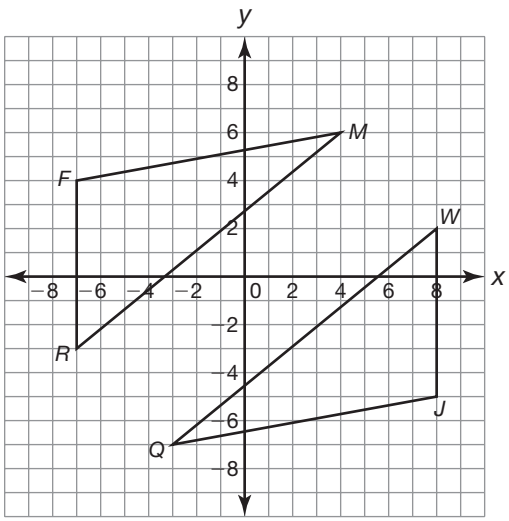
$m\angle Y = 81°, m\angle Z = 76°$

$m\angle Y \neq m\angle Z$

The triangles are not congruent.

Name _____ Date _____

3. Determine whether $\triangle FMR$ is congruent to $\triangle JQW$ by SAS.



$FR = JW = 7$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$FM = \sqrt{(4 - (-7))^2 + (6 - 4)^2}$

$FM = \sqrt{11^2 + 2^2}$

$FM = \sqrt{121 + 4}$

$FM = \sqrt{125} \approx 11.18$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$JQ = \sqrt{(-3 - 8)^2 + (-7 - (-5))^2}$

$JQ = \sqrt{(-11)^2 + (-2)^2}$

$JQ = \sqrt{121 + 4}$

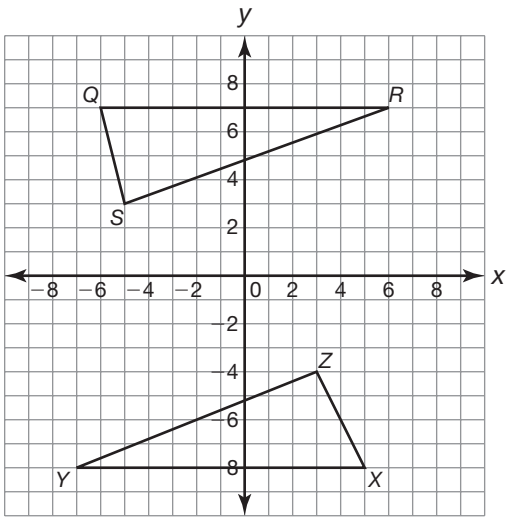
$JQ = \sqrt{125} \approx 11.18$

$FM = JQ$

$m\angle F = m\angle J = 100°$

The triangles are congruent by the SAS Congruence Theorem.

4. Determine whether $\triangle QRS$ is congruent to $\triangle XYZ$ by SAS.



$QR = XY = 12$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$RS = \sqrt{(-5 - 6)^2 + (3 - 7)^2}$

$RS = \sqrt{(-11)^2 + (-4)^2}$

$RS = \sqrt{121 + 16}$

$RS = \sqrt{137} \approx 11.70$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$YZ = \sqrt{(3 - (-7))^2 + (-4 - (-8))^2}$

$YZ = \sqrt{10^2 + 4^2}$

$YZ = \sqrt{100 + 16}$

$YZ = \sqrt{116} \approx 10.77$

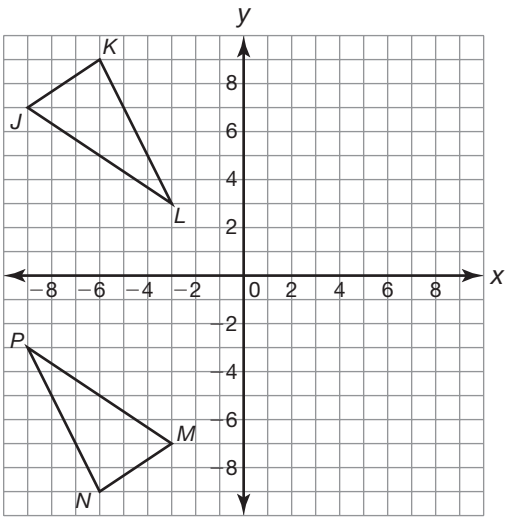
$RS \neq YZ$

$m\angle R = 20°, m\angle Y = 22°$

$m\angle R \neq m\angle Y$

The triangles are not congruent.

5. Determine whether $\triangle JKL$ is congruent to $\triangle MNP$ by SAS.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$JK = \sqrt{(-6 - (-9))^2 + (9 - 7)^2}$

$JK = \sqrt{3^2 + 2^2}$

$JK = \sqrt{9 + 4}$

$JK = \sqrt{13}$

$JK \approx 3.61$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$MN = \sqrt{(-6 - (-3))^2 + (-9 - (-7))^2}$

$MN = \sqrt{(-3)^2 + (-2)^2}$

$MN = \sqrt{9 + 4}$

$MN = \sqrt{13}$

$MN \approx 3.61$

$JK = MN$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$KL = \sqrt{(-3 - (-6))^2 + (3 - 9)^2}$

$KL = \sqrt{3^2 + (-6)^2}$

$KL = \sqrt{9 + 36}$

$KL = \sqrt{45}$

$KL \approx 6.71$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$NP = \sqrt{(-9 - (-6))^2 + (-3 - (-9))^2}$

$NP = \sqrt{(-3)^2 + 6^2}$

$NP = \sqrt{9 + 36}$

$NP = \sqrt{45}$

$NP \approx 6.71$

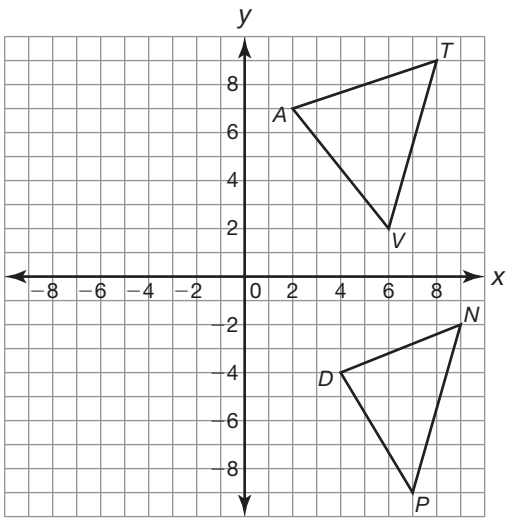
$KL = NP$

$m\angle K = m\angle N = 83°$

The triangles are congruent by the SAS Congruence Theorem.

Name _____ Date _____

6. Determine whether $\triangle ATV$ is congruent to $\triangle DNP$ by SAS.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$AT = \sqrt{(8 - 2)^2 + (9 - 7)^2}$

$AT = \sqrt{6^2 + 2^2}$

$AT = \sqrt{36 + 4}$

$AT = \sqrt{40}$

$AT \approx 6.32$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$DN = \sqrt{(9 - 4)^2 + (-2 - (-4))^2}$

$DN = \sqrt{5^2 + 2^2}$

$DN = \sqrt{25 + 4}$

$DN = \sqrt{29}$

$DN \approx 5.39$

$AT \neq DN$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$TV = \sqrt{(6 - 8)^2 + (2 - 9)^2}$

$TV = \sqrt{(-2)^2 + (-7)^2}$

$TV = \sqrt{4 + 49}$

$TV = \sqrt{53}$

$TV \approx 7.28$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$NP = \sqrt{(7 - 9)^2 + (-9 - (-2))^2}$

$NP = \sqrt{(-2)^2 + (-7)^2}$

$NP = \sqrt{4 + 49}$

$NP = \sqrt{53}$

$NP \approx 7.28$

$TV = NP$

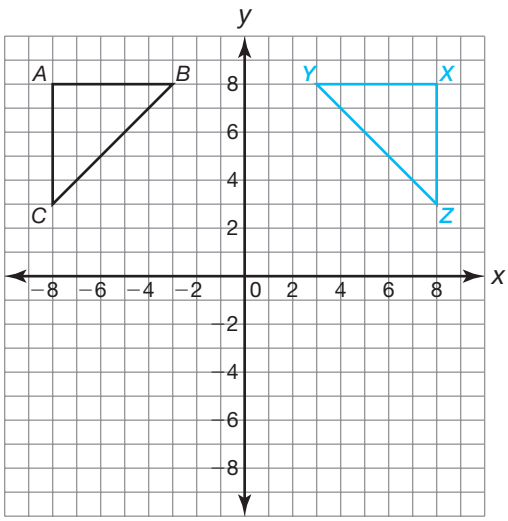
$m\angle T = 56°, m\angle N = 52°$

$m\angle T \neq m\angle N$

The triangles are not congruent.

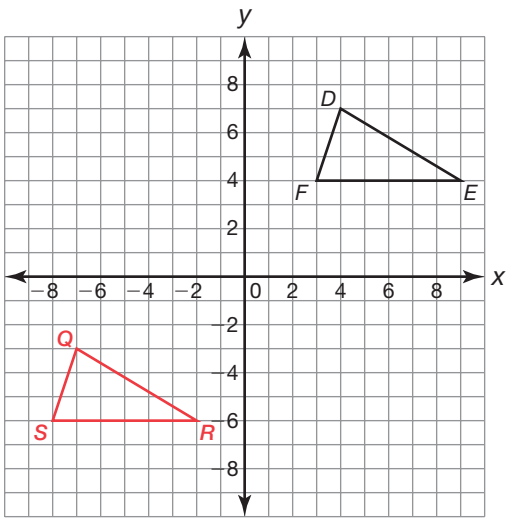
Perform the transformation described on each given triangle. Then, verify that the triangles are congruent by SAS. Use the Distance Formula and a protractor when necessary.

7. Reflect $\triangle ABC$ over the y-axis to form $\triangle XYZ$. Verify that $\triangle ABC \cong \triangle XYZ$ by SAS.



$AB = XY = 5$
$AC = XZ = 5$
$m\angle A = m\angle X = 90°$
The triangles are congruent by the SAS Congruence Theorem.

8. Translate $\triangle DEF$ 11 units to the left and 10 units down to form $\triangle QRS$. Verify that $\triangle DEF \cong \triangle QRS$ by SAS.



$EF = RS = 6$

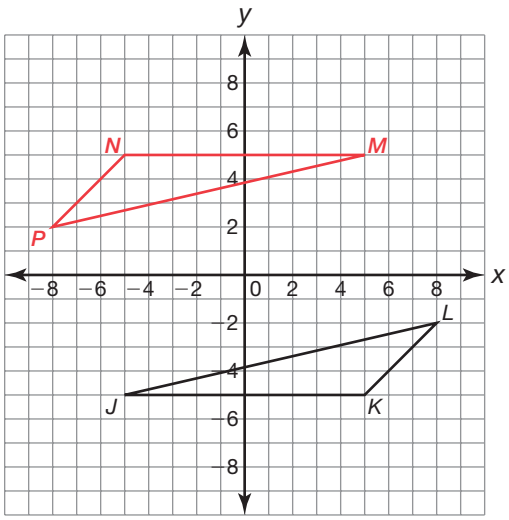
$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
$DF = \sqrt{(3 - 4)^2 + (4 - 7)^2}$
$DF = \sqrt{(-1)^2 + (-3)^2}$
$DF = \sqrt{1 + 9}$
$DF = \sqrt{10} \approx 3.16$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
$QS = \sqrt{(-8 - (-7))^2 + (-6 - (-3))^2}$
$QS = \sqrt{(-1)^2 + (-3)^2}$
$QS = \sqrt{1 + 9}$
$QS = \sqrt{10} \approx 3.16$
$DF = QS$

$m\angle F = m\angle S = 72°$
The triangles are congruent by the SAS Congruence Theorem.

Name _____ Date _____

9. Rotate $\triangle JKL$ 180° counterclockwise about the origin to form $\triangle MNP$. Verify that $\triangle JKL \cong \triangle MNP$ by SAS.



$JK = MN = 10$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$KL = \sqrt{(8 - 5)^2 + (-2 - (-5))^2}$

$KL = \sqrt{3^2 + 3^2}$

$KL = \sqrt{9 + 9}$

$KL = \sqrt{18} \approx 4.24$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$NP = \sqrt{(-8 - (-5))^2 + (2 - 5)^2}$

$NP = \sqrt{(-3)^2 + (-3)^2}$

$NP = \sqrt{9 + 9}$

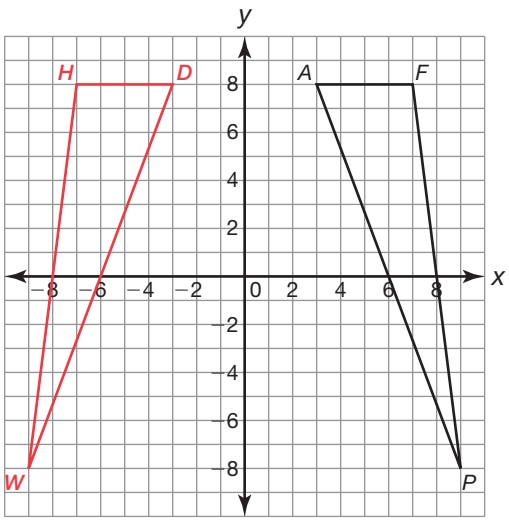
$NP = \sqrt{18} \approx 4.24$

$KL = NP$

$m\angle K = m\angle N = 135°$

The triangles are congruent by the SAS Congruence Theorem.

10. Reflect $\triangle AFP$ over the y-axis to form $\triangle DHW$. Verify that $\triangle AFP \cong \triangle DHW$ by SAS.



$AF = DH = 4$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$FP = \sqrt{(9 - 7)^2 + (-8 - 8)^2}$

$FP = \sqrt{2^2 + (-16)^2}$

$FP = \sqrt{4 + 256}$

$FP = \sqrt{260} \approx 16.12$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$HW = \sqrt{(-9 - (-7))^2 + (-8 - 8)^2}$

$HW = \sqrt{(-2)^2 + (-16)^2}$

$HW = \sqrt{4 + 256}$

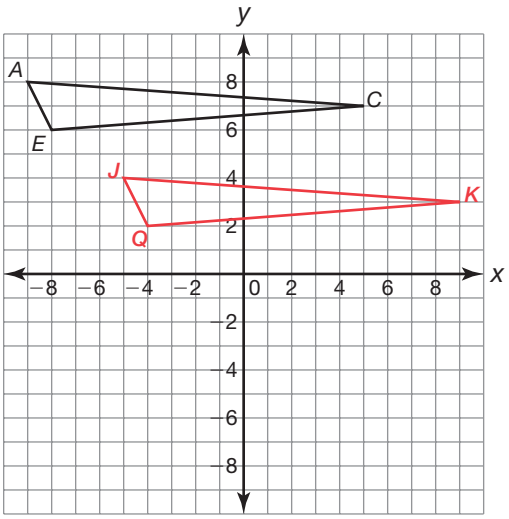
$HW = \sqrt{260} \approx 16.12$

$FP = HW$

$m\angle F = m\angle H \approx 97°$

The triangles are congruent by the SAS Congruence Theorem.

11. Translate $\triangle ACE$ 4 units to the right and 4 units down to form $\triangle JKQ$. Verify that $\triangle ACE \cong \triangle JKQ$ by SAS.



$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$AC = \sqrt{(5 - (-9))^2 + (7 - 8)^2}$$
$$AC = \sqrt{14^2 + (-1)^2}$$
$$AC = \sqrt{196 + 1}$$
$$AC = \sqrt{197}$$
$$AC \approx 14.04$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$JK = \sqrt{(9 - (-5))^2 + (3 - 4)^2}$$
$$JK = \sqrt{14^2 + (-1)^2}$$
$$JK = \sqrt{196 + 1}$$
$$JK = \sqrt{197}$$
$$JK \approx 14.04$$
$$AC = JK$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$AE = \sqrt{(-8 - (-9))^2 + (6 - 8)^2}$$
$$AE = \sqrt{1^2 + (-2)^2}$$
$$AE = \sqrt{1 + 4}$$
$$AE = \sqrt{5}$$
$$AE \approx 2.24$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$JQ = \sqrt{(-4 - (-5))^2 + (2 - 4)^2}$$
$$JQ = \sqrt{1^2 + (-2)^2}$$
$$JQ = \sqrt{1 + 4}$$
$$JQ = \sqrt{5}$$
$$JQ \approx 2.24$$
$$AE = JQ$$

$m\angle A = m\angle J = 59°$

The triangles are congruent by the SAS Congruence Theorem.

5

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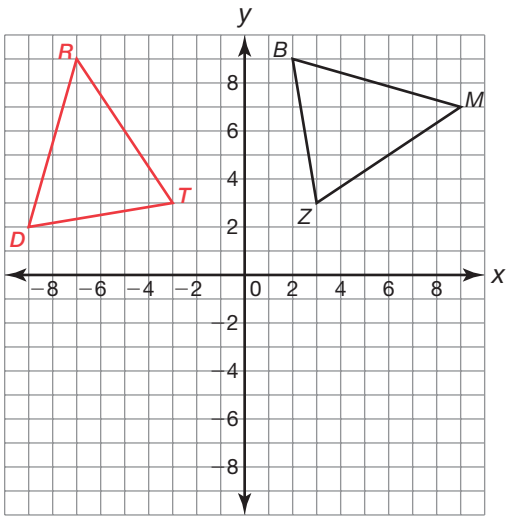
12. Rotate $\triangle BMZ$ 90° counterclockwise about the origin to form $\triangle DRT$. Verify that $\triangle BMZ \cong \triangle DRT$ by SAS.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$BM = \sqrt{(9 - 2)^2 + (7 - 9)^2}$

$BM = \sqrt{7^2 + (-2)^2}$

$BM = \sqrt{49 + 4}$

$BM = \sqrt{53}$

$BM \approx 7.28$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$DR = \sqrt{(-7 - (-9))^2 + (9 - 2)^2}$

$DR = \sqrt{2^2 + 7^2}$

$DR = \sqrt{4 + 49}$

$DR = \sqrt{53}$

$DR \approx 7.28$

$BM = DR$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$MZ = \sqrt{(3 - 9)^2 + (3 - 7)^2}$

$MZ = \sqrt{(-6)^2 + (-4)^2}$

$MZ = \sqrt{36 + 16}$

$MZ = \sqrt{52}$

$MZ \approx 7.21$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$RT = \sqrt{(-3 - (-7))^2 + (3 - 9)^2}$

$RT = \sqrt{4^2 + (-6)^2}$

$RT = \sqrt{16 + 36}$

$RT = \sqrt{52}$

$RT \approx 7.21$

$MZ = RT$

$m\angle M = m\angle R = 50°$

The triangles are congruent by the SAS Congruence Theorem.

5

Determine the angle measure or side measure that is needed in order to prove that each set of triangles are congruent by SAS.

13. In $\triangle ART$, $AR = 12$, $RT = 8$, and $m\angle R = 70°$. In $\triangle BSW$, $BS = 12$, and $m\angle S = 70°$.

SW = 8

14. In $\triangle CDE$, $CD = 7$, and $DE = 11$. In $\triangle FGH$, $FG = 7$, $GH = 11$, and $m\angle G = 45°$.

$m\angle D = 45°$

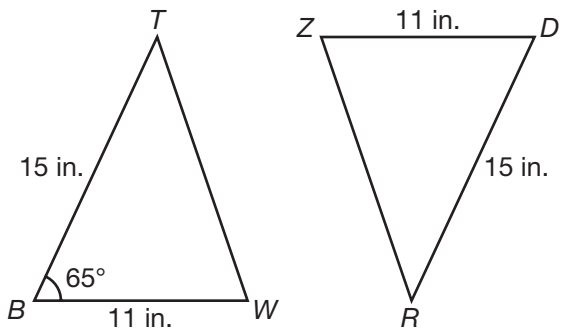
15. In $\triangle JKL$, $JK = 2$, $KL = 3$, and $m\angle K = 60°$. In $\triangle MNP$, $NP = 3$, and $m\angle N = 60°$.

MN = 2

16. In $\triangle QRS$, $QS = 6$, $RS = 4$, and $m\angle S = 20°$. In $\triangle TUV$, $TV = 6$, and $UV = 4$.

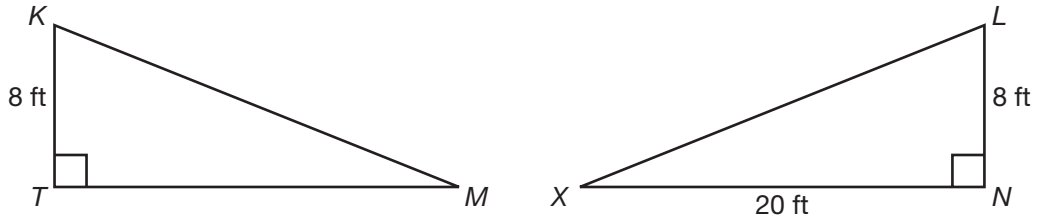
$m\angle V = 20°$

17.



$m\angle D = 65°$

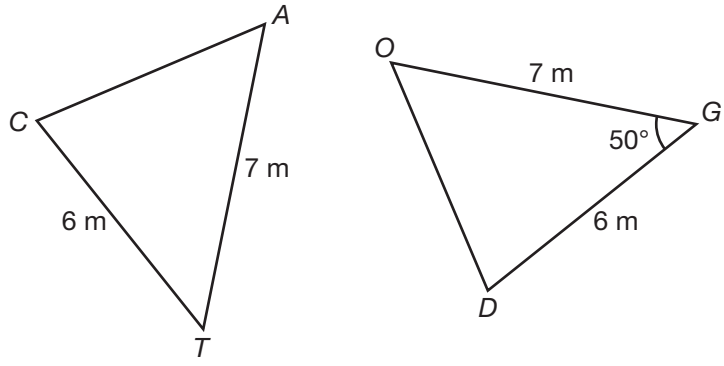
18.



MT = 20 ft

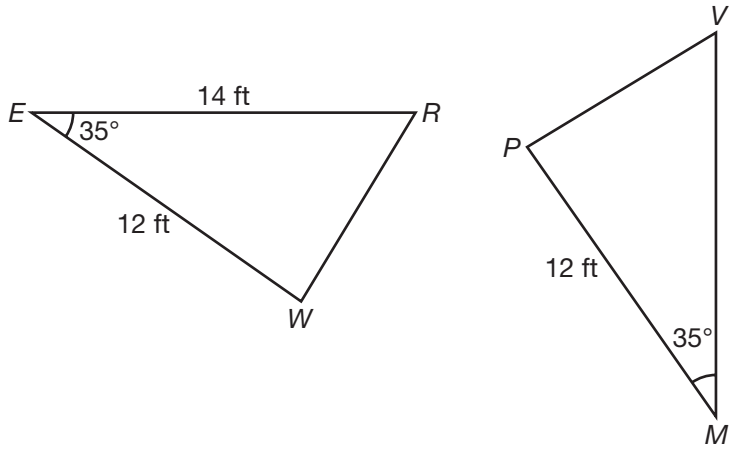
Name _____ Date _____

19.



$m\angle T = 50°$

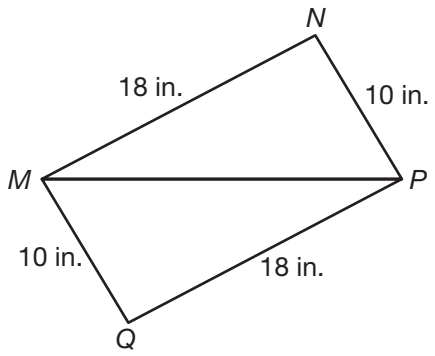
20.



$MV = 14$ ft

Determine whether there is enough information to prove that each pair of triangles are congruent by SSS or SAS. Write the congruence statements to justify your reasoning.

21. $\triangle MNP \stackrel{?}{\cong} \triangle PQM$



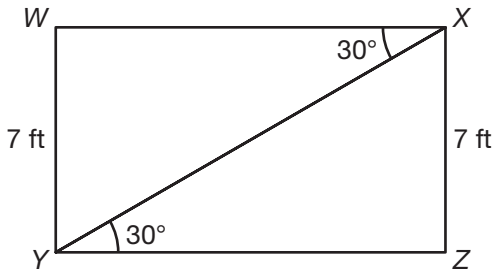
The triangles are congruent by SSS.

$\overline{MN} \cong \overline{PQ}$

$\overline{NP} \cong \overline{QM}$

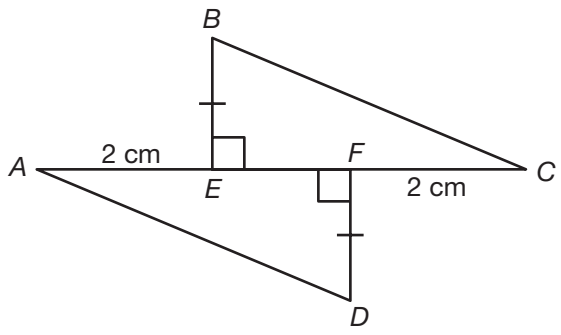
$\overline{MP} \cong \overline{PM}$

22. $\triangle WXY \stackrel{?}{\cong} \triangle ZYX$



There is not enough information to determine whether the triangles are congruent by SSS or SAS. SAS does not apply because the congruent angles in the figure are not included angles.

23. $\triangle BCE \stackrel{?}{\cong} \triangle DAF$



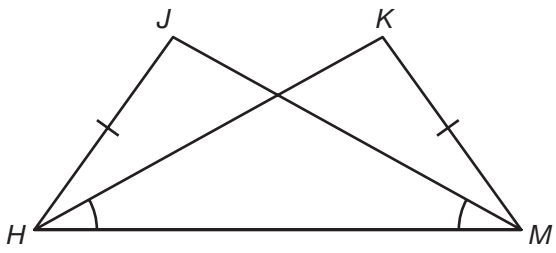
The triangles are congruent by SAS.

$\overline{BE} \cong \overline{DF}$

$\angle BEC \cong \angle DFA$

$\overline{CE} \cong \overline{AF}$

24. $\triangle HJM \stackrel{?}{\cong} \triangle MKH$



There is not enough information to determine whether the triangles are congruent by SSS or SAS. SAS does not apply because the congruent angles in the figure are not included angles.

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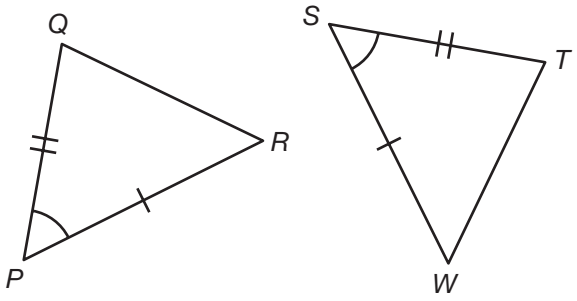
25. $\triangle PQR \overset{?}{\cong} \triangle STW$



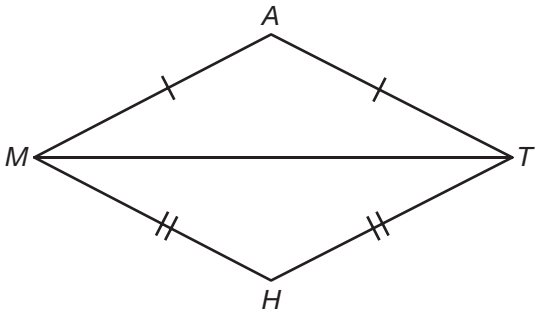
The triangles are congruent by SAS.

$\overline{PQ} \cong \overline{ST}$

$\angle QPR \cong \angle TSW$

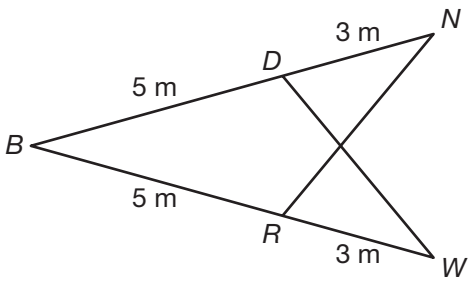
$\overline{PR} \cong \overline{SW}$

26. $\triangle MAT \overset{?}{\cong} \triangle MHT$



There is not enough information to determine whether the triangles are congruent by SSS or SAS.

27. $\triangle BDW \overset{?}{\cong} \triangle BRN$



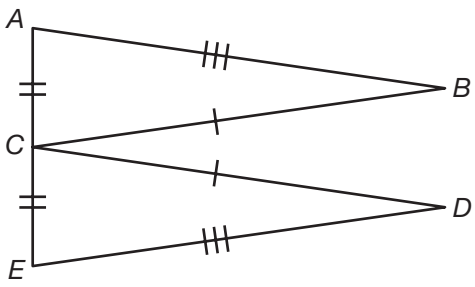
The triangles are congruent by SAS.

$\overline{BD} \cong \overline{BR}$

$\angle DBW \cong \angle RBN$

$\overline{BW} \cong \overline{BN}$

28. $\triangle ABC \overset{?}{\cong} \triangle EDC$



The triangles are congruent by SSS.

$\overline{AB} \cong \overline{ED}$

$\overline{BC} \cong \overline{DC}$

$\overline{AC} \cong \overline{EC}$

5

Name _____ Date _____

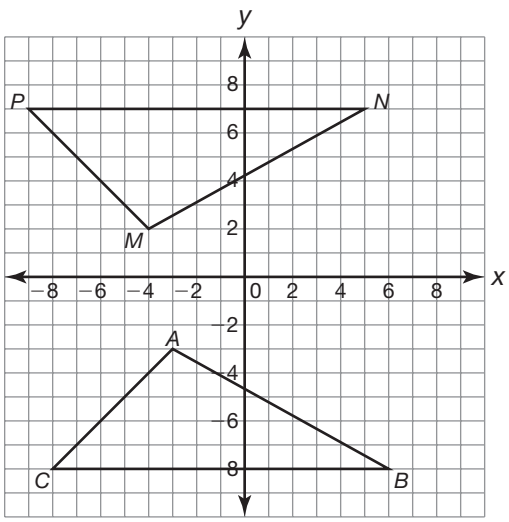
Angle to the Left of Me, Angle to the Right of Me

Angle-Side-Angle Congruence Theorem

Vocabulary

Describe how to prove the given triangles are congruent. Use the *Angle-Side-Angle Congruence Theorem* in your answer.

1.



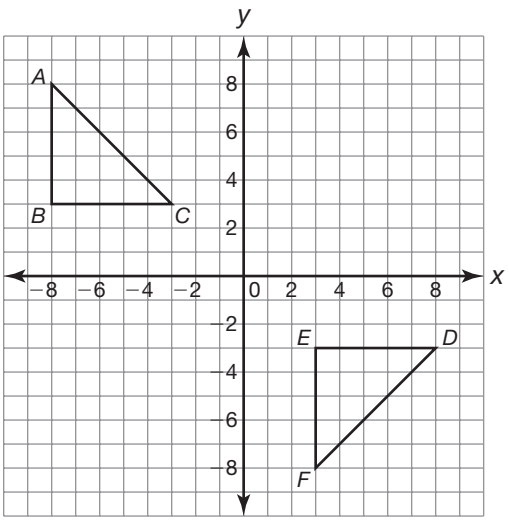
The Angle-Side-Angle Congruence Theorem states that if two angles and the included side of one triangle are congruent to the corresponding two angles and the included side of another triangle, then the triangles are congruent. In the triangles shown, $m\angle C = m\angle P = 45°$, and $m\angle B = m\angle N = 29°$. The included side ($\overline{BC}$) between $\angle B$ and $\angle C$ is congruent to the included side ($\overline{NP}$) between $\angle N$ and $\angle P$, because $BC = NP = 14$. Therefore, $\triangle ABC \cong \triangle MNP$ according to the ASA Congruence Theorem.

5

Problem Set

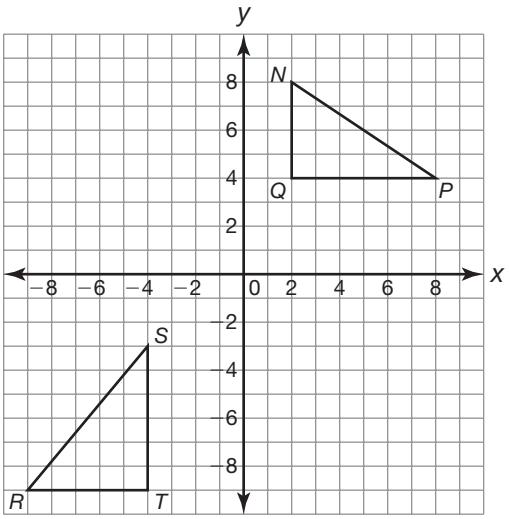
Determine whether each pair of given triangles are congruent by ASA. Use the Distance Formula and a protractor when necessary.

1. Determine whether $\triangle ABC$ is congruent to $\triangle DEF$ by ASA.



$m\angle B = m\angle E = 90°$
$m\angle C = m\angle F = 45°$
$BC = EF = 5$
The triangles are congruent by the ASA Congruence Theorem.

2. Determine whether $\triangle NPQ$ is congruent to $\triangle RST$ by ASA.



$m\angle Q = m\angle T = 90°$
$m\angle P = 34°$, $m\angle S = 40°$,
$m\angle P \neq m\angle S$
$PQ = ST = 6$
The triangles are not congruent.

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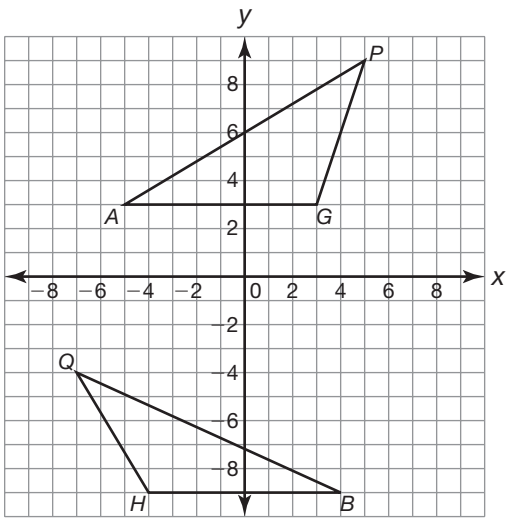
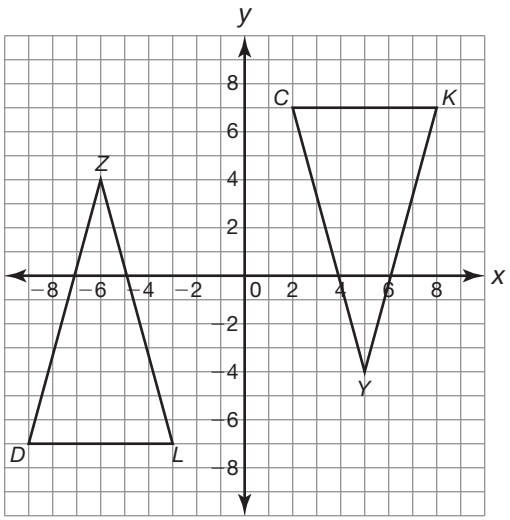
3. Determine whether $\triangle AGP$ is congruent to $\triangle BHQ$ by ASA.



$m\angle A = 31°, m\angle B = 24°$
$m\angle A \neq m\angle B$
$m\angle G = 108°, m\angle H = 121°$
$m\angle G \neq m\angle H$
$AG = BH = 8$
The triangles are not congruent.

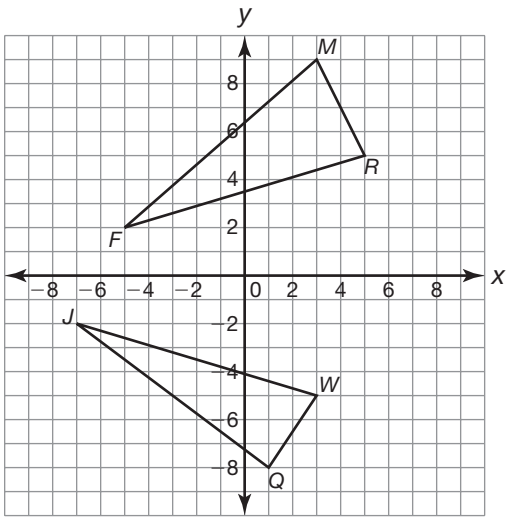
4. Determine whether $\triangle CKY$ is congruent to $\triangle DLZ$ by ASA.



$m\angle C = m\angle D = 75°$
$m\angle K = m\angle L = 75°$
$CK = DL = 6$
The triangles are congruent by the ASA Congruence Theorem.

5

5. Determine whether $\triangle FMR$ is congruent to $\triangle JQW$ by ASA.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$FM = \sqrt{(3 - (-5))^2 + (9 - 2)^2}$

$FM = \sqrt{8^2 + 7^2}$

$FM = \sqrt{64 + 49}$

$FM = \sqrt{113} \approx 10.63$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$JQ = \sqrt{(1 - (-7))^2 + (-8 - (-2))^2}$

$JQ = \sqrt{8^2 + (-6)^2}$

$JQ = \sqrt{64 + 36}$

$JQ = \sqrt{100} = 10$

$FM \neq JQ$

$m\angle F = 24°, m\angle J = 20°$

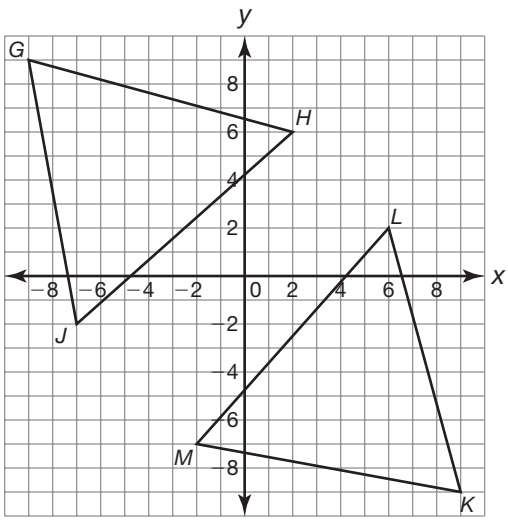
$m\angle F \neq m\angle J$

$m\angle M = 75°, m\angle Q = 87°$

$m\angle M \neq m\angle Q$

The triangles are not congruent.

6. Determine whether $\triangle GHJ$ is congruent to $\triangle KLM$ by ASA.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$HJ = \sqrt{(-7 - 2)^2 + (-2 - 6)^2}$

$HJ = \sqrt{(-9)^2 + (-8)^2}$

$HJ = \sqrt{81 + 64}$

$HJ = \sqrt{145} \approx 12.04$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$LM = \sqrt{(-2 - 6)^2 + (-7 - 2)^2}$

$LM = \sqrt{(-8)^2 + (-9)^2}$

$LM = \sqrt{64 + 81}$

$LM = \sqrt{145} \approx 12.04$

$HJ = LM$

$m\angle H = m\angle L = 57°$

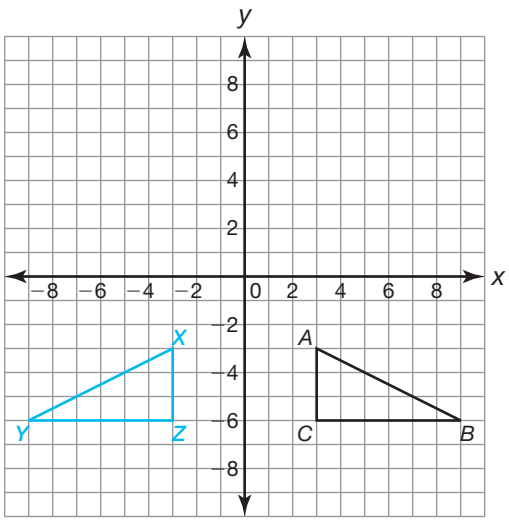
$m\angle J = m\angle M = 59°$

The triangles are congruent by the ASA Congruence Theorem.

Name _____ Date _____

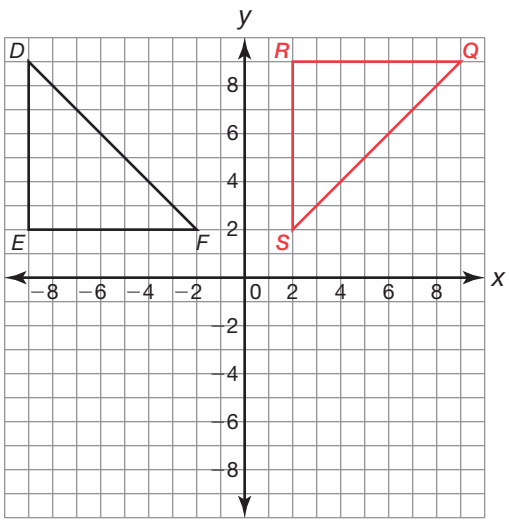
Perform the transformation described on each given triangle. Then, verify that the triangles are congruent by ASA. Use the Distance Formula and a protractor when necessary.

7. Reflect $\triangle ABC$ over the y-axis to form $\triangle XYZ$. Verify that $\triangle ABC \cong \triangle XYZ$ by SAS.



$m\angle C = m\angle Z = 90°$
$m\angle A = m\angle X = 63°$
$AC = XZ = 3$
The triangles are congruent by the ASA Congruence Theorem.

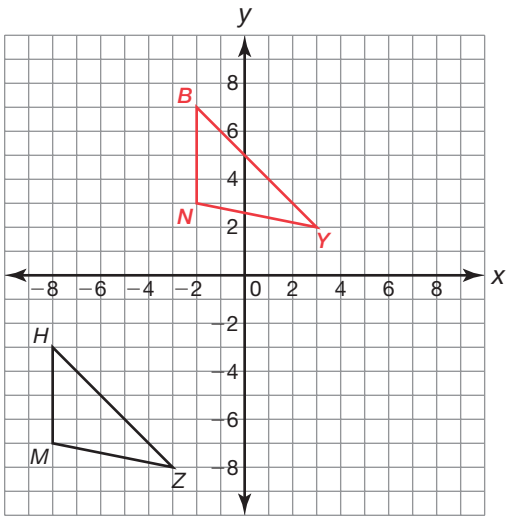
8. Rotate $\triangle DEF$ 90° clockwise about the origin to form $\triangle QRS$. Verify that $\triangle DEF \cong \triangle QRS$ by SAS.



$m\angle E = m\angle R = 90°$
$m\angle F = m\angle S = 45°$
$EF = RS = 7$
The triangles are congruent by the ASA Congruence Theorem.

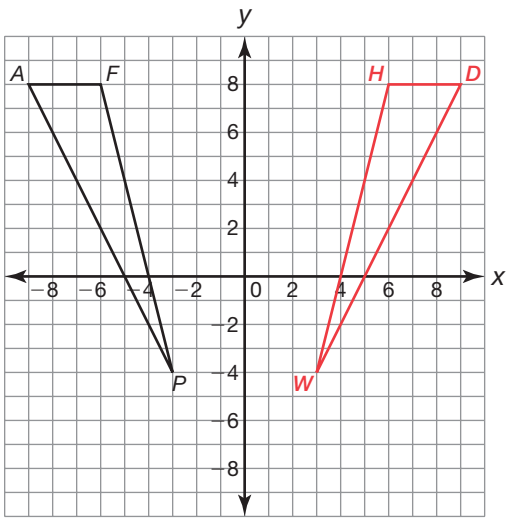
5

9. Translate $\triangle HMZ$ 6 units to the right and 10 units up to form $\triangle BNY$. Verify that $\triangle HMZ \cong \triangle BNY$ by ASA.



$m\angle H = m\angle B = 45°$
$m\angle M = m\angle N = 101°$
$HM = BN = 4$
The triangles are congruent by the ASA Congruence Theorem.

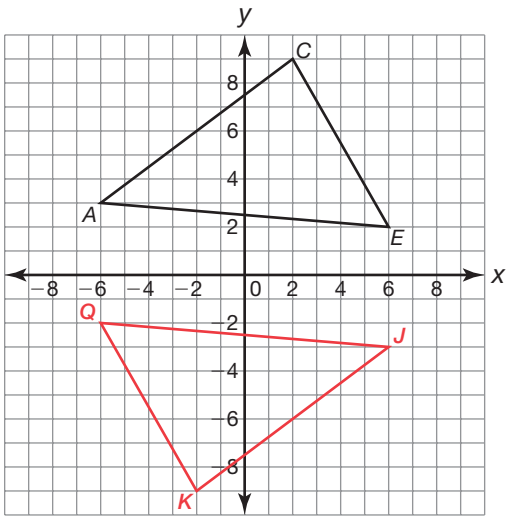
10. Reflect $\triangle AFP$ over the y-axis to form $\triangle DHW$. Verify that $\triangle AFP \cong \triangle DHW$ by ASA.



$m\angle A = m\angle D = 63°$
$m\angle F = m\angle H = 104°$
$AF = DH = 3$
The triangles are congruent by the ASA Congruence Theorem.

Name _____ Date _____

11. Rotate $\triangle ACE$ 180° counterclockwise about the origin to form $\triangle JKQ$. Verify that $\triangle ACE \cong \triangle JKQ$ by SAS.

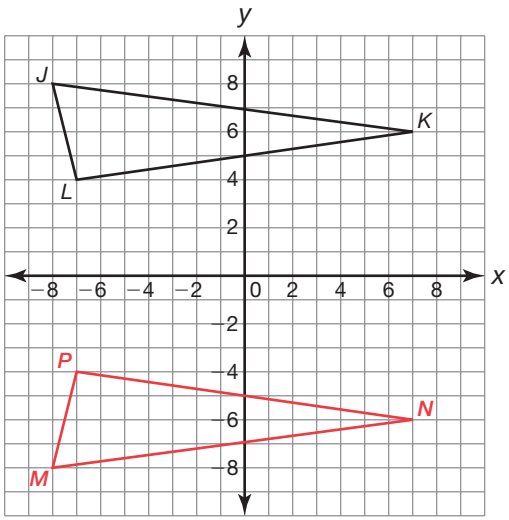


$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
$AC = \sqrt{(2 - (-6))^2 + (9 - 3)^2}$
$AC = \sqrt{8^2 + 6^2}$
$AC = \sqrt{64 + 36}$
$AC = \sqrt{100} = 10$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
$JK = \sqrt{(-2 - 6)^2 + (-9 - (-3))^2}$
$JK = \sqrt{(-8)^2 + (-6)^2}$
$JK = \sqrt{64 + 36}$
$JK = \sqrt{100} = 10$
$AC = JK$

$m\angle A = m\angle J = 42°$
$m\angle C = m\angle K = 83°$
The triangles are congruent by the ASA Congruence Theorem.

12. Reflect $\triangle JKL$ over the x-axis to form $\triangle MNP$. Verify that $\triangle JKL \cong \triangle MNP$ by ASA.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
$KL = \sqrt{(-7 - 7)^2 + (4 - 6)^2}$
$KL = \sqrt{(-14)^2 + (-2)^2}$
$KL = \sqrt{196 + 4}$
$KL = \sqrt{200} \approx 14.14$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
$NP = \sqrt{(-7 - 7)^2 + (-4 - (-6))^2}$
$NP = \sqrt{(-14)^2 + 2^2}$
$NP = \sqrt{196 + 4}$
$NP = \sqrt{200} \approx 14.14$
$KL = NP$

$m\angle K = m\angle N = 16°$
$m\angle L = m\angle P = 96°$
The triangles are congruent by the ASA Congruence Theorem.

Determine the angle measure or side measure that is needed in order to prove that each set of triangles are congruent by ASA.

13. In $\triangle ADZ$, $m\angle A = 20°$, $AD = 9$, and $m\angle D = 70°$. In $\triangle BEN$, $BE = 9$, and $m\angle E = 70°$.

$m\angle B = 20°$

14. In $\triangle CUP$, $m\angle U = 45°$, and $m\angle P = 55°$. In $\triangle HAT$, $AT = 14$, $m\angle A = 45°$, and $m\angle T = 55°$.

$UP = 14$

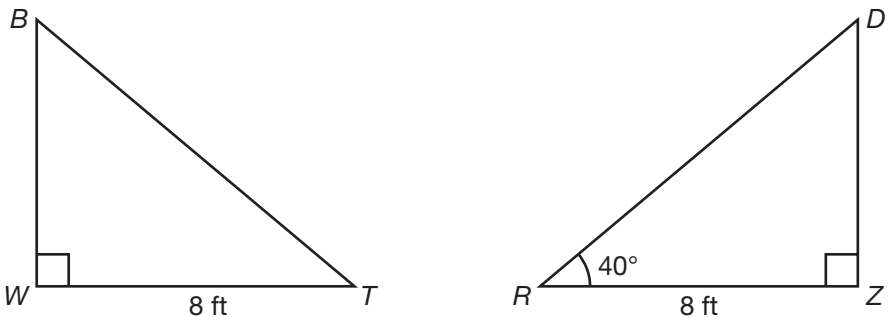
15. In $\triangle HOW$, $m\angle H = 10°$, $HW = 3$, and $m\angle W = 60°$. In $\triangle FAR$, $FR = 3$, and $m\angle F = 10°$.

$m\angle R = 60°$

16. In $\triangle DRY$, $m\angle D = 100°$, $DR = 25$, and $m\angle R = 30°$. In $\triangle WET$, $m\angle W = 100°$, and $m\angle E = 30°$.

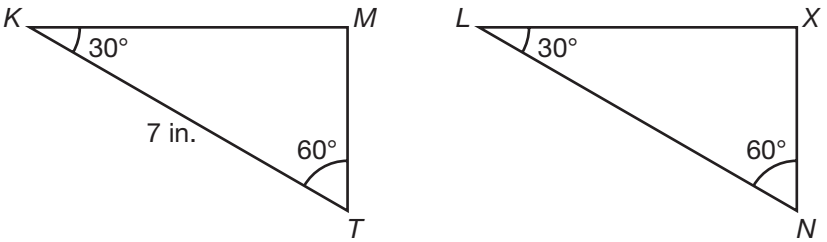
$WE = 25$

17.



$m\angle T = 40°$

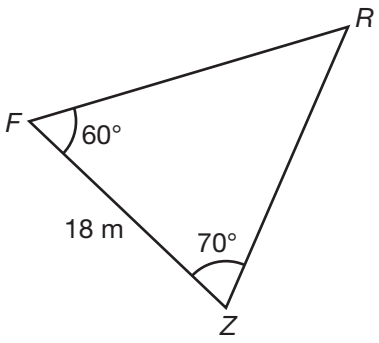
18.

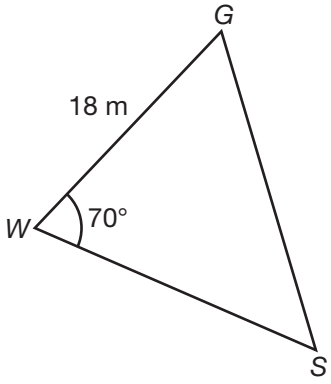


$LN = 7$ in.

Name _____ Date _____

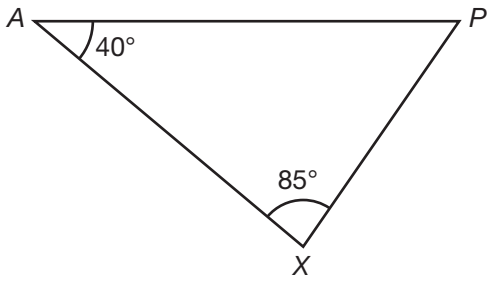
19.

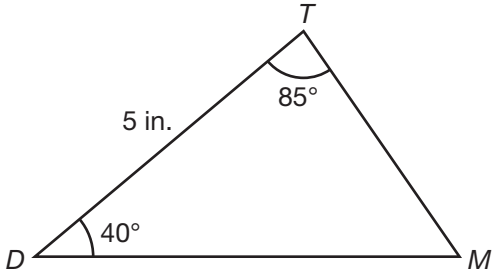




$m\angle G = 60°$

20.





$AX = 5$ in.

5

Name _____ Date _____

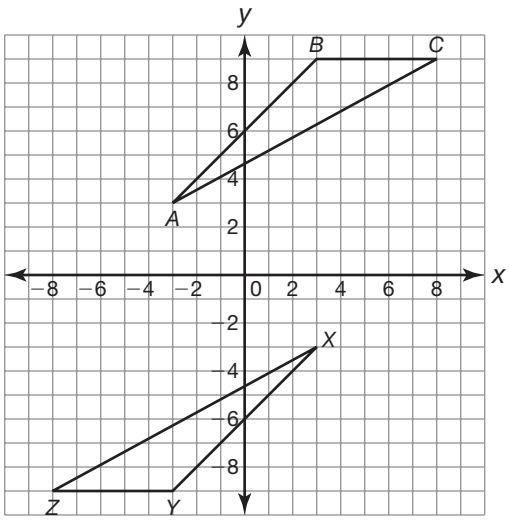
Sides Not Included

Angle-Angle-Side Congruence Theorem

Vocabulary

Describe how to prove the given triangles are congruent. Use the *Angle-Angle-Side Congruence Theorem* in your answer.

1.



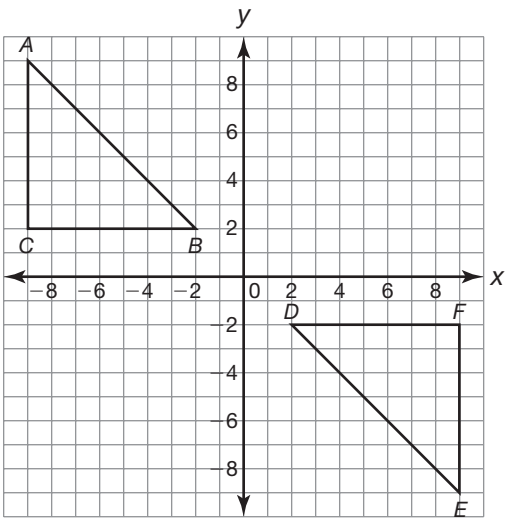
The Angle-Angle-Side Congruence Theorem states that if two angles and a non-included side of one triangle are congruent to the corresponding angles and the corresponding non-included side of a second triangle, then the triangles are congruent. In the triangles shown, $m\angle A = m\angle X = 16°$, and $m\angle B = m\angle Y = 135°$. The non-included side ($\overline{BC}$) of $\angle A$ *and* $\angle B$ is congruent to the corresponding non-included side ($\overline{YZ}$) of $\angle X$ *and* $\angle Y$, because $BC = YZ = 5$. Therefore, $\triangle ABC \cong \triangle XYZ$ according to the AAS Congruence Theorem.

5

Problem Set

Determine whether each set of given triangles are congruent by AAS. Use the Distance Formula and a protractor when necessary.

1. Determine whether $\triangle ABC$ is congruent to $\triangle DEF$ by AAS.



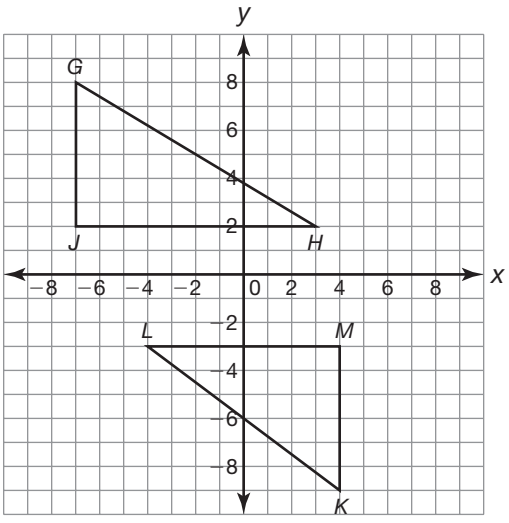
$m\angle A = m\angle D = 45°$

$m\angle B = m\angle E = 45°$

$BC = EF = 7$

The triangles are congruent by the AAS Congruence Theorem.

2. Determine whether $\triangle GHJ$ is congruent to $\triangle KLM$ by AAS.



$m\angle H = 31°, m\angle L = 37°$

$m\angle H \neq m\angle L$

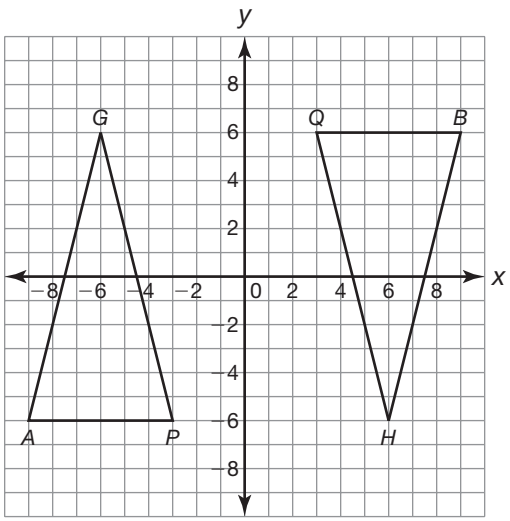
$m\angle J = m\angle M = 90°$

$GJ = KM = 6$

The triangles are not congruent.

Name _____ Date _____

3. Determine whether $\triangle AGP$ is congruent to $\triangle BHQ$ by AAS.



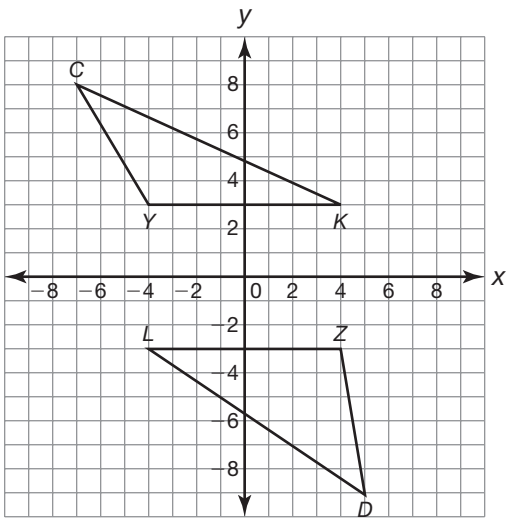
$m\angle G = m\angle H = 28°$

$m\angle A = m\angle B = 76°$

$AP = BQ = 6$

The triangles are congruent by the AAS Congruence Theorem.

4. Determine whether $\triangle CKY$ is congruent to $\triangle DLZ$ by AAS.



$m\angle C = 35°, m\angle D = 47°$

$m\angle C \neq m\angle D$

$m\angle K = 24°, m\angle L = 34°$

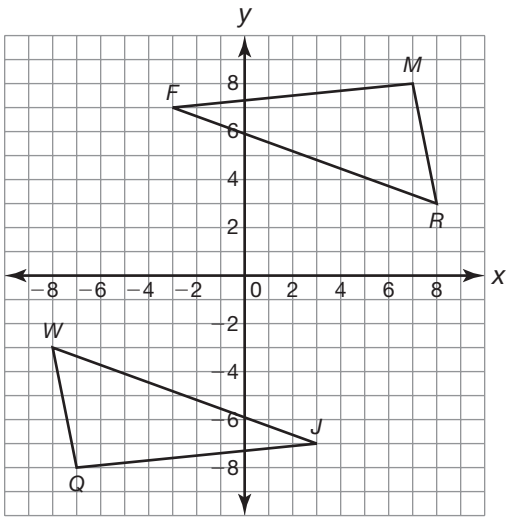
$m\angle K \neq m\angle L$

$KY = LZ = 8$

The triangles are not congruent.

5

5. Determine whether $\triangle FMR$ is congruent to $\triangle JQW$ by AAS.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$FM = \sqrt{(7 - (-3))^2 + (8 - 7)^2}$

$FM = \sqrt{10^2 + 1^2}$

$FM = \sqrt{100 + 1}$

$FM = \sqrt{101} \approx 10.05$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$JQ = \sqrt{(-7 - 3)^2 + (-8 - (-7))^2}$

$JQ = \sqrt{(-10)^2 + (-1)^2}$

$JQ = \sqrt{100 + 1}$

$JQ = \sqrt{101} \approx 10.05$

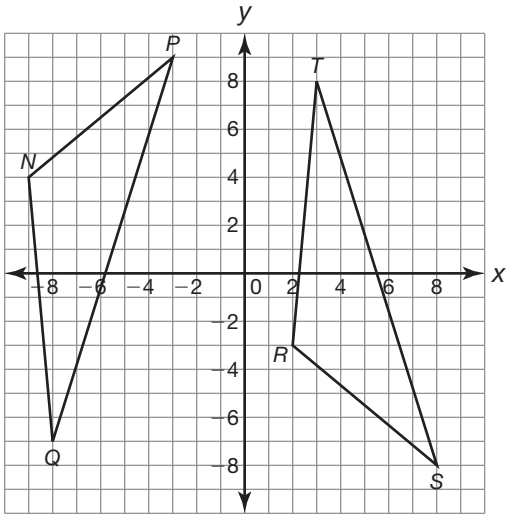
$FM = JQ$

$m\angle F = m\angle J = 26°$

$m\angle R = m\angle W = 59°$

The triangles are congruent by the AAS Congruence Theorem.

6. Determine whether $\triangle NPQ$ is congruent to $\triangle RST$ by AAS.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$NP = \sqrt{(-3 - (-9))^2 + (9 - 4)^2}$

$NP = \sqrt{6^2 + 5^2}$

$NP = \sqrt{36 + 25}$

$NP = \sqrt{61} \approx 7.81$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$RS = \sqrt{(8 - 2)^2 + (-8 - (-3))^2}$

$RS = \sqrt{6^2 + (-5)^2}$

$RS = \sqrt{36 + 25}$

$RS = \sqrt{61} \approx 7.81$

$NP = RS$

$m\angle N = m\angle R = 125°$

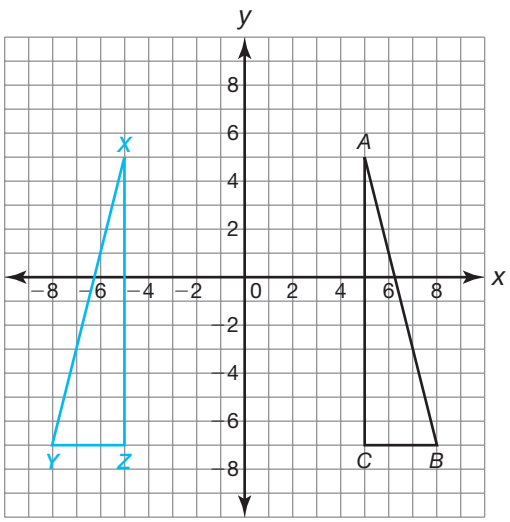
$m\angle Q = m\angle T = 23°$

The triangles are congruent by the AAS Congruence Theorem.

Name _____ Date _____

Perform the transformation described on each given triangle. Then, verify that the triangles are congruent by AAS. Use the Distance Formula and a protractor when necessary.

7. Reflect $\triangle ABC$ over the y-axis to form $\triangle XYZ$. Verify that $\triangle ABC \cong \triangle XYZ$ by AAS.



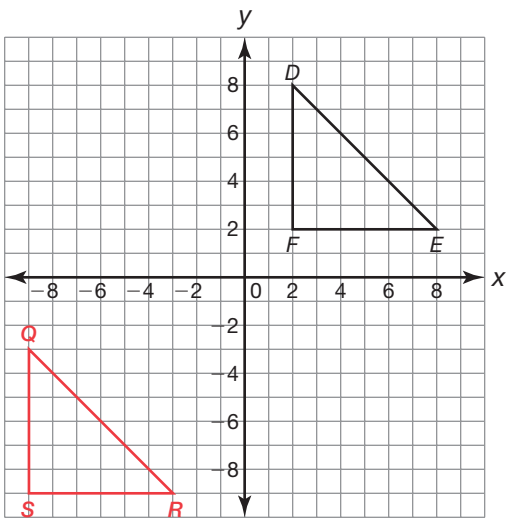
$m\angle B = m\angle Y = 76°$

$m\angle C = m\angle Z = 90°$

$AC = XZ = 12$

The triangles are congruent by the AAS Congruence Theorem.

8. Translate $\triangle DEF$ 11 units to the left and 11 units down to form $\triangle QRS$. Verify that $\triangle DEF \cong \triangle QRS$ by AAS.



$m\angle D = m\angle Q = 45°$

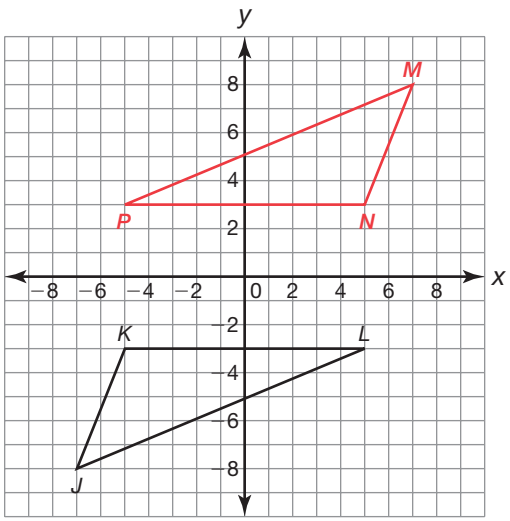
$m\angle E = m\angle R = 45°$

$EF = RS = 6$

The triangles are congruent by the AAS Congruence Theorem.

5

9. Rotate △*JKL* 180° counterclockwise about the origin to form △*MNP*. Verify that △*JKL* ≅ △*MNP* by AAS.



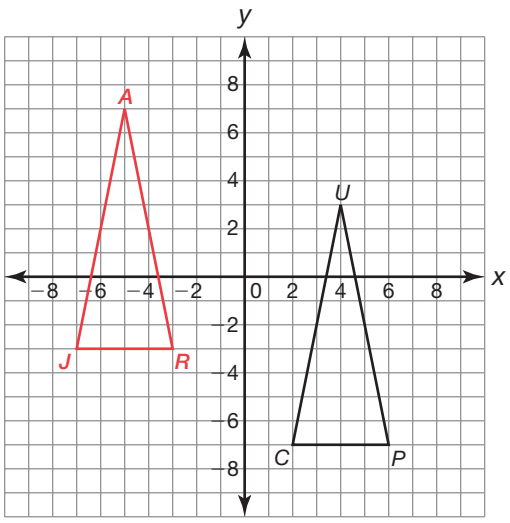
$m\angle J = m\angle M = 46°$

$m\angle K = m\angle N = 112°$

$KL = NP = 10$

The triangles are congruent by the AAS Congruence Theorem.

10. Translate △*CUP* 9 units to the left and 4 units up to form △*JAR*. Verify that △*CUP* ≅ △*JAR* by AAS.



$m\angle U = m\angle A = 23°$

$m\angle P = m\angle R = 79°$

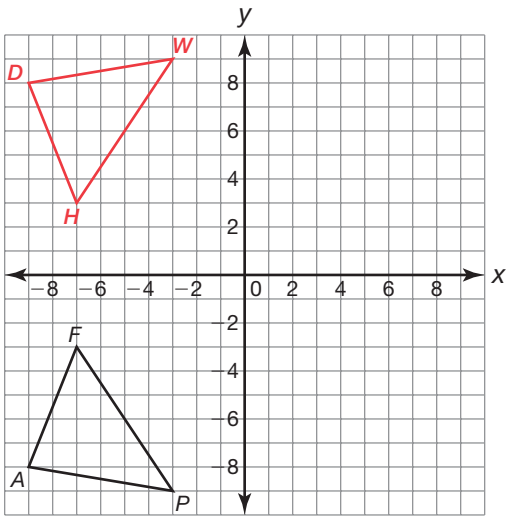
$CP = JR = 4$

The triangles are congruent by the AAS Congruence Theorem.

5

Name _____ Date _____

11. Reflect $\triangle AFP$ over the x-axis to form $\triangle DHW$. Verify that $\triangle AFP \cong \triangle DHW$ by AAS.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$AP = \sqrt{(-3 - (-9))^2 + (-9 - (-8))^2}$

$AP = \sqrt{6^2 + (-1)^2}$

$AP = \sqrt{36 + 1}$

$AP = \sqrt{37} \approx 6.08$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$DW = \sqrt{(-3 - (-9))^2 + (9 - 8)^2}$

$DW = \sqrt{6^2 + 1^2}$

$DW = \sqrt{36 + 1}$

$DW = \sqrt{37} \approx 6.08$

$AP = DW$

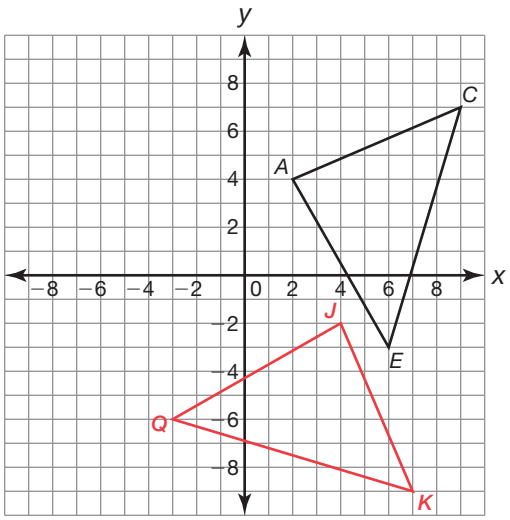
$m\angle A = m\angle D = 78°$

$m\angle F = m\angle H = 55°$

The triangles are congruent by the AAS Congruence Theorem.

5

12. Rotate $\triangle ACE$ 270° counterclockwise about the origin to form $\triangle JKQ$. Verify that $\triangle ACE \cong \triangle JKQ$ by AAS.



$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$AC = \sqrt{(9 - 2)^2 + (7 - 4)^2}$

$AC = \sqrt{7^2 + 3^2}$

$AC = \sqrt{49 + 9}$

$AC = \sqrt{58} \approx 7.62$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$JK = \sqrt{(7 - 4)^2 + (-9 - (-2))^2}$

$JK = \sqrt{3^2 + (-7)^2}$

$JK = \sqrt{9 + 49}$

$JK = \sqrt{58} \approx 7.62$

$AC = JK$

$m\angle A = m\angle J = 83°$

$m\angle E = m\angle Q = 46°$

The triangles are congruent by the AAS Congruence Theorem.

Determine the angle measure or side measure that is needed in order to prove that each set of triangles are congruent by AAS.

13. In $\triangle ANT$, $m\angle A = 30°$, $m\angle N = 60°$, and $NT = 5$. In $\triangle BUG$, $m\angle U = 60°$, and $UG = 5$.

$m\angle B = 30°$

14. In $\triangle BCD$, $m\angle B = 25°$, and $m\angle D = 105°$. In $\triangle RST$, $RS = 12$, $m\angle R = 25°$, and $m\angle T = 105°$.

$BC = 12$

15. In $\triangle EMZ$, $m\angle E = 40°$, $EZ = 7$, and $m\angle M = 70°$. In $\triangle DGP$, $DP = 7$, and $m\angle D = 40°$.

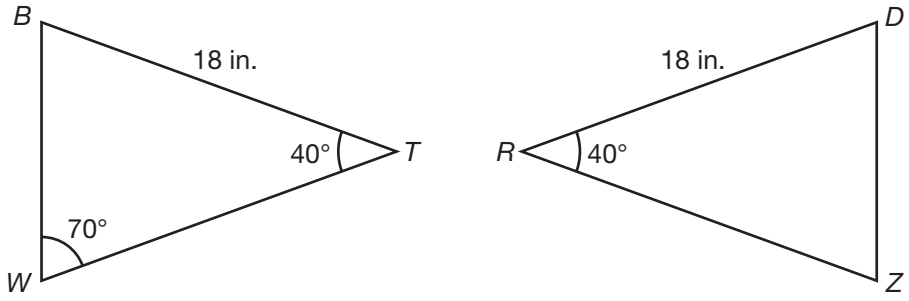
$m\angle G = 70°$

16. In $\triangle BMX$, $m\angle M = 90°$, $BM = 16$, and $m\angle X = 15°$. In $\triangle CNY$, $m\angle N = 90°$, and $m\angle Y = 15°$.

$CN = 16$

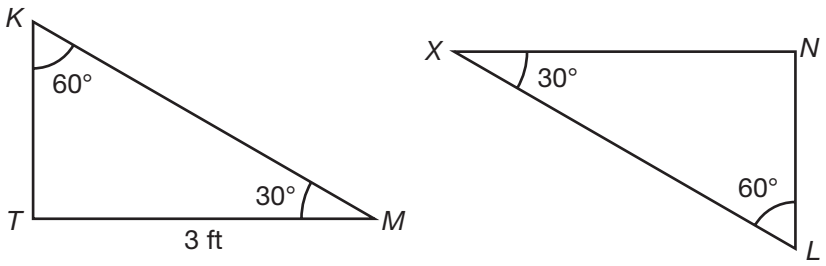
Name _____ Date _____

17.



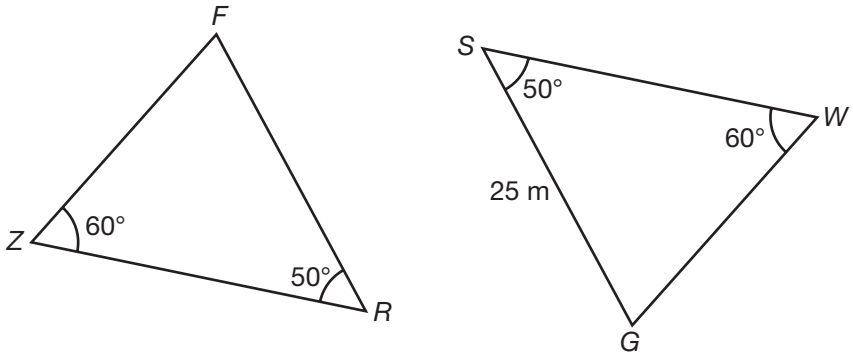
$m\angle Z = 70°$

18.



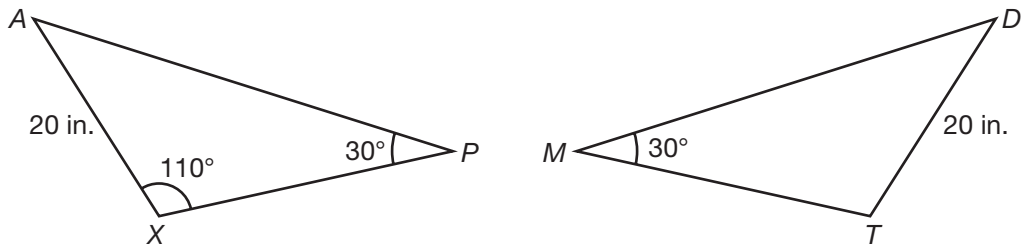
$XN = 3$ ft

19.



$FR = 25$ m

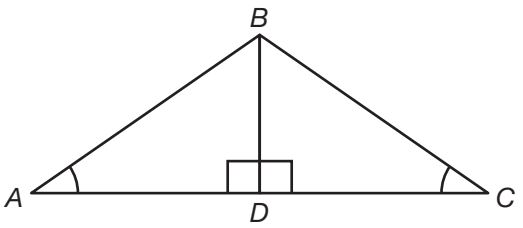
20.



$m\angle T = 110°$

Determine whether there is enough information to prove that each pair of triangles are congruent by ASA or AAS. Write the congruence statements to justify your reasoning.

21. $\triangle ABD \stackrel{?}{\cong} \triangle CBD$



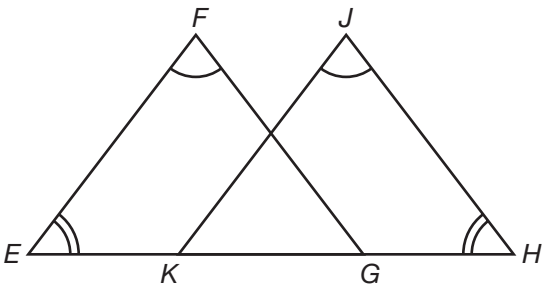
The triangles are congruent by AAS.

$\angle BAD \cong \angle BCD$

$\angle ADB \cong \angle CDB$

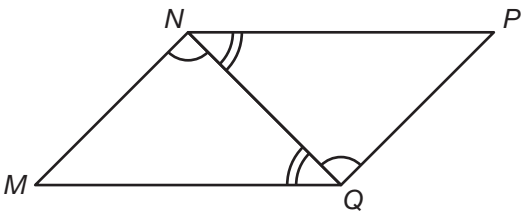
$\overline{BD} \cong \overline{BD}$

22. $\triangle EFG \stackrel{?}{\cong} \triangle HJK$



There is not enough information to determine whether the triangles are congruent by ASA or AAS.

23. $\triangle MNQ \stackrel{?}{\cong} \triangle PQN$



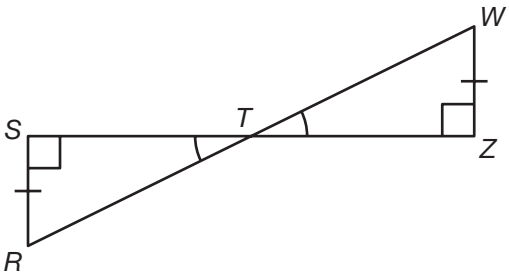
The triangles are congruent by ASA.

$\angle MNQ \cong \angle PQN$

$\overline{NQ} \cong \overline{QN}$

$\angle MQN \cong \angle PNQ$

24. $\triangle RST \stackrel{?}{\cong} \triangle WZT$



The triangles are congruent by AAS.

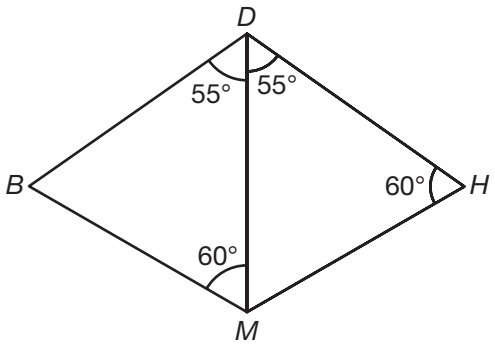
$\angle RTS \cong \angle WTZ$

$\angle RST \cong \angle WZT$

$\overline{RS} \cong \overline{WZ}$

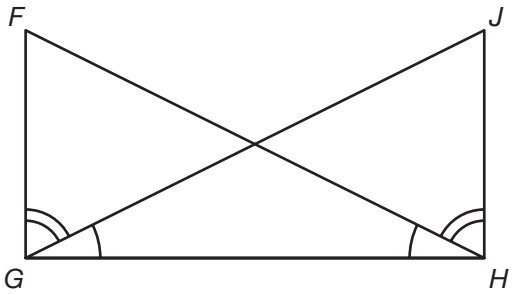
Name _____ Date _____

25. $\triangle BDM \stackrel{?}{\cong} \triangle MDH$



There is not enough information to determine whether the triangles are congruent by ASA or AAS.

26. $\triangle FGH \stackrel{?}{\cong} \triangle JHG$



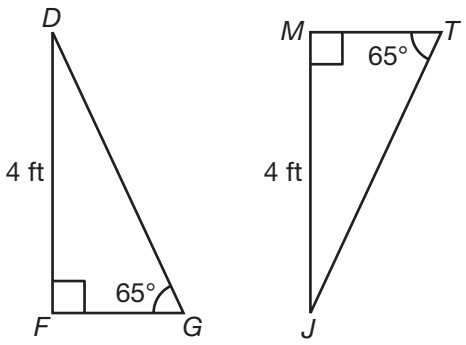
The triangles are congruent by ASA.

$\angle FGH \cong \angle JHG$

$\overline{GH} \cong \overline{HG}$

$\angle FHG \cong \angle JGH$

27. $\triangle DFG \stackrel{?}{\cong} \triangle JMT$



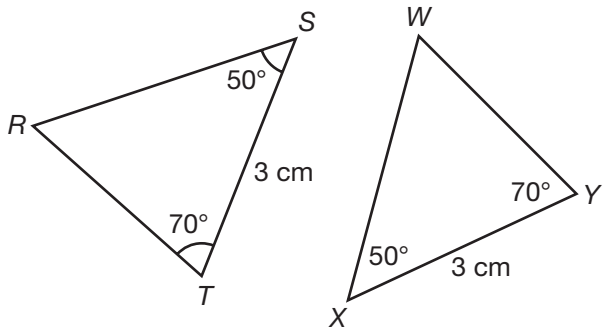
The triangles are congruent by AAS.

$\angle DGF \cong \angle JTM$

$\angle DFG \cong \angle JMT$

$\overline{DF} \cong \overline{JM}$

28. $\triangle RST \stackrel{?}{\cong} \triangle WXY$



The triangles are congruent by ASA.

$\angle RST \cong \angle WXY$

$\overline{ST} \cong \overline{XY}$

$\angle RTS \cong \angle WYX$

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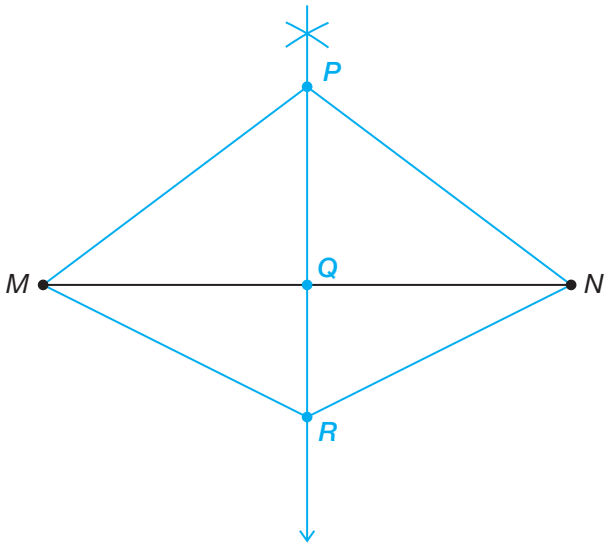
Any Other Theorems You Forgot to Mention?
Using Congruent Triangles

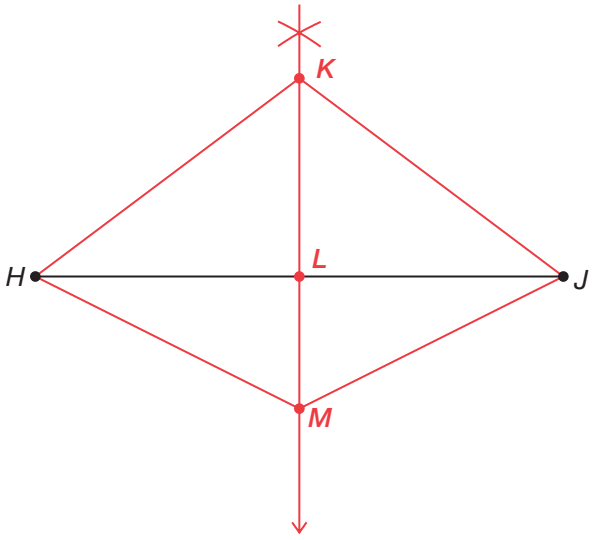
Problem Set

Construct a perpendicular bisector to each line segment. Connect points on the bisector on either side of the line segment to form the new line segment indicated.

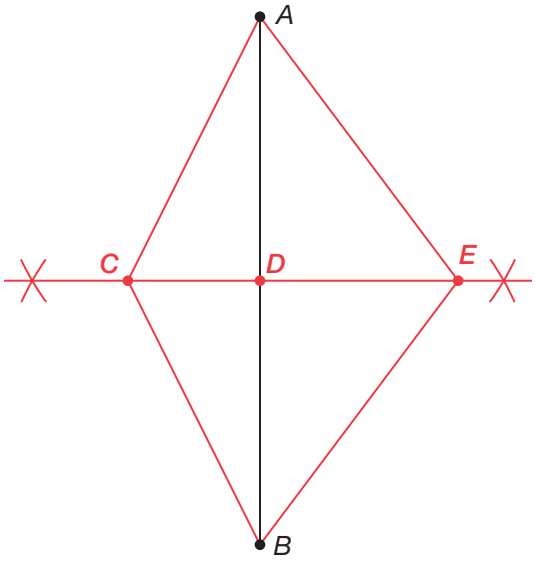
1. $\overline{MN}$ bisected by $\overline{PR}$ at point Q



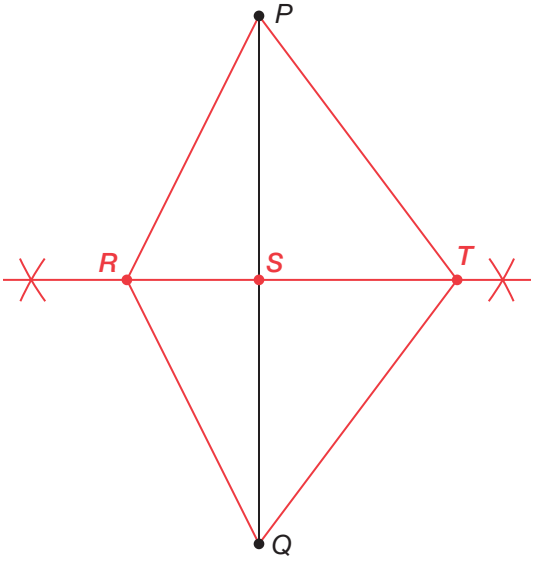
2. $\overline{HJ}$ bisected by $\overline{KM}$ at point L



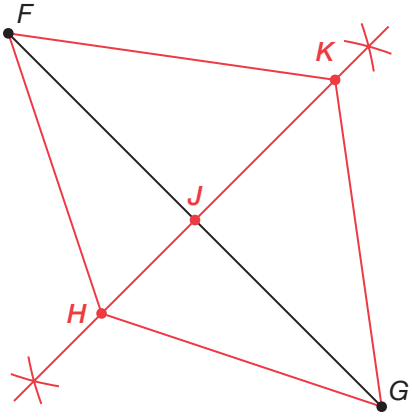
3. $\overline{AB}$ bisected by $\overline{CE}$ at point D



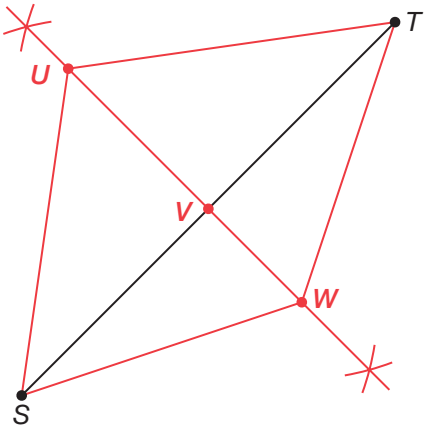
4. $\overline{PQ}$ bisected by $\overline{RT}$ at point S



5. $\overline{FG}$ bisected by $\overline{HK}$ at point J



6. $\overline{ST}$ bisected by $\overline{UW}$ at point V



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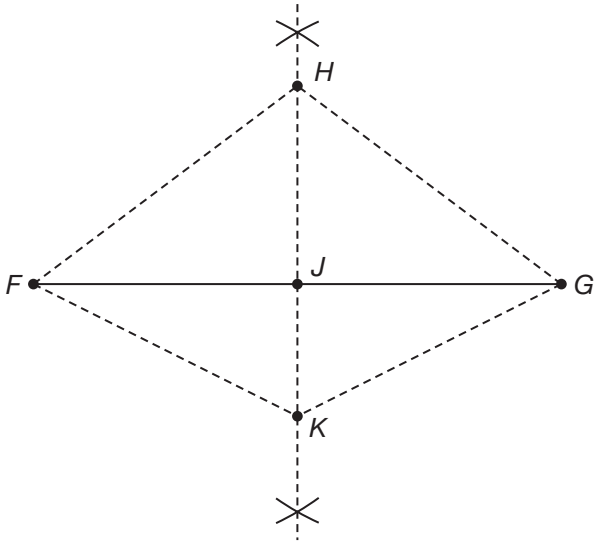
Use a triangle congruence theorem to complete each proof. Some of the statements and reasons are provided for you.

7. Given: $\overline{HK}$ is a perpendicular bisector of $\overline{FJ}$ at point J

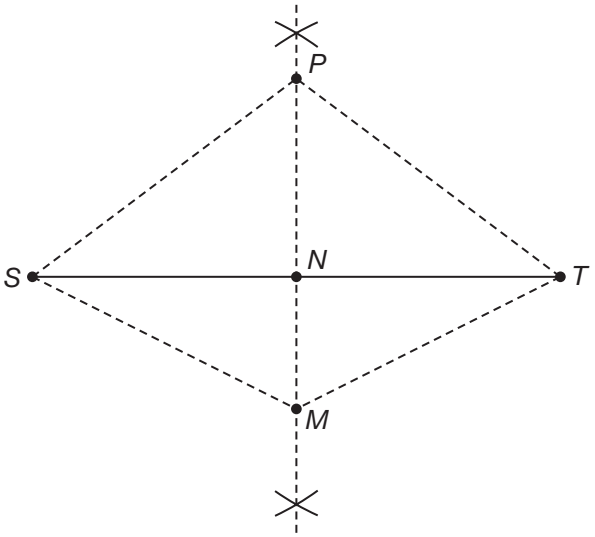
Prove: Point H is equidistant to points F and G



1. $\overline{FG} \perp \overline{HK}$, $\overline{HK}$ bisects $\overline{FG}$	1. Definition of perpendicular bisector
2. $\angle FJH$ and $\angle GJH$ are right angles.	2. Definition of perpendicular lines
3. $\angle FJH \cong \angle GJH$	3. All right angles are congruent.
4. $\overline{FJ} \cong \overline{GJ}$	4. Definition of bisect
5. $\overline{HJ} \cong \overline{HJ}$	5. Reflexive Property
6. $\triangle FJH \cong \triangle GJH$	6. SAS Congruence Theorem
7. $\overline{FH} \cong \overline{GH}$	7. Corresponding sides of congruent triangles are congruent
8. Point H is equidistant to points F and G	8. Definition of equidistant

8. Given: $\overline{PM}$ is a perpendicular bisector of $\overline{ST}$ at point N

Prove: Point M is equidistant to points S and T



1. $\overline{ST} \perp \overline{PM}$, $\overline{PM}$ bisects $\overline{ST}$	1. Definition of perpendicular bisector
2. $\angle SNM$ and $\angle TNM$ are right angles.	2. Definition of perpendicular lines
3. $\angle SNM \cong \angle TNM$	3. All right angles are congruent.
4. $\overline{SN} \cong \overline{TN}$	4. Definition of bisect
5. $\overline{MN} \cong \overline{MN}$	5. Reflexive Property
6. $\triangle SNM \cong \triangle TNM$	6. SAS Congruence Theorem
7. $\overline{SM} \cong \overline{TM}$	7. Corresponding sides of congruent triangles are congruent
8. Point M is equidistant to points S and T	8. Definition of equidistant

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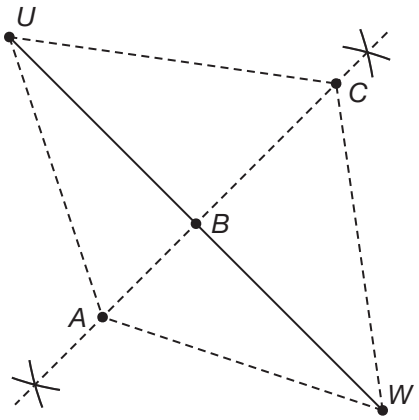
9. Given: $\overline{CA}$ is a perpendicular bisector of $\overline{UW}$ at point B

Prove: Point C is equidistant to points U and W



1. $\overline{UW} \perp \overline{CA}$, $\overline{CA}$ bisects $\overline{UW}$	1. Definition of perpendicular bisector
2. $\angle UBC$ and $\angle WBC$ are right angles.	2. Definition of perpendicular lines
3. $\angle UBC \cong \angle WBC$	3. All right angles are congruent.
4. $\overline{UB} \cong \overline{WB}$	4. Definition of bisect
5. $\overline{CB} \cong \overline{CB}$	5. Reflexive Property
6. $\triangle UBC \cong \triangle WBC$	6. SAS Congruence Theorem
7. $\overline{UC} \cong \overline{WC}$	7. Corresponding sides of congruent triangles are congruent
8. Point C is equidistant to points U and W	8. Definition of equidistant

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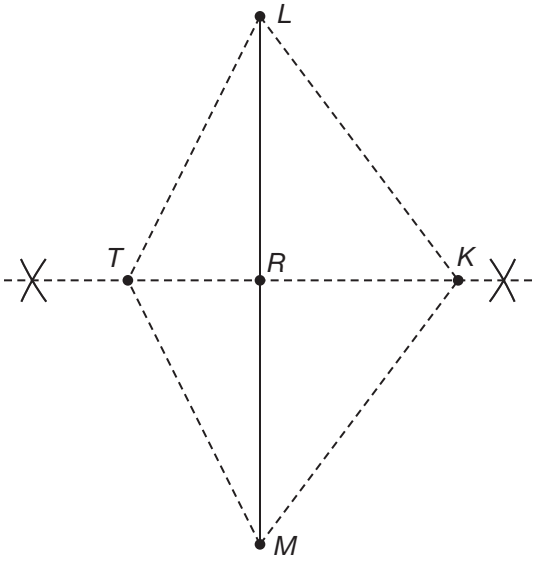
10. Given: $\overline{TK}$ is a perpendicular bisector of $\overline{LM}$ at point R

Prove: Point T is equidistant to points L and M



1. $\overline{LM} \perp \overline{TK}$, $\overline{TK}$ bisects $\overline{LM}$	1. Definition of perpendicular bisector
2. $\angle LRT$ and $\angle MRT$ are right angles.	2. Definition of perpendicular lines
3. $\angle LRT \cong \angle MRT$	3. All right angles are congruent.
4. $\overline{LR} \cong \overline{MR}$	4. Definition of bisect
5. $\overline{TR} \cong \overline{TR}$	5. Reflexive Property
6. $\triangle LRT \cong \triangle MRT$	6. SAS Congruence Theorem
7. $\overline{LR} \cong \overline{MT}$	7. Corresponding sides of congruent triangles are congruent
8. Point T is equidistant to points L and M	8. Definition of equidistant

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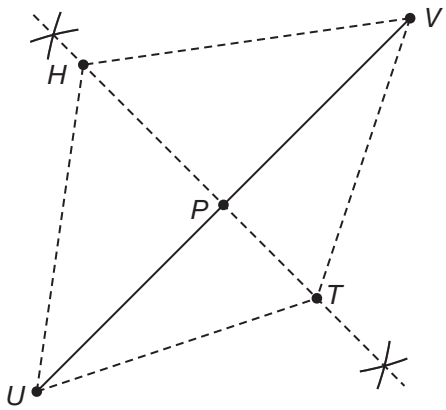
Name _____ Date _____

11. Given: $\overline{HT}$ is a perpendicular bisector of $\overline{UV}$ at point P

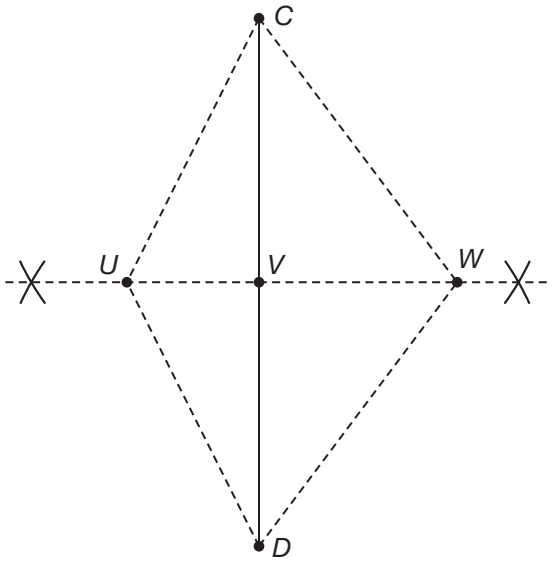
Prove: Point H is equidistant to points U and V



1. $\overline{UV} \perp \overline{HT}$, $\overline{HT}$ bisects $\overline{UV}$	1. Definition of perpendicular bisector
2. $\angle UPH$ and $\angle VPH$ are right angles.	2. Definition of perpendicular lines
3. $\angle UPH \cong \angle VPH$	3. All right angles are congruent.
4. $\overline{UP} \cong \overline{VP}$	4. Definition of bisect
5. $\overline{HP} \cong \overline{HP}$	5. Reflexive Property
6. $\triangle UPH \cong \triangle VPH$	6. SAS Congruence Theorem
7. $\overline{UH} \cong \overline{VH}$	7. Corresponding sides of congruent triangles are congruent
8. Point H is equidistant to points U and V	8. Definition of equidistant

12. Given: $\overline{UW}$ is a perpendicular bisector of $\overline{CD}$ at point V

Prove: Point U is equidistant to points C and D

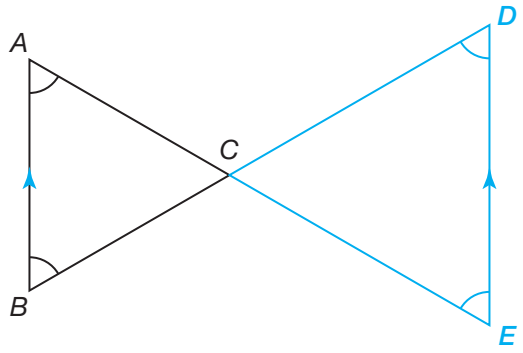


1. $CD \perp UW$, UW bisects CD	1. Definition of perpendicular bisector
2. $\angle CVU$ and $\angle DVU$ are right angles.	2. Definition of perpendicular lines
3. $\angle CVU \cong \angle DVU$	3. All right angles are congruent.
4. $\overline{CV} \cong \overline{DV}$	4. Definition of bisect
5. $\overline{UV} \cong \overline{UV}$	5. Reflexive Property
6. $\triangle CVU \cong \triangle DVU$	6. SAS Congruence Theorem
7. $\overline{CU} \cong \overline{DU}$	7. Corresponding sides of congruent triangles are congruent
8. Point U is equidistant to points C and D	8. Definition of equidistant

Name _____ Date _____

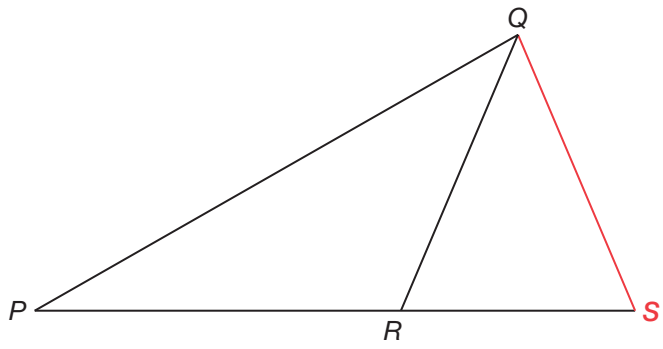
Complete each diagram to provide a counterexample that proves the indicated theorem does not work for congruent triangles. Explain your reasoning. A hint is provided in each case.

13. Angle-Angle-Angle (Hint: Use vertical angles.)



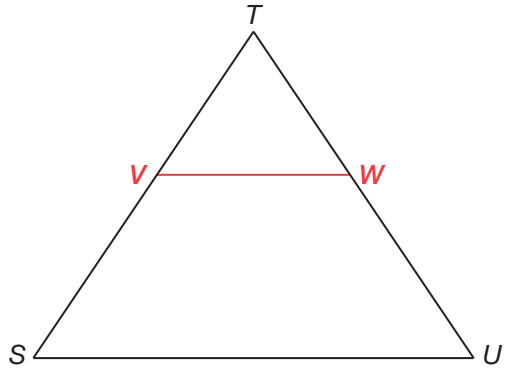
Extend $\overline{AC}$ and $\overline{BC}$, and connect points D and E so that $\overline{AB}$ is parallel to $\overline{DE}$. Since vertical angles are congruent, all three corresponding angles of the two triangles are congruent. The side lengths, however, are different, so $\triangle ABC$ is not congruent to $\triangle DEC$.

14. Side-Side-Angle (Hint: Draw a triangle that shares $\angle P$ with the given triangle.)



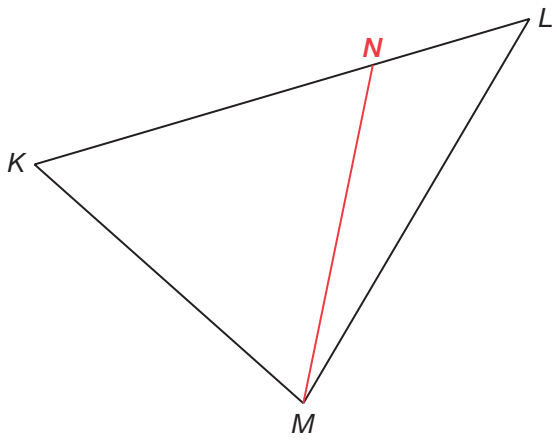
Angle P and $\overline{PQ}$ are the same for both triangles. We can draw $\overline{QS}$ the same length as $\overline{QR}$. Then $\triangle PQR$ and $\triangle PQS$ have side-side-angle congruency, but since $\angle QRS$ is not congruent to $\angle QSR$, the triangles are not congruent.

15. Angle-Angle-Angle (Hint: Draw a triangle that shares $\angle T$ with the given triangle.)



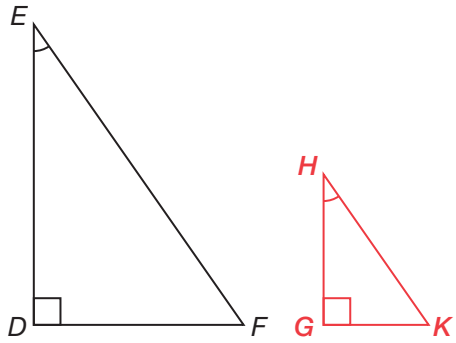
Draw $\overline{VW}$ parallel to $\overline{SU}$. Since alternative interior angles are congruent, $\angle V \cong \angle S$ and $\angle W \cong \angle U$. All three corresponding angles of the two triangles are congruent. The side lengths, however, are different, so $\triangle STU$ is not congruent to $\triangle VTW$.

16. Side-Side-Angle (Hint: Draw a triangle that shares $\angle L$ with the given triangle.)



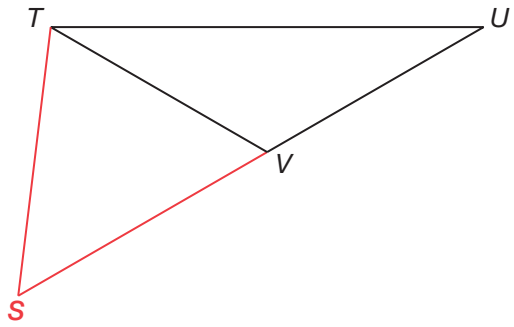
Angle L and $\overline{LM}$ are the same for both triangles. We can draw $\overline{MN}$ the same length as $\overline{KM}$. Then $\triangle LMK$ and $\triangle LMN$ have side-side-angle congruency, but since $\angle LMK$ is not congruent to $\angle LMN$, the triangles are not congruent.

17. Angle-Angle-Angle (Hint: Draw a triangle that has an angle with the same measure as $\angle E$.)



Draw $\triangle GHK$ such that $\angle G = 90°$ and $\angle H \cong \angle E$. Since right angles are congruent, $\angle D \cong \angle G$. Since the two triangles are two corresponding angles, we also know that $\angle F \cong \angle K$.All three corresponding angles of the two triangles are congruent. The side lengths, however, are different, so $\triangle DEF$ is not congruent to $\triangle GHK$.

18. Side-Side-Angle (Hint: Draw a triangle that shares $\angle U$ with the given triangle.)



Angle U and $\overline{TU}$ are the same for both triangles. We can draw $\overline{ST}$ the same length as $\overline{TV}$. Then $\triangle STU$ and $\triangle VTU$ have side-side-angle congruency, but since $\angle STU$ is not congruent to $\angle VTU$, the triangles are not congruent.

Name _____ Date _____

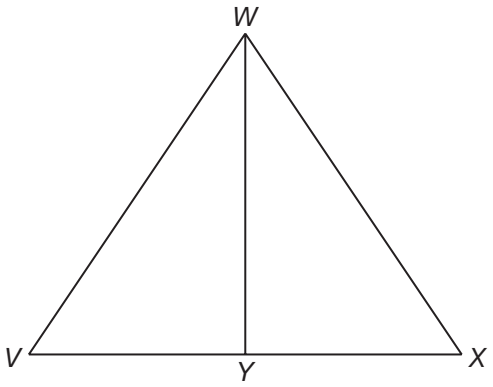
State the congruence theorem that proves the triangles in each diagram are congruent. If not enough information is given, name an example of information that could be given that you could use to prove congruency. Explain your reasoning.

19. Given: $\overline{VW} \cong \overline{XW}$

Prove: $\triangle VYW \cong \triangle XYW$

Not enough information is given.

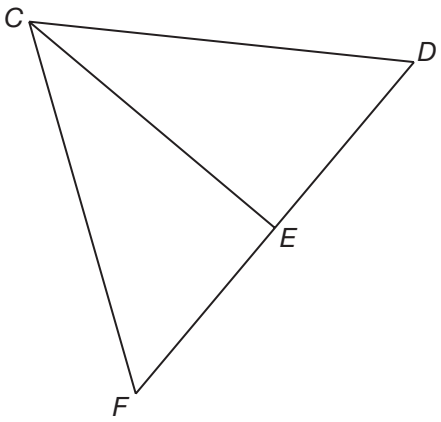
If $\angle VWY \cong \angle XWY$ is given, then $\triangle VYW \cong \triangle XYW$ by the SAS Triangle Congruence Theorem.



20. Given: $\overline{CE}$ is a perpendicular bisector of $\overline{FD}$

Prove: $\triangle FEC \cong \triangle DEC$

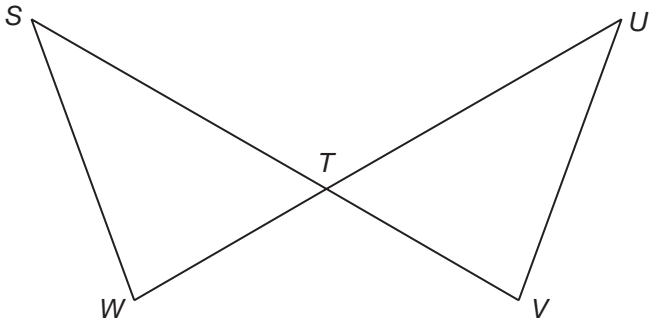
$\overline{CE} \cong \overline{DE}$ by the Reflexive Property. $\triangle FEC \cong \triangle DEC$ using the SAS Triangle Congruence Theorem.



21. Given: $\angle WST \cong \angle VUT, \overline{ST} \cong \overline{UT}$

Prove: $\triangle WST \cong \triangle VUT$

$\angle STW \cong \angle UTV$ because they are vertical angles. $\triangle WST \cong \triangle VUT$ using the ASA Triangle Congruence Theorem.

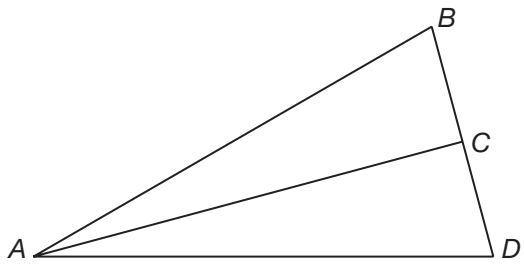


22. Given: $\triangle ABD$ is isosceles with $\overline{AB} \cong \overline{AD}$

Prove: $\triangle ABC \cong \triangle ADC$

Not enough information is given.

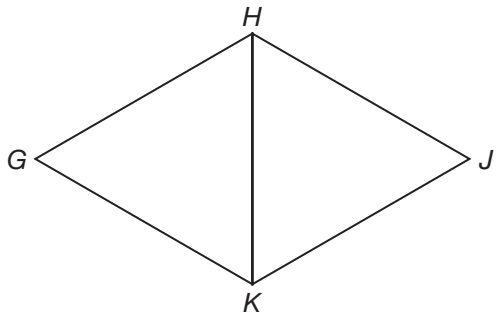
If $\angle BAC \cong \angle DAC$ is given, then $\triangle ABC \cong \triangle ADC$ by the SAS Triangle Congruence Theorem.



23. Given: $\overline{GH} \cong \overline{JK}$, $\overline{HJ} \cong \overline{KG}$

Prove: $\triangle GHK \cong \triangle JKH$

$\overline{HK} \cong \overline{HK}$ by the Reflexive Property. $\triangle GHK \cong \triangle JKH$ using the SSS Triangle Congruence Theorem.



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24. Given: $\overline{PT} \cong \overline{SR}$, $\angle PQT \cong \angle RQS$

Prove: $\triangle TPQ \cong \triangle SRQ$

Since right angles are congruent, $\angle PTQ \cong \angle RSQ$. $\triangle GHK \cong \triangle JKH$ using the AAS Triangle Congruence Theorem.