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Squares and Rectangles
Properties of Squares and Rectangles

Vocabulary

Define the term in your own words.

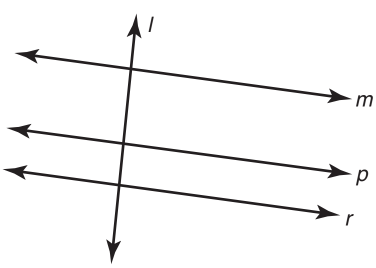
1. Explain the Perpendicular/Parallel Line Theorem in your own words.

   The Perpendicular/Parallel Line Theorem states that if two lines are perpendicular to the same line, then the two lines are parallel to each other.

Problem Set

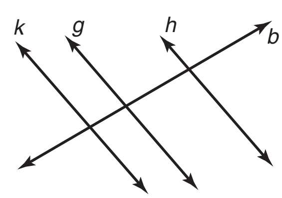
Use the given statements and the Perpendicular/Parallel Line Theorem to identify the pair of parallel lines in each figure.

1. Given: $l \perp m$ and $l \perp r$



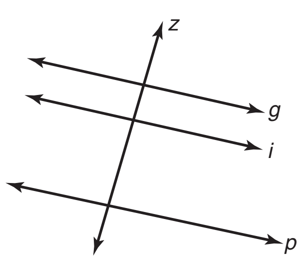
$m \parallel r$

2. $k \perp b$ and $g \perp b$



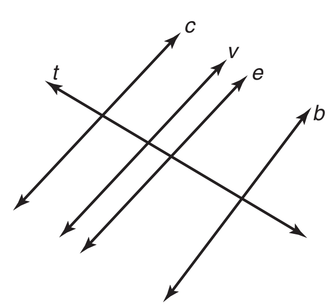
$k \parallel g$

3. Given: $z \perp g$ and $z \perp p$



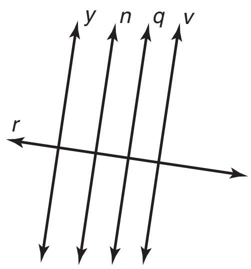
$g \parallel p$

4. Given: $c \perp t$ and $t \perp e$



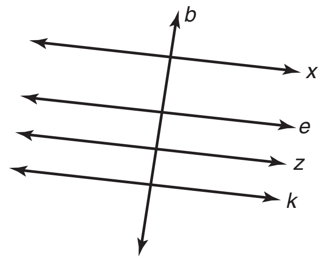
$c \parallel e$

5. Given: $n \perp r$ and $r \perp q$



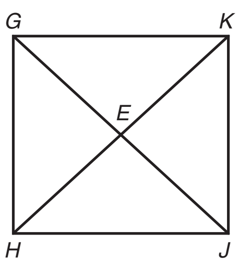
$n \parallel q$

6. Given: $b \perp x$ and $k \perp b$



$x \parallel k$

Complete each statement for square *GKJH*.



7. $\overline{GK} \cong \overline{KJ} \cong \overline{JH} \cong \overline{HG}$

8. $\angle KGH \cong \angle GHJ \cong \angle HJK \cong \angle JKG \cong \angle GEK \cong \angle GEH \cong \angle HEJ \cong \angle JEK$

9. $\angle GEK$, $\angle KGH$, $\angle GHJ$, $\angle HJK$, $\angle JKG$, $\angle GEH$, $\angle HEG$, and $\angle JEK$ are right angles.

10. $\overline{GK} \parallel \overline{HJ}$ and $\overline{GH} \parallel \overline{KJ}$

11. $\overline{GE} \cong \overline{JE} \cong \overline{HE} \cong \overline{KE}$

12. $\angle KGE \cong \angle EGH \cong \angle GHE \cong \angle EHJ \cong \angle HJE \cong \angle EJK \cong \angle JKE \cong \angle EKG$

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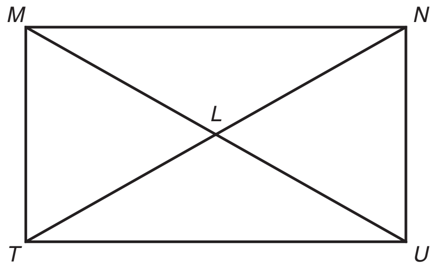
Complete each statement for rectangle *TMNU*.



13. $\overline{MN} \cong$ $\underline{\overline{TU}}$ and $\overline{MT} \cong$ $\underline{\overline{NU}}$

14. $\angle NMT \cong \angle$ $\underline{TUN}$ $\cong \angle$ $\underline{UNM}$ $\cong \angle$ $\underline{MTU}$

15. $\angle MTU$, $\angle$ $\underline{TUN}$, $\angle$ $\underline{UNM}$, and $\angle$ $\underline{NMT}$ are right angles.

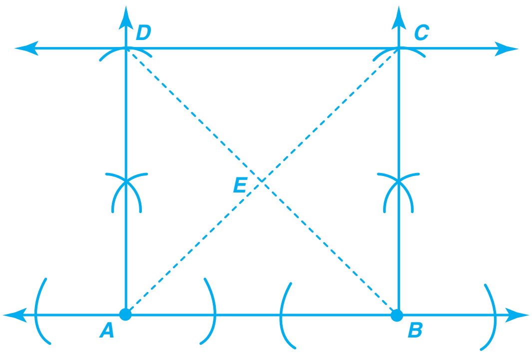
16. $\overline{MN} \parallel$ $\underline{\overline{TU}}$ and $\overline{MT} \parallel$ $\underline{\overline{NU}}$

17. $\overline{MU} \cong$ $\underline{\overline{NT}}$

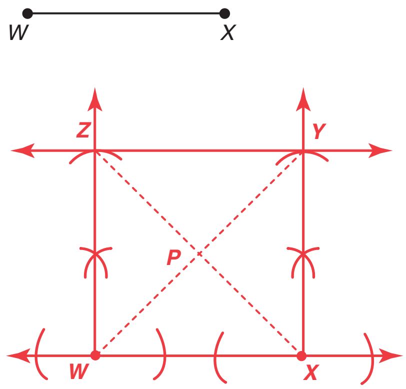
18. $\overline{ML} \cong$ $\underline{\overline{UL}}$ $\cong$ $\underline{\overline{TL}}$ $\cong$ $\underline{\overline{TU}}$

Construct each quadrilateral using the given information.

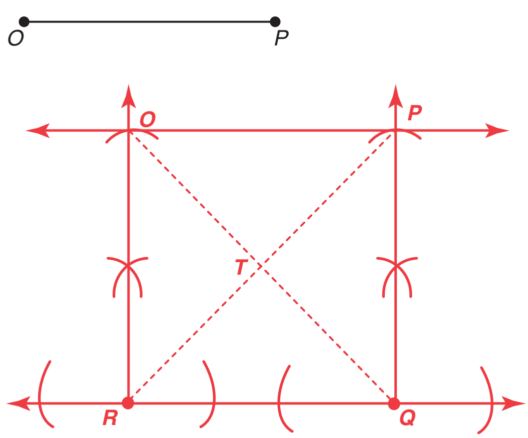
19. Use $\overline{AB}$ to construct square *ABCD* with diagonals $\overline{AC}$ and $\overline{BD}$ intersecting at point *E*.



20. Use $\overline{WX}$ to construct square $WXYZ$ with diagonals $\overline{WY}$ and $\overline{XZ}$ intersecting at point P.



21. Use $\overline{OP}$ to construct square $OPQR$ with diagonals $\overline{OQ}$ and $\overline{PR}$ intersecting at point T.



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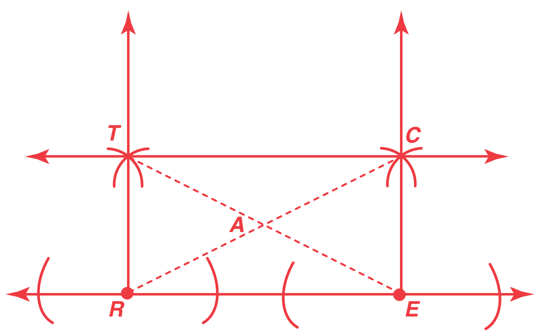
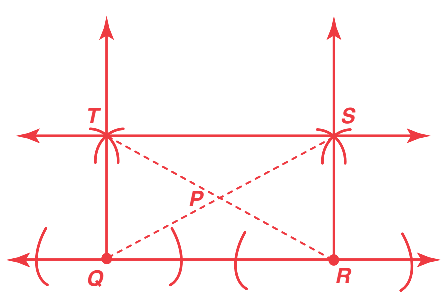
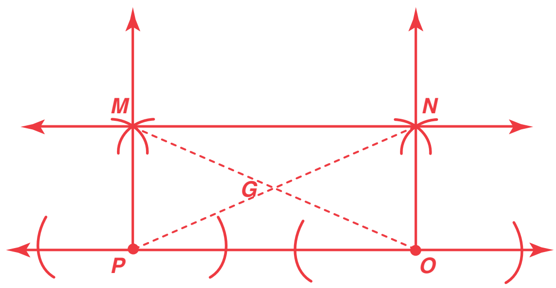
22. Use $\overline{RE}$ to construct rectangle *RECT* with diagonals $\overline{RC}$ and $\overline{ET}$ intersecting at point *A*. Do not construct a square.



23. Use $\overline{QR}$ to construct rectangle *QRST* with diagonals $\overline{QS}$ and $\overline{RT}$ intersecting at point *P*. Do not construct a square.

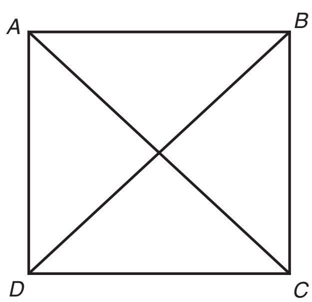


24. Use $\overline{MN}$ to construct rectangle *MNOP* with diagonals $\overline{MO}$ and $\overline{NP}$ intersecting at point *G*. Do not construct a square.



Create each proof.

25. Write a paragraph proof to prove $\overline{AC} \cong \overline{BD}$ in square *ABCD*.



You are given square *ABCD* with diagonals $\overline{AC}$ and $\overline{DB}$. By definition of a square, $\angle ADC$ and $\angle BCD$ are right angles. Because all right angles are congruent, you can conclude that $\angle ADC \cong \angle BCD$. Also by definition of a square, $\overline{AD} \cong \overline{BC}$. By the Reflexive Property, $\overline{DC} \cong \overline{DC}$. Therefore, $\triangle ADC \cong \triangle BCD$ by the SAS Congruence Theorem. So, $\overline{AC} \cong \overline{BD}$ by CPCTC.

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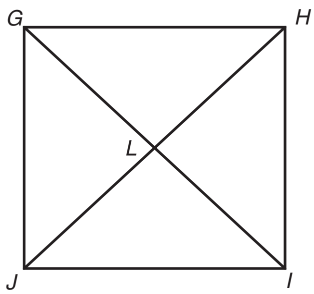
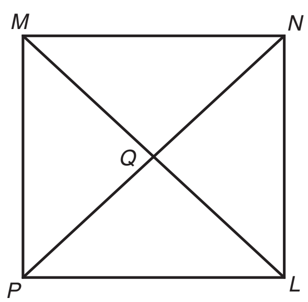
26. Write a paragraph proof to prove $\overline{GL} \cong \overline{IL}$ and $\overline{HL} \cong \overline{JL}$ in square *GHIJ*.



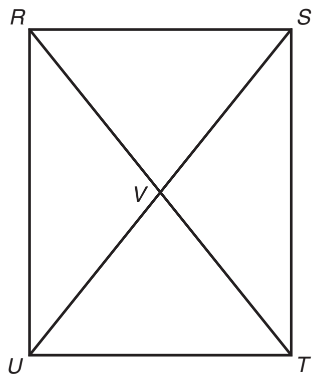
You are given square *GHIJ* with diagonals $\overline{GI}$ and $\overline{JH}$ intersecting at point *L*. By definition of a square, $\overline{GH} \cong \overline{JI}$. Also, $\overline{GH} \parallel \overline{JI}$, because opposite sides of a square are parallel. Because $\angle HGI$ and $\angle GIJ$ are alternate interior angles to the parallel lines, it can be determined that $\angle HGI \cong \angle GIJ$ by the Alternate Interior Angle Theorem. It also follows that $\angle GLH$ and $\angle JLI$ are vertical angles, so $\angle GLH \cong \angle JLI$ by the Vertical Angle Theorem. Therefore, $\triangle GHL \cong \triangle IJL$ by the AAS Congruence Theorem. So, $\overline{GL} \cong \overline{IL}$ and $\overline{HL} \cong \overline{JL}$ by CPCTC.

27. Create a two-column proof to prove $\overline{ML} \perp \overline{NP}$ in square *MNLP*.



Statements	Reasons
1. Square *MNLP* with diagonals $\overline{ML}$ and $\overline{NP}$ intersecting at point *Q*	1. Given
2. $\overline{MN} \cong \overline{PM}$	2. Definition of a square
3. $\overline{PQ} \cong \overline{QN}$	3. Diagonals of a square bisect each other
4. $\overline{MQ} \cong \overline{MQ}$	4. Reflexive Property
5. $\triangle PMQ \cong \triangle NMQ$	5. SSS Congruence Theorem
6. $\angle PQM$ and $\angle NQM$ are supplementary.	6. Definition of Linear Pair
7. $\angle PQM \cong \angle MQN$	7. CPCTC
8. $\angle PQM$ and $\angle MQN$ are right angles.	8. If two angles are supplementary and congruent, then they are right angles.
9. $\overline{ML} \perp \overline{NP}$	9. Definition of perpendicular lines

28. Create a two-column proof to prove $\overline{RT} \cong \overline{SU}$ in rectangle *RSTU*.



Statements	Reasons
1. Rect *RSTU* with diagonals $\overline{US}$ and $\overline{RT}$ intersecting at point *V*	1. Given
2. $\angle RUT$ and $\angle STU$ are right angles.	2. Definition of a rectangle
3. $\angle RUT \cong \angle STU$	3. All right angles are congruent.
4. $\overline{UT} \cong \overline{UT}$	4. Reflexive Property
5. $\overline{RU} \cong \overline{ST}$	5. Opposite sides of a rectangle are congruent
6. $\triangle URT \cong \triangle TSU$	6. SAS Congruence Theorem
7. $\overline{RT} \cong \overline{SU}$	7. CPCTC

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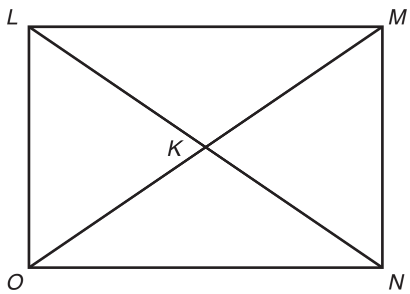
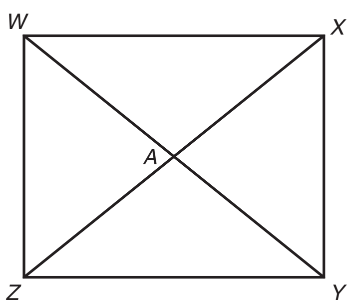
29. Create a two-column proof to prove $\overline{LK} \cong \overline{KN}$ and $\overline{OK} \cong \overline{KM}$ in rectangle *LMNO*.



Statements	Reasons
1. Rect *LMNO* with diagonals $\overline{LN}$ and $\overline{OM}$ intersecting at point *K*	1. Given
2. $\overline{LO} \cong \overline{MN}$	2. Opposite sides of a rectangle are congruent.
3. $\angle LKO \cong \angle MKN$	3. Vertical Angle Theorem
4. $\overline{LM}$ perpendicular to $\overline{LO}$ and $\overline{LO}$ perpendicular to $\overline{ON}$	4. Definition of perpendicular lines
5. $\overline{LO}$ parallel to $\overline{MN}$	5. Perpendicular/Parallel Line Theorem
6. $\angle OLN \cong \angle MNL$ $\angle LOM \cong \angle NMO$	6. Alternate Interior Angle Theorem
7. $\triangle OLK \cong \triangle MNK$	7. AAS Congruence Theorem
8. $\overline{LK} \cong \overline{NK}$ $\overline{OK} \cong \overline{MK}$	8. CPCTC

30. Write a paragraph proof to prove opposite sides are parallel in rectangle *WXYZ*.



You are given rectangle *WXYZ*. By definition of a rectangle, $\angle ZWX$, $\angle WXY$, $\angle XYZ$, and $\angle YZW$ are right angles. By definition of perpendicular lines, it follows that $\overline{WX} \perp \overline{XY}$, $\overline{XY} \perp \overline{ZY}$, $\overline{ZY} \perp \overline{WZ}$, and $\overline{WZ} \perp \overline{WX}$. Therefore, by the Perpendicular/Parallel Line Theorem, $\overline{WX} \parallel \overline{ZY}$ and $\overline{WZ} \parallel \overline{XY}$, or opposite sides of the rectangle are parallel.

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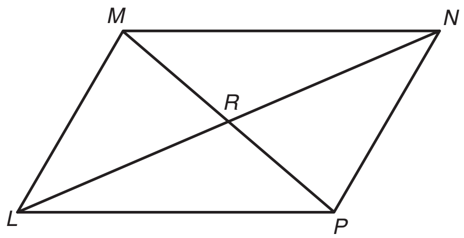
Parallelograms and Rhombi
Properties of Parallelograms and Rhombi

Vocabulary

1. Explain how the Parallelogram/Congruent-Parallel Side Theorem can be used to determine if a quadrilateral is a parallelogram.
   If a quadrilateral has one pair of opposite sides congruent and parallel then the Parallelogram/Congruent-Parallel Side Theorem states that the quadrilateral is a parallelogram.

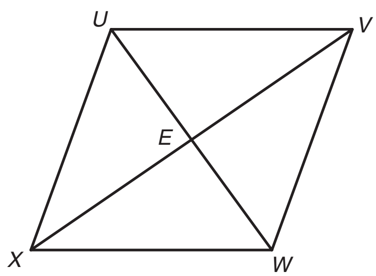
Problem Set

Complete each statement for parallelogram *MNPL*.



1. $\overline{MN} \cong$ $\underline{\overline{LP}}$ and $\overline{ML} \cong$ $\underline{\overline{NP}}$
2. $\angle NML \cong \angle$ $\underline{LPN}$ and $\angle MLP \cong \angle$ $\underline{MNP}$
3. $\overline{MN} \parallel$ $\underline{\overline{LP}}$ and $\overline{ML} \parallel$ $\underline{\overline{NP}}$
4. $\overline{MR} \cong$ $\underline{\overline{RP}}$ and $\overline{LR} \cong$ $\underline{\overline{RN}}$

Complete each statement for rhombus *UVWX*.



5. $\overline{UV} \cong \underline{\overline{VW}} \cong \underline{\overline{WX}} \cong \underline{\overline{XU}}$

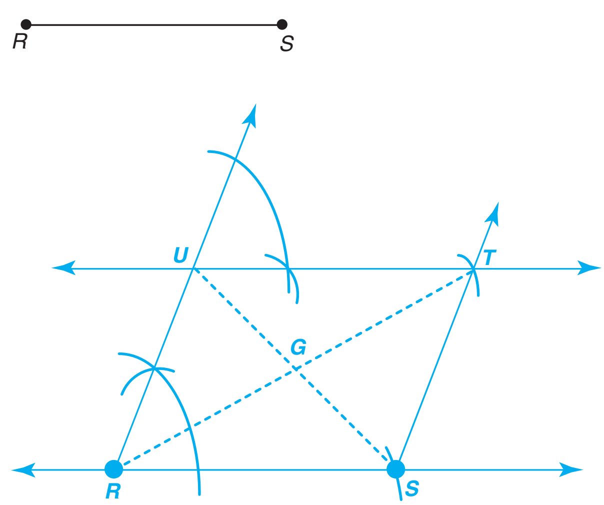
6. $\angle UVW \cong \angle \underline{UXW}$ and $\angle XUV \cong \angle \underline{VWX}$

7. $\overline{UV} \parallel \underline{\overline{XW}}$ and $\overline{UX} \parallel \underline{\overline{VW}}$

8. $\overline{UE} \cong \underline{\overline{EW}}$ and $\overline{XE} \cong \underline{\overline{EV}}$

Construct each quadrilateral using the given information.

9. Use $\overline{RS}$ to construct parallelogram *RSTU* with diagonals $\overline{RT}$ and $\overline{SU}$ intersecting at point *G*.



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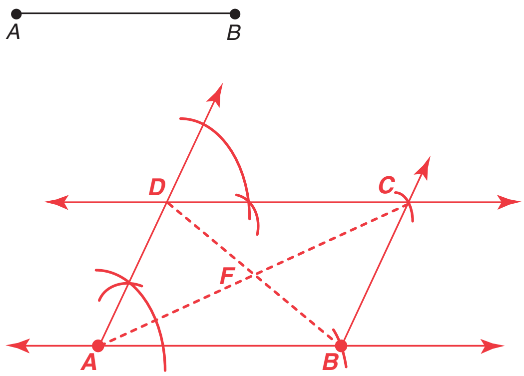
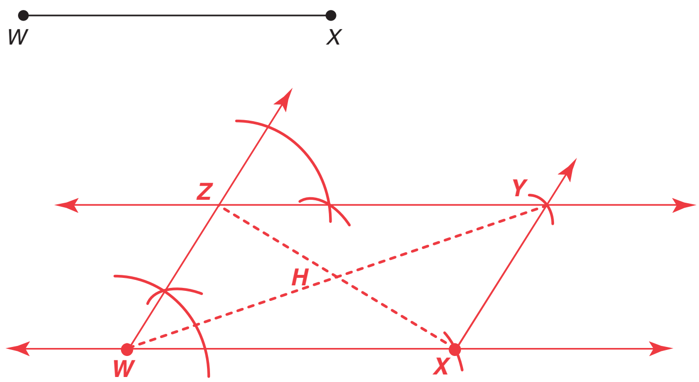
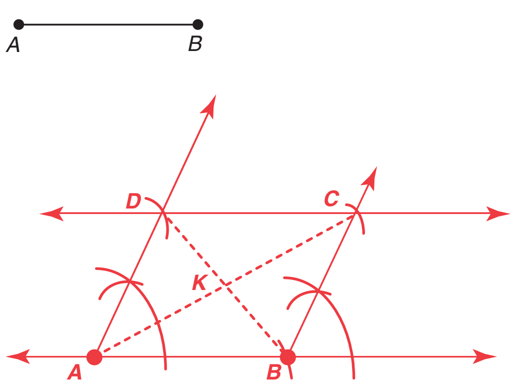
10. Use $\overline{AB}$ to construct parallelogram *ABCD* with diagonals $\overline{AC}$ and $\overline{BD}$ intersecting at point *F*.



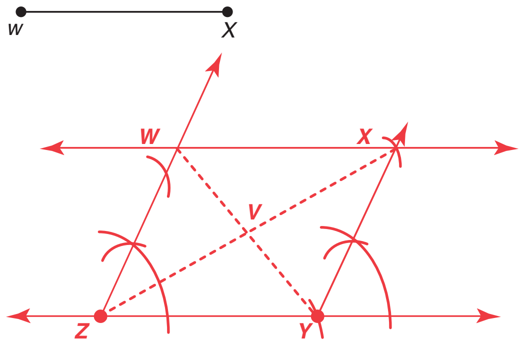
11. Use $\overline{WX}$ to construct parallelogram *WXYZ* with diagonals $\overline{WY}$ and $\overline{XZ}$ intersecting at point *H*.



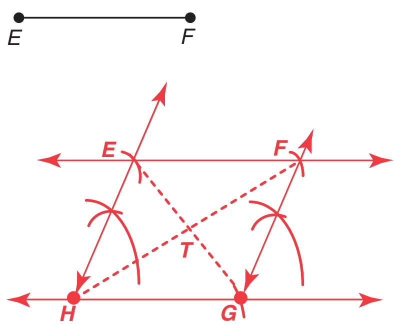
12. Use $\overline{AB}$ to construct rhombus *ABCD* with diagonals $\overline{AC}$ and $\overline{BD}$ intersecting at point *K*. Do not construct a square.



13. Use $\overline{WX}$ to construct rhombus $WXYZ$ with diagonals $\overline{WY}$ and $\overline{XZ}$ intersecting at point V. Do not construct a square.

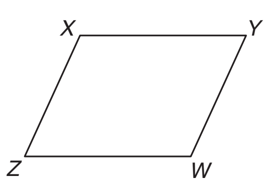


14. Use $\overline{EF}$ to construct rhombus $EFGH$ with diagonals $\overline{EG}$ and $\overline{FH}$ intersecting at point T. Do not construct a square.



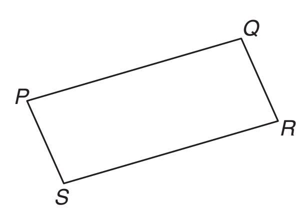
Determine the missing statement needed to prove each quadrilateral is a parallelogram by the Parallelogram/Congruent-Parallel Side Theorem.

15. $\overline{XY} \parallel \overline{ZW}$



$\overline{XY} \cong \overline{ZW}$

16. $\overline{PS} \cong \overline{QR}$



$\overline{PS} \parallel \overline{QR}$

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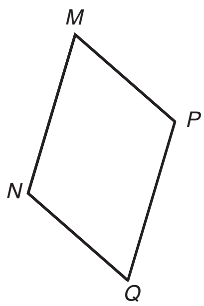
17. $\overline{MN} \cong \overline{PQ}$

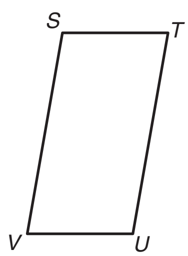


$\overline{MN} \parallel \overline{PQ}$

18. $\overline{CF} \parallel \overline{DE}$

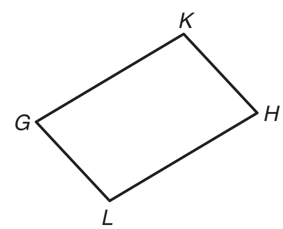
$\overline{CF} \cong \overline{DE}$

19. $\overline{ST} \parallel \overline{VU}$



$\overline{ST} \cong \overline{VU}$

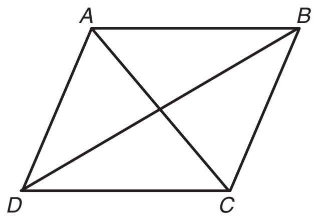
20. $\overline{KG} \cong \overline{HL}$



$\overline{KG} \parallel \overline{HL}$

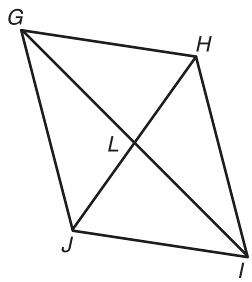
Create each proof.

21. Write a paragraph proof to prove $\angle BAD \cong \angle DCB$ in parallelogram *ABCD*.



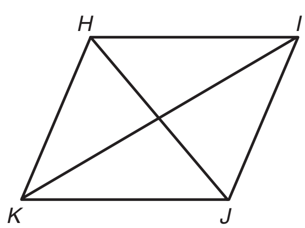
We are given parallelogram *ABCD* with diagonals $\overline{AC}$ and $\overline{DB}$. By definition of a parallelogram, $\overline{AB} \parallel \overline{CD}$ and $\overline{AD} \parallel \overline{BC}$. So, $\angle ABD \cong \angle CDB$ and $\angle ADB \cong \angle DBC$ by the Alternate Interior Angle Theorem. By the Reflexive Property, $\overline{DB} \cong \overline{DB}$. Therefore, $\triangle ABD \cong \triangle CDB$ by the ASA Congruence Theorem. So, $\angle BAD \cong \angle DCB$ by CPCTC.

22. Create a two-column proof to prove $\overline{GL} \cong \overline{IL}$ and $\overline{JL} \cong \overline{HL}$ in parallelogram *GHIJ*.



Statements	Reasons
1. Parallelogram *GHIJ* with diagonals $\overline{GI}$ and $\overline{HJ}$ intersecting at point *L*	1. Given
2. $\overline{GH} \parallel \overline{JI}$ and $\overline{GJ} \parallel \overline{HI}$	2. Definition of a parallelogram
3. $\angle HGI \cong \angle GIJ$ and $\angle GHJ \cong \angle HJI$	3. Alternate Interior Angles Theorem
4. $\overline{GH} \cong \overline{JI}$	4. Opposite sides of a parallelogram are congruent.
5. $\triangle HGL \cong \triangle JIL$	5. ASA Congruence Theorem
6. $\overline{GL} \cong \overline{IL}$ and $\overline{JL} \cong \overline{HL}$	6. CPCTC

23. Write a paragraph proof to prove opposite sides are congruent in parallelogram *HIJK*.



We are given parallelogram *HIJK* with diagonals $\overline{HJ}$ and $\overline{KI}$. By definition of a parallelogram, $\overline{HI} \parallel \overline{KJ}$ and $\overline{HK} \parallel \overline{IJ}$. By the Alternate Interior Angle Theorem, $\angle JHK \cong \angle HJI$ and $\angle IHJ \cong \angle HJK$. By the Reflexive Property, $\overline{HJ} \cong \overline{HJ}$. Therefore, $\triangle KHJ \cong \triangle IJH$ by the Angle Side Angle Congruence Theorem. It follows that $\overline{HI} \cong \overline{KJ}$ and $\overline{HK} \cong \overline{IJ}$ by CPCTC, or opposite sides of the parallelogram are congruent.

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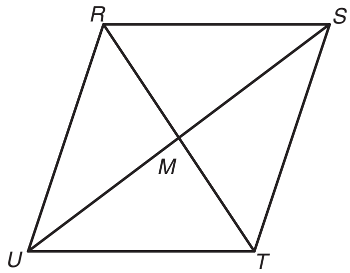
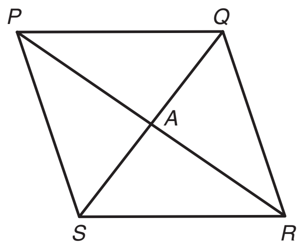
24. Create a two-column proof to prove $\overline{RT} \perp \overline{SU}$ in rhombus $RSTU$.



Statements	Reasons
1. Rhombus $RSTU$ with diagonals $\overline{RT}$ and $\overline{SU}$ intersecting at point M.	1. Given
2. $\overline{RS} \cong \overline{RU}$	2. Definition of a rhombus
3. $\overline{UM} \cong \overline{SM}$	3. Diagonals of a rhombus bisect each other
4. $\overline{RM} \cong \overline{RM}$	4. Reflexive Property
5. $\triangle RMU \cong \triangle RMS$	5. SSS Congruence Theorem
6. $\angle RMU$ and $\angle RMS$ are supplementary.	6. Definition of Linear Pair
7. $\angle RMU \cong \angle RMS$	7. CPCTC
8. $\angle RMU$ and $\angle RMS$ are right angles.	8. If two angles are supplementary and congruent then they are right angles.
9. $\overline{RT} \perp \overline{SU}$	9. Definition of perpendicular

25. Create a two-column proof to prove $\angle QPR \cong \angle SPR$, $\angle QRP \cong \angle SRP$, $\angle PSQ \cong \angle RSQ$, and $\angle PQS \cong \angle RQS$ in rhombus $PQRS$.



Statements	Reasons
1. Rhombus $PQRS$ with diagonals $\overline{PR}$ and $\overline{SQ}$ intersecting at point A	1. Given
2. $\overline{PQ} \cong \overline{QR} \cong \overline{RS} \cong \overline{SP}$	2. Definition of a rhombus
3. $\overline{PR} \cong \overline{PR}$	3. Reflexive Property
4. $\triangle PQR \cong \triangle PSR$	4. SSS Congruence Theorem
5. $\overline{QS} \cong \overline{QS}$	5. Reflexive Property
6. $\triangle QPS \cong \triangle QRS$	6. SSS Congruence Theorem
7. $\angle QPR \cong \angle SPR$, $\angle QRP \cong \angle SRP$, $\angle PSQ \cong \angle RSQ$, and $\angle PQS \cong \angle RQS$	7. CPCTC

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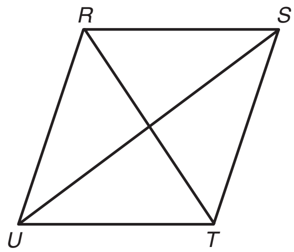
26. Create a two-column proof to prove rhombus *RSTU* is a parallelogram.



Statements	Reasons
1. Rhombus *RSTU* with diagonals $\overline{RT}$ and $\overline{SU}$	1. Given
2. $\overline{RS} \cong \overline{ST} \cong \overline{TU} \cong \overline{UR}$	2. Definition of a rhombus
3. $\overline{TR} \cong \overline{TR}$	3. Reflexive Property
4. $\triangle RUT \cong \triangle TSR$	4. SSS Congruence Theorem
5. $\angle SRT \cong \angle UTR$	5. CPCTC
6. $\overline{RS} \parallel \overline{UT}$	6. Alternate Interior Angle Converse Theorem
7. *RSTU* is a parallelogram.	7. Parallelogram/Congruent-Parallel Side Theorem

Use the given information to answer each question.

27. Tommy drew a quadrilateral. He used a protractor to measure all four angles of the quadrilateral. How many pairs of angles must be congruent for the quadrilateral to be a parallelogram? Explain.

Opposite angles are congruent in a parallelogram, so both pairs of opposite angles must be congruent.

28. Khyree cut a quadrilateral out of a piece of cardstock, but is not sure if the figure is a parallelogram or a rhombus. He measures the lengths of the opposite sides and determines them to be congruent. He measures the opposite angles of the quadrilateral and determines them also to be congruent. He measures one angle and is able to determine that the quadrilateral is a rhombus. What angle did he measure? Explain.

Khyree must have measured the angle that is formed by the diagonals. If that angle is a right angle then the quadrilateral must be a rhombus.

29. Penny makes the following statement: "Every rhombus is a parallelogram." Do you agree? Explain.

All rhombi have the properties of a parallelogram, so every rhombus must be a parallelogram. Penny is correct.

30. Sally plans to make the base of her sculpture in the shape of a rhombus. She cuts out four pieces of wood to create a mold for concrete. The pieces of wood are the following lengths: 5 inches, 5 inches, 3 inches, and 3 inches. Will the base of Sally's sculpture be a rhombus? Explain.

No. A rhombus has four congruent sides. If Sally makes the base of her sculpture with the four pieces of wood she has cut, all four sides of the quadrilateral will not be the same length.

31. Ronald has a picture in the shape of a quadrilateral that he cut out of a magazine. How could Ronald use a ruler to prove that the picture is a parallelogram?

He could measure the lengths of the four sides of the quadrilateral. If opposite sides are the same length then the quadrilateral is a parallelogram.

32. Three angles of a parallelogram have the following measures: 58°, 122°, and 58°. What is the measure of the fourth angle? How do you know?

Opposite angles are congruent in a parallelogram. Because there is already one pair of angles that each measure 58°, the other pair of angles must each measure 122°. The measure of the fourth angle is 122°.

Name ____ Date ______________

Kites and Trapezoids
Properties of Kites and Trapezoids

Vocabulary

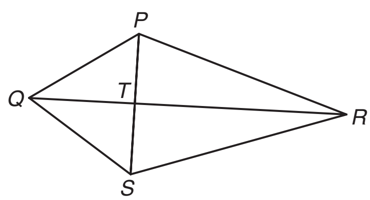
Write the term from the box that best completes each statement.

base angles of a trapezoid	biconditional statement
midsegment	isosceles trapezoid

1. The base angles of a trapezoid are either pair of angles of a trapezoid that share a base as a common side.
2. A(n) isosceles trapezoid is a trapezoid with congruent non-parallel sides.
3. A(n) biconditional statement is a statement that contains *if and only if*.
4. The midsegment of a trapezoid is a segment formed by connecting the midpoints of the legs of the trapezoid.

Problem Set

Complete each statement for kite *PRSQ*.



1. $\overline{PQ} \cong \overline{QS}$ and $\overline{PR} \cong \overline{SR}$
2. $\angle QPR \cong \angle QSR$
3. $\overline{PT} \cong \overline{ST}$
4. $\angle PQT \cong \angle TQS$ and $\angle PRT \cong \angle TRS$

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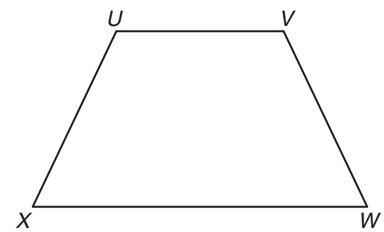
Complete each statement for trapezoid *UVWX*.



5. The bases are $\overline{UV}$ and $\overline{WX}$.

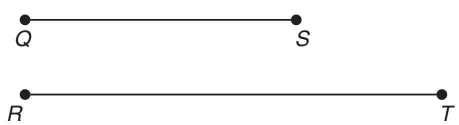
6. The pairs of base angles are $\angle VUX$ and $\angle WVU$, and $\angle UXW$ and $\angle XWV$.

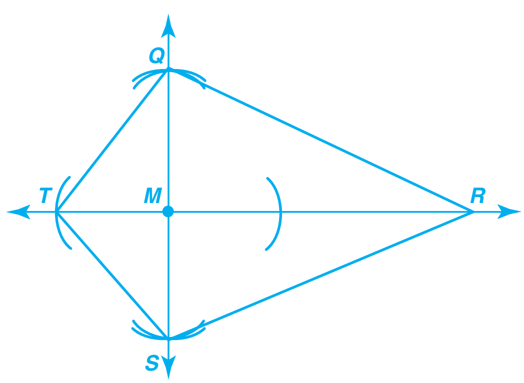
7. The legs are $\overline{UX}$ and $\overline{VW}$.

8. The vertices are *V*, *U*, *X*, and *W*.

Construct each quadrilateral using the given information.

9. Construct kite *QRST* with diagonals $\overline{QS}$ and $\overline{RT}$ intersecting at point *M*.





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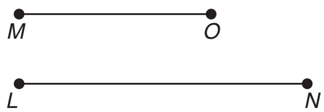
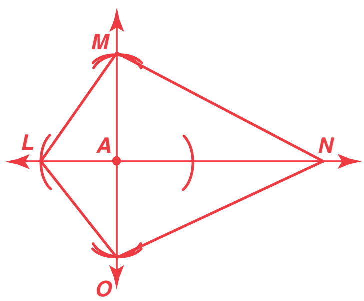
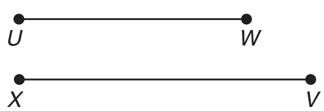
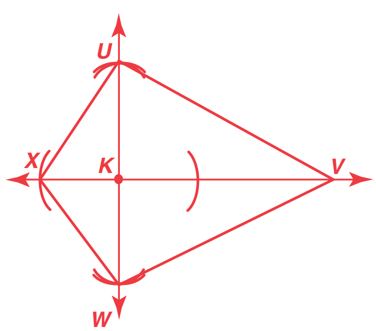
10. Construct kite *LMNO* with diagonals $\overline{MO}$ and $\overline{LN}$ intersecting at point *A*.



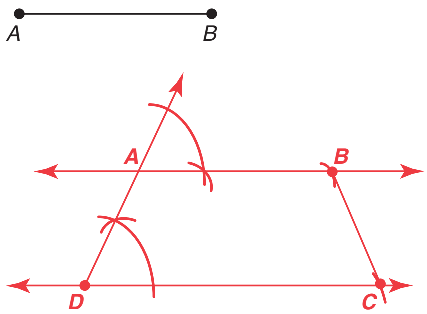


11. Construct kite *UVWX* with diagonals $\overline{UW}$ and $\overline{XV}$ intersecting at point *K*.

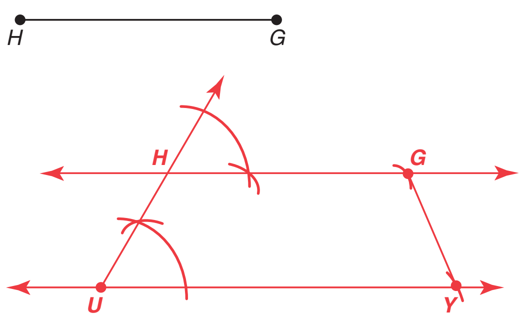




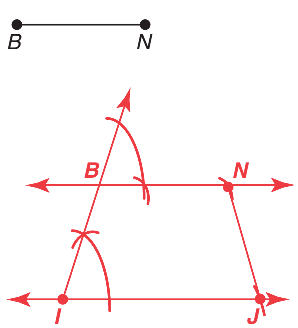
12. Construct trapezoid *ABCD* with $\overline{AB}$ as a base.



13. Construct trapezoid *HGYU* with $\overline{HG}$ as a base.



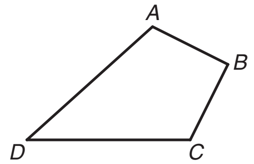
14. Construct trapezoid *BNJI* with $\overline{BN}$ as a base.



Name ______________________________ Date ______________

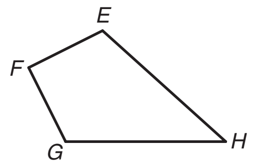
Use the given figure to answer each question.

15. The figure shown is a kite with $\angle DAB \cong \angle DCB$. Which sides of the kite are congruent?



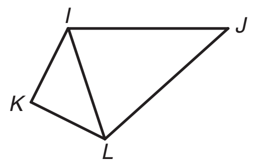
$\overline{AB}$ and $\overline{CB}$ are congruent.
$\overline{AD}$ and $\overline{CD}$ are congruent.

16. The figure shown is a kite with $\overline{FG} \cong \overline{FE}$. Which of the kite's angles are congruent?



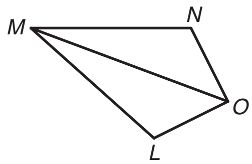
$\angle E$ and $\angle G$ are congruent.

17. Given that *IJLK* is a kite, what kind of triangles are formed by diagonal $\overline{IL}$?



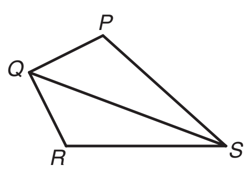
Triangle *IKL* and triangle *IJL* are both isosceles triangles.

18. Given that *LMNO* is a kite, what is the relationship between the triangles formed by diagonal $\overline{MO}$?



Triangles *MNO* and *MLO* are congruent.

19. Given that *PQRS* is a kite, which angles are congruent?

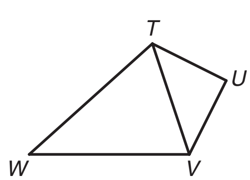


$\angle QPS$ and $\angle QRS$ are congruent.

$\angle RQS$ and $\angle PQS$ are congruent.

$\angle RSQ$ and $\angle PSQ$ are congruent.

20. Given that *TUVW* is a kite, which angles are congruent?



$\angle UTV$ and $\angle UVT$ are congruent.

$\angle WTV$ and $\angle WVT$ are congruent.

$\angle UTW$ and $\angle UVW$ are congruent.

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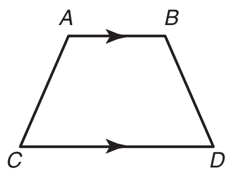
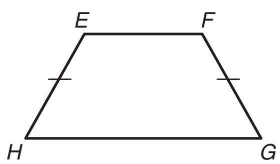
Use the given figure to answer each question.

21. The figure shown is an isosceles trapezoid with $\overline{AB} \parallel \overline{CD}$. Which sides are congruent?



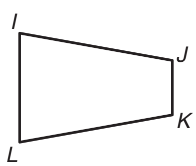
$\overline{AC}$ and $\overline{BD}$ are congruent.

22. The figure shown is an isosceles trapezoid with $\overline{EH} \cong \overline{FG}$. Which sides are parallel?



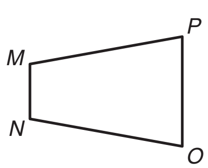
$\overline{EF}$ and $\overline{HG}$ are parallel.

23. The figure shown is an isosceles trapezoid with $\overline{IJ} \cong \overline{KL}$. What are the bases?



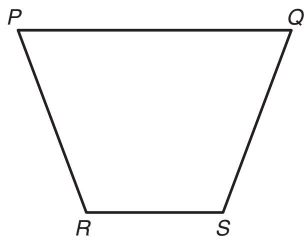
The bases are $\overline{IL}$ and $\overline{JK}$.

24. The figure shown is an isosceles trapezoid with $\overline{MP} \cong \overline{NO}$. What are the pairs of base angles?



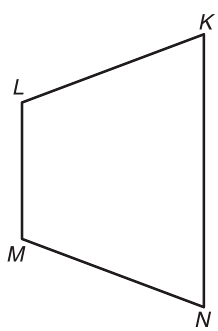
$\angle N$ and $\angle M$ are a pair of base angles.
$\angle O$ and $\angle P$ are a pair of base angles.

25. The figure shown is an isosceles trapezoid with $\overline{PQ} \parallel \overline{RS}$. Which sides are congruent?



$\overline{PR} \cong \overline{QS}$

26. The figure shown is an isosceles trapezoid with $\overline{LM} \parallel \overline{KN}$. What are the pairs of base angles?

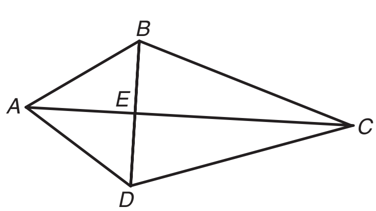


$\angle L$ and $\angle M$ are a pair of base angles

$\angle K$ and $\angle N$ are a pair of base angles

Create each proof.

27. Write a paragraph proof to prove $\angle ABC \cong \angle ADC$ in kite $ABCD$.



You are given kite $ABCD$ with diagonals $\overline{BD}$ and $\overline{AC}$ intersecting at point E. By definition of a kite, we know that $\overline{AB} \cong \overline{AD}$ and $\overline{BC} \cong \overline{CD}$. By the Reflexive Property, you know that $\overline{AC} \cong \overline{AC}$. Therefore, $\triangle ABC \cong \triangle ADC$ by the SSS Congruence Theorem. So, $\angle ABC \cong \angle ADC$ by CPCTC.

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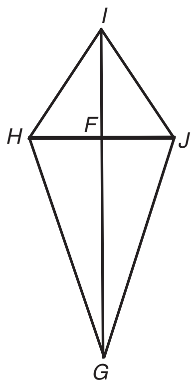
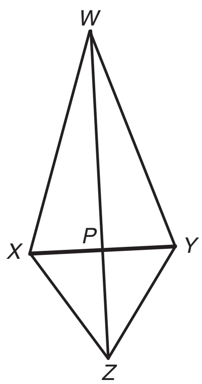
28. Write a two-column proof to prove $\overline{HF} \cong \overline{JF}$ in kite $GHIJ$.



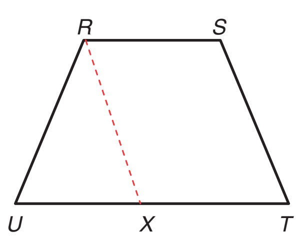
Statements	Reasons
1. Kite $GHIJ$ with diagonals $\overline{HJ}$ and $\overline{GI}$ intersecting at point F	1. Given
2. $\overline{GH} \cong \overline{GJ}$ and $\overline{IH} \cong \overline{IJ}$	2. Definition of a kite
3. $\overline{GI} \cong \overline{GI}$	3. Reflexive Property
4. $\triangle GHI \cong \triangle GJI$	4. SSS Congruence Theorem
5. $\angle HGF \cong \angle JGF$	5. CPCTC
6. $\overline{GF} \cong \overline{GF}$	6. Reflexive Property
7. $\triangle GHF \cong \triangle GJF$	7. SAS Congruence Theorem
8. $\overline{HF} \cong \overline{JF}$	8. CPCTC

29. Write a paragraph proof to prove $\overline{WZ}$ bisects $\angle XWY$ and $\angle XZY$ in kite $WYZX$.



You are given kite $WYZX$ with diagonals $\overline{XY}$ and $\overline{WZ}$ intersecting at point P. By definition of a kite, we know that $\overline{WX} \cong \overline{WY}$ and $\overline{XZ} \cong \overline{YZ}$. By the Reflexive Property, you know that $\overline{WZ} \cong \overline{WZ}$. Therefore, $\triangle WXZ \cong \triangle WYZ$ by the SSS Congruence Theorem. So, $\angle XWZ \cong \angle YWZ$ and $\angle XZW \cong \angle YZW$ by CPCTC. By definition of a bisector, $\overline{WZ}$ bisects $\angle XWY$ and $\angle XZY$.

30. Write a paragraph proof to prove $\angle U \cong \angle T$ in isosceles trapezoid $RSTU$.



You are given isosceles trapezoid $RSTU$, and by the definition of a trapezoid, $\overline{RS} \parallel \overline{UT}$. You can construct a segment, $\overline{RX}$, which is parallel to $\overline{ST}$. Because opposite sides RS and UT are parallel, quadrilateral $RSTX$ is a parallelogram, and $\overline{RX} \cong \overline{ST}$. Because the trapezoid is isosceles, $\overline{RU} \cong \overline{ST}$, and by the Transitive Property, $\overline{RX} \cong \overline{RU}$. So, $\triangle RUX$ is isosceles. Because $\triangle RUX$ is isosceles, the base angles are congruent, and $\angle RUX \cong \angle RXU$. Because $\overline{RS} \parallel \overline{UT}$, $\angle RXU \cong \angle STU$ by the Corresponding Angles Theorem. Because $\angle RUX \cong \angle RXU$ and $\angle RXU \cong \angle STU$, by the Transitive Property, $\angle RUX \cong \angle STU$, or $\angle U \cong \angle T$.

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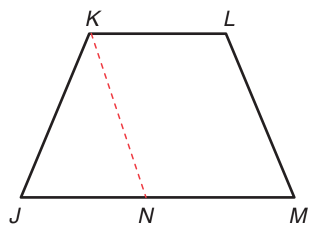
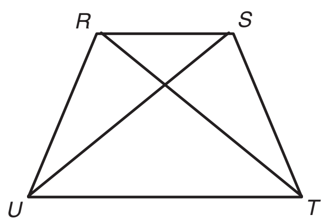
31. Write a two-column proof to prove $\angle K \cong \angle L$ in isosceles trapezoid $JKLM$.



Statements	Reasons
1. Isosceles trapezoid $JKLM$ with $\overline{KJ} \cong \overline{LM}$	1. Given
2. $\overline{KL} \parallel \overline{JM}$	2. Definition of a trapezoid
3. $\angle L$ is supplementary to $\angle M$ $\angle K$ is supplementary to $\angle J$	3. Same-side alternate interior angles between parallel lines are supplementary.
4. Construct $\overline{KN} \parallel \overline{LM}$	4. Construction
5. Quadrilateral $KLMN$ is a parallelogram.	5. Definition of a parallelogram
6. $\overline{KN} \cong \overline{LM}$	6. Opposite sides of a parallelogram are congruent.
7. $\overline{KJ} \cong \overline{KN}$	7. Transitive Property
8. $\triangle JKN$ is isosceles	8. Definition of an isosceles triangle
9. $\angle J \cong \angle KNJ$	9. Base angles in an isosceles triangle are congruent.
10. $\angle LKN \cong \angle KNJ$	10. Alternate Interior Angles Theorem
11. $\angle J \cong \angle LKN$	11. Transitive Property
12. $\angle LKN \cong \angle M$	12. Opposite angles in a parallelogram are congruent.
13. $\angle J \cong \angle M$	13. Transitive Property
14. $\angle K \cong \angle L$	14. Supplements of congruent angles are congruent.

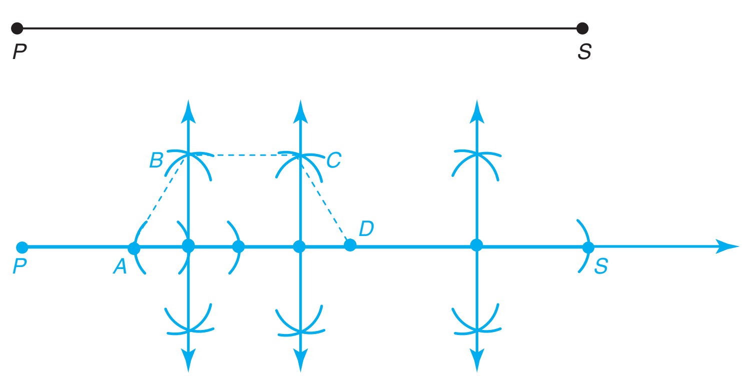
32. Write a two-column proof to prove that diagonals $\overline{RT}$ and $\overline{SU}$ in isosceles trapezoid *RSTU* are congruent if $\overline{RU} \cong \overline{ST}$.



Statements	Reasons
1. Isosceles trapezoid *RSTU* with $\overline{RU} \cong \overline{ST}$	1. Given
2. $\overline{RS} \parallel \overline{UT}$	2. Definition of a trapezoid
3. $\angle RUT \cong \angle STU$	3. Base angles of an isosceles trapezoid are congruent.
4. $\overline{UT} \cong \overline{UT}$	4. Reflexive Property
5. $\triangle RUT \cong \triangle STU$	5. SAS Congruence Theorem
6. $\overline{RT} \cong \overline{SU}$	6. CPCTC

Construct each isosceles trapezoid using the given information.

33. Construct isosceles trapezoid *ABCD* if $\overline{PS}$ is the perimeter of the trapezoid.



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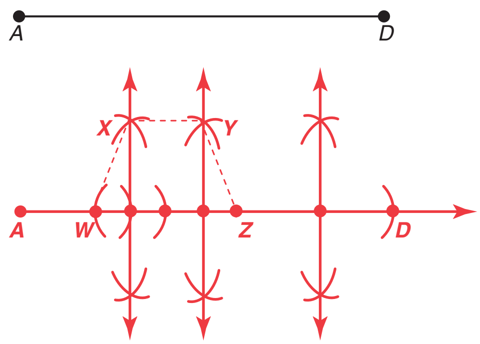
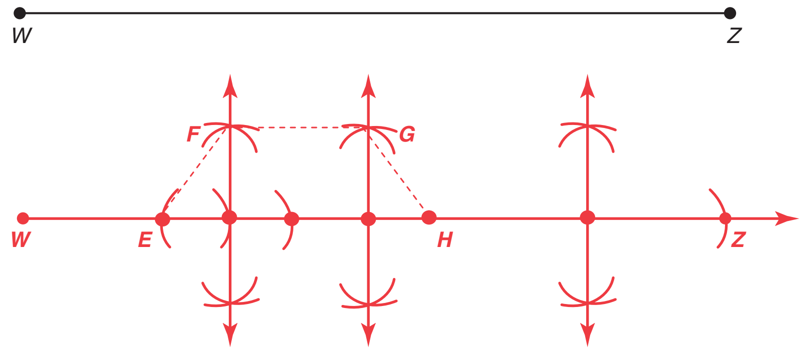
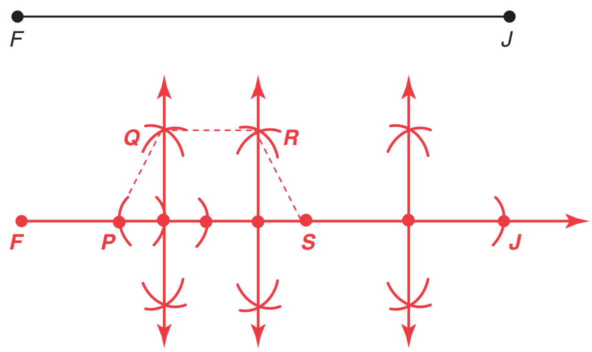
34. Construct isosceles trapezoid *WXYZ* if $\overline{AD}$ is the perimeter of the trapezoid.



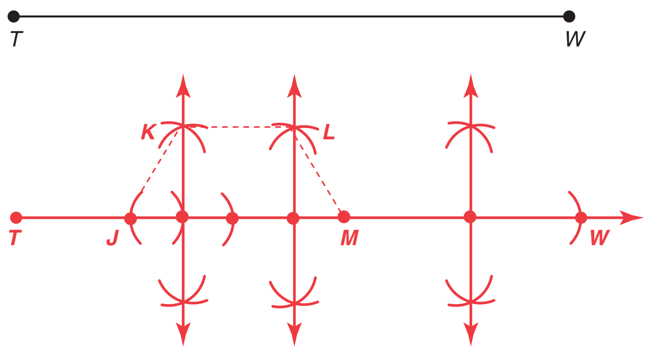
35. Construct isosceles trapezoid *EFGH* if $\overline{WZ}$ is the perimeter of the trapezoid.



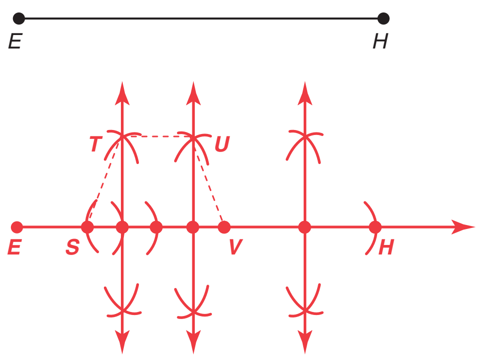
36. Construct isosceles trapezoid *PQRS* if $\overline{FJ}$ is the perimeter of the trapezoid.



37. Construct isosceles trapezoid *JKLM* if $\overline{TW}$ is the perimeter of the trapezoid.



38. Construct isosceles trapezoid *STUV* if $\overline{EH}$ is the perimeter of the trapezoid.



Use the given information to answer each question.

39. Alice created a kite out of two sticks and some fabric. The sticks were 10 inches and 15 inches long. She tied the sticks together so they were perpendicular and attached the fabric. When she measured the kite, she noticed that the distance from where the sticks meet to the top of the kite was 5 inches. What is the area of the kite Alice created?

$A = 2\left(\frac{1}{2}\right)(5)(5) + 2\left(\frac{1}{2}\right)(5)(10)$

$A = 25 + 50$

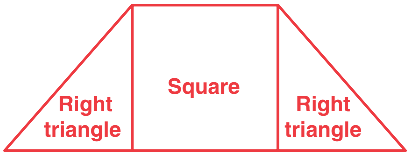
$A = 75$

The area of the kite is 75 square inches.

7

Name ____________________ Date __________

40. Simon connected a square and two congruent right triangles together to form an isosceles trapezoid. Draw a diagram to represent the isosceles trapezoid.



41. Magda told Sam that an isosceles trapezoid must also be a parallelogram because there is a pair of congruent sides in an isosceles trapezoid. Is Magda correct? Explain.

Magda is incorrect. Parallelograms have two pairs of parallel sides. Trapezoids have exactly one pair of parallel sides. A trapezoid is not a parallelogram.

42. Sylvia drew what she thought was an isosceles trapezoid. She measured the base angles and determined that they measured 81°, 79°, 101° and 99°. Could her drawing be an isosceles trapezoid? Explain.

Sylvia's drawing could not be an isosceles trapezoid. The base angles of an isosceles trapezoid are congruent. The base angles of Sylvia's figure are not congruent.

43. Joanne constructed a kite with a perimeter of 38 centimeters so that the sum of the two shorter sides is 10 centimeters. What are the lengths of each of the two longer sides?

$38 - 10 = 28$

$28 \div 2 = 14$

Each of the shorter sides is 14 centimeters.

44. Ilyssa constructed a kite that has side lengths of 8 inches and 5 inches. What are the lengths of the other two sides? Explain.

A kite has two pairs of congruent sides. The lengths of the other two sides must also be 8 inches and 5 inches.

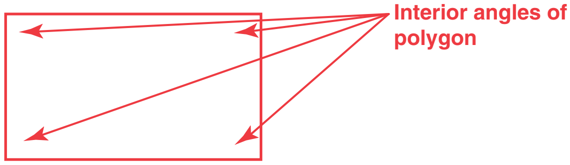
Name ____ Date ______________

Interior Angles of a Polygon
Sum of the Interior Angle Measures of a Polygon

Vocabulary

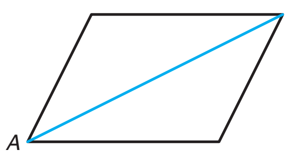
Give an example of the term.

1. Draw an example of a polygon. Label the interior angles of the polygon.

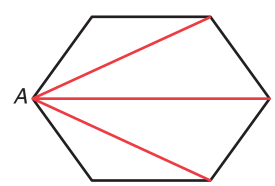


Problem Set

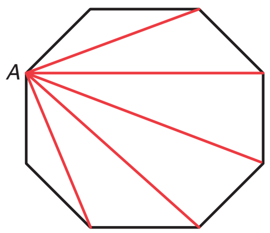
Draw all possible diagonals from vertex *A* for each polygon. Then write the number of triangles formed by the diagonals.

1. 

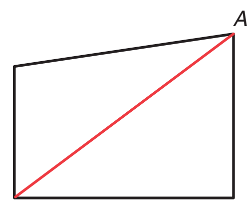
2 triangles

2. 

4 triangles

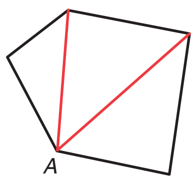
3. 

6 triangles

4. 

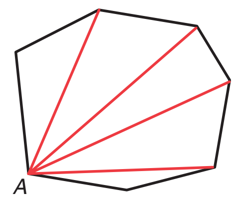
2 triangles

5.



3 triangles

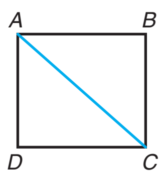
6.



5 triangles

Use the triangles formed by diagonals to calculate the sum of the interior angle measures of each polygon.

7. Draw all of the diagonals that connect to vertex *A*. What is the sum of the interior angles of square *ABCD*?

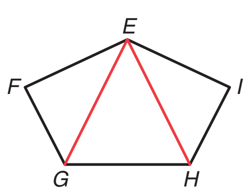


The diagonal divides the figure into two triangles. The sum of the interior angles of each triangle is 180°, so I multiplied 180° by 2 to determine the sum of the interior angles of the figure:

$180° \times 2 = 360°$

The sum of the interior angles is 360°.

8. Draw all of the diagonals that connect to vertex *E*. What is the sum of the interior angles of figure *EFGHI*?



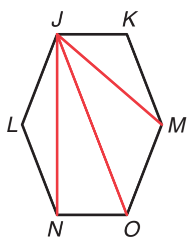
The diagonals divide the figure into 3 triangles. The sum of the interior angles of each triangle is 180°, so I multiplied 180° by 3 to determine the sum of the interior angles of the figure:

$180° \times 3 = 540°$

The sum of the interior angles is 540°.

Name ____ Date ______________

9. Draw all of the diagonals that connect to vertex *J*. What is the sum of the interior angles of figure *JKMONL*?

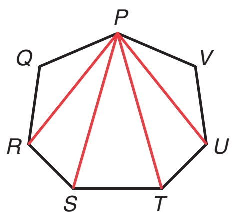


The diagonals divide the figure into 4 triangles. The sum of the interior angles of each triangle is 180°, so I multiplied 180° by 4 to determine the sum of the interior angles of the figure:

$180° \times 4 = 720°$

The sum of the interior angles is 720°.

10. Draw all of the diagonals that connect to vertex *P*. What is the sum of the interior angles of the figure *PQRSTUV*?



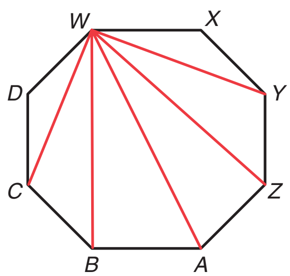
The diagonals divide the figure into 5 triangles. The sum of the interior angles of each triangle is 180°, so I multiplied 180° by 5 to determine the sum of the interior angles of the figure:

$180° \times 5 = 900°$

The sum of the interior angles is 900°.

7

11. Draw all of the diagonals that connect to vertex *W*. What is the sum of the interior angles of the figure *WXYZABCD*?

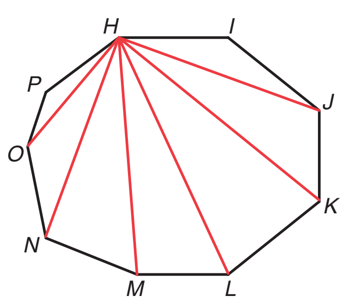


The diagonals divide the figure into 6 triangles. The sum of the interior angles of each triangle is 180°, so I multiplied 180° by 6 to determine the sum of the interior angles of the figure.

$180° \times 6 = 1080°$

The sum of the interior angles is 1080°.

12. Draw all of the diagonals that connect to vertex *H*. What is the sum of the interior angles of the figure *HIJKLMNOP*?



The diagonals divide the figure into 7 triangles. The sum of the interior angles of each triangle is 180°, so I multiplied 180° by 7 to determine the sum of the interior angles of the figure.

$180° \times 7 = 1260°$

The sum of the interior angles is 1260°.

Name ____________________ Date __________

Calculate the sum of the interior angle measures of each polygon.

13. A polygon has 8 sides.

The sum is equal to $(n - 2) \cdot 180°$:

$(8 - 2) \cdot 180° = 6 \cdot 180° = 1080°$

The sum of the interior angles of the polygon is 1080°.

14. A polygon has 9 sides.

The sum is equal to $(n - 2) \cdot 180°$:

$(9 - 2) \cdot 180° = 7 \cdot 180° = 1260°$

The sum of the interior angles of the polygon is 1260°.

15. A polygon has 13 sides.

The sum is equal to $(n - 2) \cdot 180°$:

$(13 - 2) \cdot 180° = 11 \cdot 180° = 1980°$

The sum of the interior angles of the polygon is 1980°.

16. A polygon has 16 sides.

The sum is equal to $(n - 2) \cdot 180°$:

$(16 - 2) \cdot 180° = 14 \cdot 180° = 2520°$

The sum of the interior angles of the polygon is 2520°.

17. A polygon has 20 sides.

The sum is equal to $(n - 2) \cdot 180°$.

$(20 - 2) \cdot 180° = 18 \cdot 180 = 3240°$

The sum of the interior angles of the polygon is 3240°.

18. A polygon has 25 sides.

The sum is equal to $(n - 2) \cdot 180°$.

$(25 - 2) \cdot 180° = 23 \cdot 180 = 4140°$

The sum of the interior angles of the polygon is 4140°.

The sum of the measures of the interior angles of a polygon is given. Determine the number of sides for each polygon.

19. 1080°

$180°(n - 2) = 1080°$

$n - 2 = 6$

$n = 8$

8 sides

20. 1800°

$180°(n - 2) = 1800°$

$n - 2 = 10$

$n = 12$

12 sides

21. 540°

$180°(n - 2) = 540°$

$n - 2 = 3$

$n = 5$

5 sides

22. 1260°

$180°(n - 2) = 1260°$

$n - 2 = 7$

$n = 9$

9 sides

23. 3780°

$180°(n - 2) = 3780°$

$n - 2 = 21$

$n = 23$

23 sides

24. 6840°

$180°(n - 2) = 6840°$

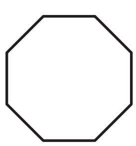
$n - 2 = 38$

$n = 40$

40 sides

For each regular polygon, calculate the measure of each of its interior angles.

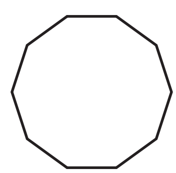
25.



$$\frac{(n - 2)180°}{n} = \frac{(8 - 2)180°}{8} = \frac{(6)180°}{8} = \frac{1080°}{8} = 135°$$

The measure of each interior angle is 135°.

26.



$$\frac{(n - 2)180°}{n} = \frac{(10 - 2)180°}{10} = \frac{(8)180°}{10} = \frac{1440°}{10} = 144°$$

The measure of each interior angle is 144°.

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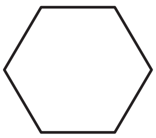
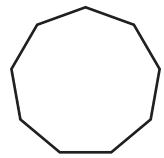
27.



$$\frac{(n-2)180^\circ}{n} = \frac{(6-2)180^\circ}{6} = \frac{(4)180^\circ}{6} = \frac{720^\circ}{6} = 120^\circ$$

The measure of each interior angle is 120°.

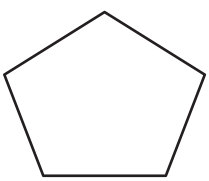
28.



$$\frac{(n-2)180^\circ}{n} = \frac{(9-2)180^\circ}{9} = \frac{(7)180^\circ}{9} = \frac{1260^\circ}{9} = 140^\circ$$

The measure of each interior angle is 140°.

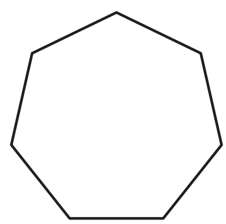
29.



$$\frac{(n-2)180^\circ}{n} = \frac{(5-2)180^\circ}{5} = \frac{(3)180^\circ}{5} = \frac{540^\circ}{5} = 108^\circ$$

The measure of each interior angle is 108°.

30.



$$\frac{(n-2)180^\circ}{n} = \frac{(7-2)180^\circ}{7} = \frac{(5)180^\circ}{7} = \frac{900^\circ}{7} \approx 128.6^\circ$$

The measure of each interior angle is approximately 128.6°.

Calculate the number of sides for each polygon.

31. The measure of each angle of a regular polygon is 108°.

$$108° = \frac{(n - 2)180°}{n}$$

$108°n = (n - 2)(180°)$

$108°n = 180°n - 360°$

$72°n = 360°$

$n = 5$

The regular polygon has 5 sides.

32. The measure of each angle of a regular polygon is 156°.

$$156° = \frac{(n - 2)180°}{n}$$

$156°n = (n - 2)(180°)$

$156°n = 180°n - 360°$

$24°n = 360°$

$n = 15$

The regular polygon has 15 sides.

33. The measure of each angle of a regular polygon is 160°.

$$160° = \frac{(n - 2)180°}{n}$$

$160°n = (n - 2)(180°)$

$160°n = 180°n - 360°$

$20°n = 360°$

$n = 18$

The regular polygon has 18 sides.

34. The measure of each angle of a regular polygon is 162°.

$$162° = \frac{(n - 2)180°}{n}$$

$162°n = (n - 2)(180°)$

$162°n = 180°n - 360°$

$18°n = 360°$

$n = 20$

The regular polygon has 20 sides.

Name ____________________ Date ____________

35. The measure of each angle of a regular polygon is 144°.

$$144° = \frac{(n - 2)180°}{n}$$

$144°n = (n - 2)(180°)$

$144°n = 180°n - 360°$

$36°n = 360°$

$n = 10$

The regular polygon has 10 sides.

36. The measure of each angle of a regular polygon is 165.6°.

$$165.6° = \frac{(n - 2)180°}{n}$$

$165.6°n = (n - 2)(180°)$

$165.6°n = 180°n - 360°$

$14.4°n = 360°$

$n = 25$

The regular polygon has 25 sides.

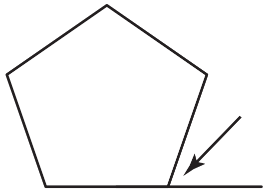
Name ____________________ Date ________

Exterior and Interior Angle Measurement Interactions
Sum of the Exterior Angle Measures of a Polygon

Vocabulary

Identify the term in the diagram.

1. Identify the term that is illustrated by the arrow in the diagram below.

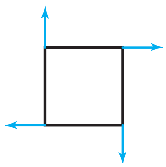


exterior angle of a polygon

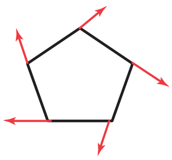
Problem Set

Extend each vertex of the polygon to create one exterior angle at each vertex.

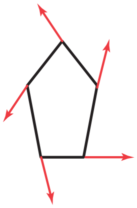
1.



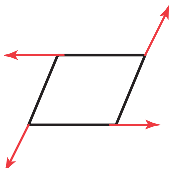
2.



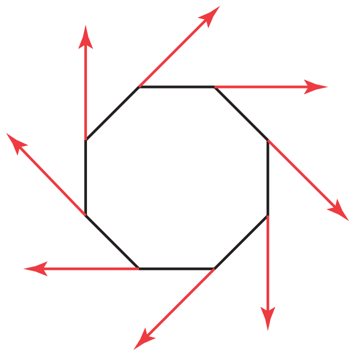
3.



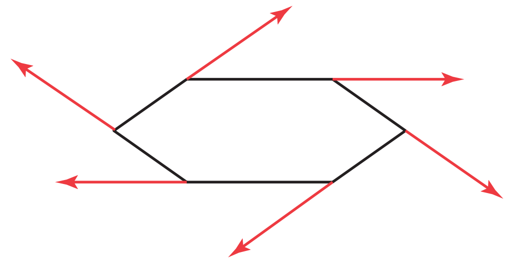
4.



5.



6.



Calculate the sum of the measures of the exterior angles for each polygon.

7. pentagon
   360°

8. hexagon
   360°

9. triangle
   360°

10. nonagon
    360°

11. 20-gon
    360°

12. 150-gon
    360°

Given the measure of an interior angle of a polygon, calculate the measure of the adjacent exterior angle.

13. What is the measure of an exterior angle if it is adjacent to an interior angle of a polygon that measures 90°?
    Interior and exterior angles are supplementary. So subtract 90°, the measure of the interior angle, from 180°.

    $180° - 90° = 90°$

Name ____________________ Date ________

14. What is the measure of an exterior angle if it is adjacent to an interior angle of a polygon that measures 120°?

Interior and exterior angles are supplementary. So subtract 120°, the measure of the interior angle, from 180°.

$180° - 120° = 60°$

15. What is the measure of an exterior angle if it is adjacent to an interior angle of a polygon that measures 108°?

Interior and exterior angles are supplementary. So subtract 108°, the measure of the interior angle, from 180°.

$180° - 108° = 72°$

16. What is the measure of an exterior angle if it is adjacent to an interior angle of a polygon that measures 135°?

Interior and exterior angles are supplementary. So subtract 135°, the measure of the interior angle, from 180°.

$180° - 135° = 45°$

17. What is the measure of an exterior angle if it is adjacent to an interior angle of a polygon that measures 115°?

Interior and exterior angles are supplementary. So subtract 115°, the measure of the interior angle, from 180°.

$180° - 115° = 65°$

18. What is the measure of an exterior angle if it is adjacent to an interior angle of a polygon that measures 124°?

Interior and exterior angles are supplementary. So subtract 124°, the measure of the interior angle, from 180°.

$180° - 124° = 56°$

Given the regular polygon, calculate the measure of each of its exterior angles.

19. What is the measure of each exterior angle of a square?

$\frac{360}{4} = 90°$

20. What is the measure of each exterior angle of a regular pentagon?

$\frac{360}{5} = 72°$

21. What is the measure of each exterior angle of a regular hexagon?
$\frac{360}{6} = 60°$

22. What is the measure of each exterior angle of a regular octagon?
$\frac{360}{8} = 45°$

23. What is the measure of each exterior angle of a regular decagon?
$\frac{360}{10} = 36°$

24. What is the measure of each exterior angle of a regular 12-gon?
$\frac{360}{12} = 30°$

Calculate the number of sides of the regular polygon given the measure of each exterior angle.

25. 45°
$\frac{360}{n} = 45$
$45n = 360$
$n = 8$
8 sides

26. 90°
$\frac{360}{n} = 90$
$90n = 360$
$n = 4$
4 sides

27. 36°
$\frac{360}{n} = 36$
$36n = 360$
$n = 10$
10 sides

28. 60°
$\frac{360}{n} = 60$
$60n = 360$
$n = 6$
6 sides

29. 40°
$\frac{360}{n} = 40$
$40n = 360$
$n = 9$
9 sides

30. 30°
$\frac{360}{n} = 30$
$30n = 360$
$n = 12$
12 sides

Name ____ Date ______________

Quadrilateral Family

Categorizing Quadrilaterals Based on Their Properties

Problem Set

List all of the quadrilaterals that have the given characteristic.

1. all sides congruent

   square and rhombus

2. diagonals congruent

   rectangle and square

3. no parallel sides

   kite

4. diagonals bisect each other

   parallelogram, rectangle, rhombus, and square

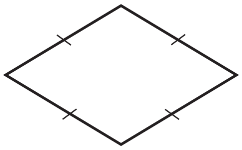
5. two pairs of parallel sides

   parallelogram, rectangle, rhombus, and square

6. all angles congruent

   rectangle and square

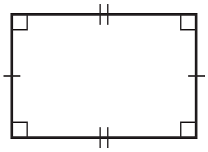
Identify all of the terms from the following list that apply to each figure: quadrilateral, parallelogram, rectangle, square, trapezoid, rhombus, kite.

7. 

   rhombus

   parallelogram

   quadrilateral

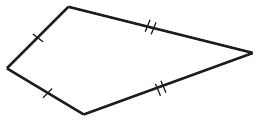
8. 

   rectangle

   parallelogram

   quadrilateral

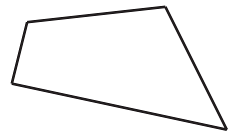
9.



kite

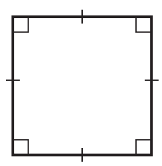
quadrilateral

10.



quadrilateral

11.



square

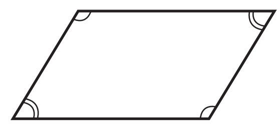
rectangle

rhombus

parallelogram

quadrilateral

12.

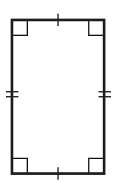


parallelogram

quadrilateral

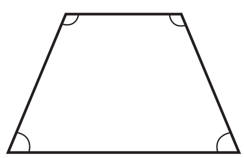
Name the type of quadrilateral that best describes each figure. Explain your answer.

13.



Rectangle. The quadrilateral has two pairs of parallel sides and four right angles, but the four sides are not all congruent.

14.



Trapezoid. This quadrilateral has exactly two parallel sides.

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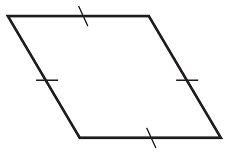
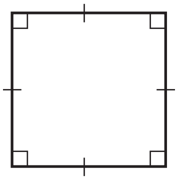
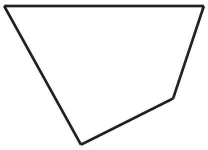
15. 

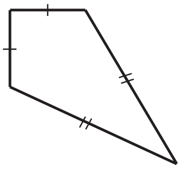
Rhombus. This quadrilateral has four congruent sides and two pairs of parallel sides, but it has no right angles.

16. 

Square. This quadrilateral has two pairs of parallel sides, four right angles, and four congruent sides.

17. 

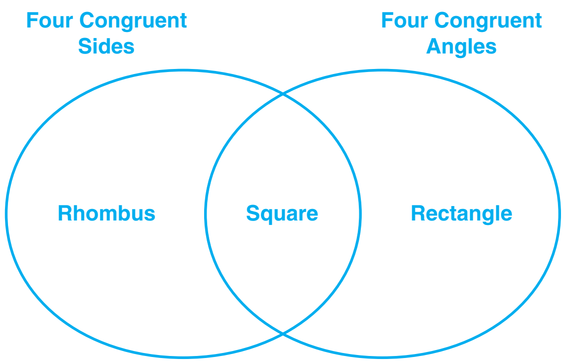
Quadrilateral. This figure has no congruent sides or angles, and no parallel sides.

18. 

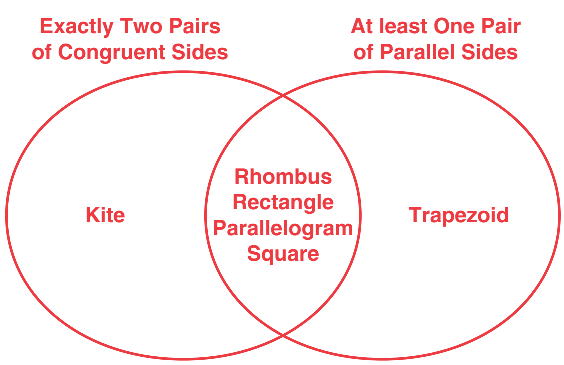
Kite. This quadrilateral has two pairs of adjacent congruent sides, but no parallel sides.

Draw the part of the Venn diagram that is described.

19. Suppose that part of a Venn diagram has two circles. One circle represents all types of quadrilaterals with four congruent sides. The other circle represents all types of quadrilaterals with four congruent angles. Draw this part of the Venn diagram and label it with the appropriate types of quadrilaterals.



20. Suppose that part of a Venn diagram has two circles. One circle represents all types of quadrilaterals with two pairs of congruent sides (adjacent or opposite). The other circle represents all types of quadrilaterals with at least one pair of parallel sides. Draw this part of the Venn diagram and label it with the appropriate types of quadrilaterals.



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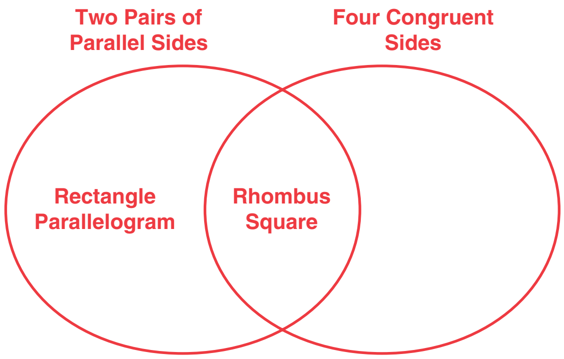
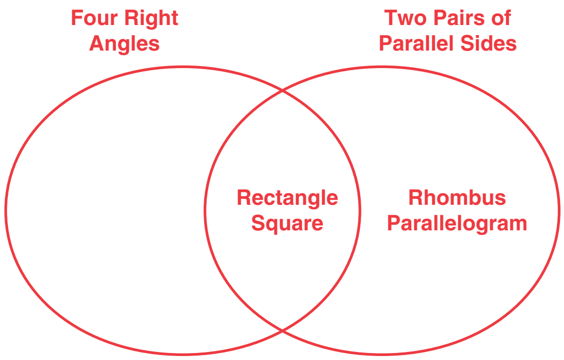
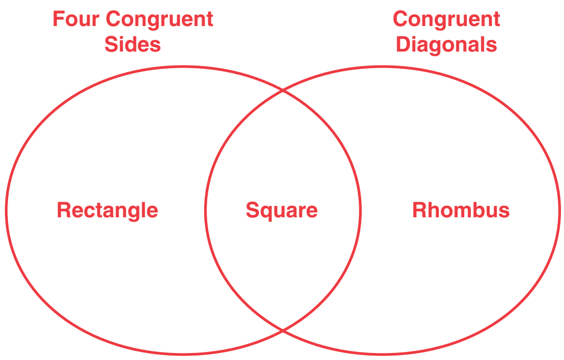
21. Suppose that part of a Venn diagram has two circles. One circle represents all types of quadrilaterals with two pairs of parallel sides. The other circle represents all types of quadrilaterals with four congruent sides. Draw this part of the Venn diagram and label it with the appropriate types of quadrilaterals.



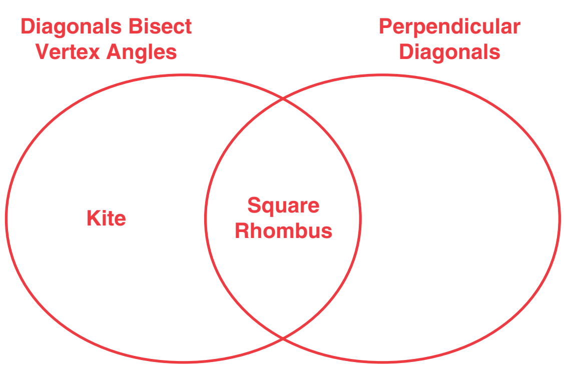
22. Suppose that part of a Venn diagram has two circles. One circle represents all types of quadrilaterals with four right angles. The other circle represents all types of quadrilaterals with two pairs of parallel sides. Draw this part of the Venn diagram and label it with the appropriate types of quadrilaterals.



23. Suppose that a Venn diagram has two circles. One circle represents all types of quadrilaterals with four congruent sides. The other circle represents all types of quadrilaterals with congruent diagonals. Draw this part of the Venn diagram and label it with the appropriate types of quadrilaterals.



24. Suppose that a Venn diagram has two circles. One circle represents all types of quadrilaterals with diagonals that bisect the vertex angles. The other circle represents all types of quadrilaterals with perpendicular diagonals. Draw this part of the Venn diagram and label it with the appropriate types of quadrilaterals.



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Tell whether the statement is true or false. If false, explain why.

25. A trapezoid is also a parallelogram.

False. Parallelograms have two pairs of parallel sides. Trapezoids only have one pair.

26. A square is also a rhombus.

True

27. Diagonals of a rectangle are perpendicular.

False. The diagonals of a rhombus, square, and a kite are perpendicular.

28. A parallelogram has exactly one pair of opposite angles congruent.

False. Both pairs of opposite angles are congruent in a parallelogram.

29. A square has diagonals that are perpendicular and congruent.

True.

30. All quadrilaterals have supplementary consecutive angles.

False. All parallelograms have supplementary consecutive angles, not quadrilaterals.

List the steps to tell how you would construct the quadrilateral with the given information.

31. Rectangle *HIJK* given only diagonal $\overline{HJ}$.

1. Duplicate $\overline{HJ}$ and bisect it to determine the midpoint.
2. Duplicate $\overline{HJ}$ again, labeling it $\overline{IK}$, and bisecting it to determine the midpoint.
3. Draw segments $\overline{HJ}$ and $\overline{IK}$ so that their midpoints intersect.
4. Connect the endpoints of the segments to form rectangle *HIJK*.

32. Square *ABCD* given only diagonal $\overline{AC}$.

1. Duplicate $\overline{AC}$ and bisect it to determine the midpoint.
2. Draw the perpendicular bisector of $\overline{AC}$.
3. Duplicate $\overline{AC}$ again, labeling it $\overline{BD}$, and bisecting it to determine the midpoint.
4. Duplicate segment $\overline{BD}$ so that it is along the perpendicular bisector of $\overline{AC}$ and the midpoints of $\overline{AC}$ and $\overline{BD}$ meet.
5. Connect the endpoints of the segments to form square *ABCD*.

33. Kite *RTSU* given only diagonal $\overline{RS}$.

1. Duplicate $\overline{RS}$.
2. Construct a perpendicular segment to $\overline{RS}$ such that $\overline{RS}$ bisects the perpendicular segment.
3. Label the perpendicular segment $\overline{TU}$.
4. Connect the endpoints of the two segments to form kite *RSTU*.

34. Rhombus *MNOP* given only diagonal $\overline{MO}$.

1. Duplicate $\overline{MO}$ and bisect it to determine the midpoint.
2. Draw the perpendicular bisector of $\overline{MO}$.
3. Draw a segment $\overline{NP}$ and bisect it to determine the midpoint.
4. Duplicate segment $\overline{NP}$ so that it is along the perpendicular bisector of $\overline{MO}$ and the midpoints of $\overline{NP}$ and $\overline{MO}$ meet.
5. Connect the endpoints of the segments to form a rhombus *MNOP*.

35. Parallelogram *JKLM* given only diagonal $\overline{JL}$.

1. Duplicate $\overline{JL}$ and bisect it to determine the midpoint.
2. Draw a segment $\overline{KM}$, and bisect it to determine the midpoint.
3. Draw segments $\overline{JL}$ and $\overline{KM}$ so that their midpoints intersect.
4. Connect the endpoints of the segments to form parallelogram *JKLM*.

36. Isosceles trapezoid *BCDE* given only diagonal $\overline{BD}$.

1. Draw a line. Construct a line parallel to the line drawn.
2. Duplicate $\overline{BD}$ so that its endpoints lie on the parallel lines. Label the segment $\overline{BD}$.
3. Duplicate $\overline{BD}$ again so that its endpoints lie on the parallel lines and intersects the first line drawn. Label the segment $\overline{CE}$.
4. Connect the endpoints of the segments to form isosceles trapezoid *BCDE*.