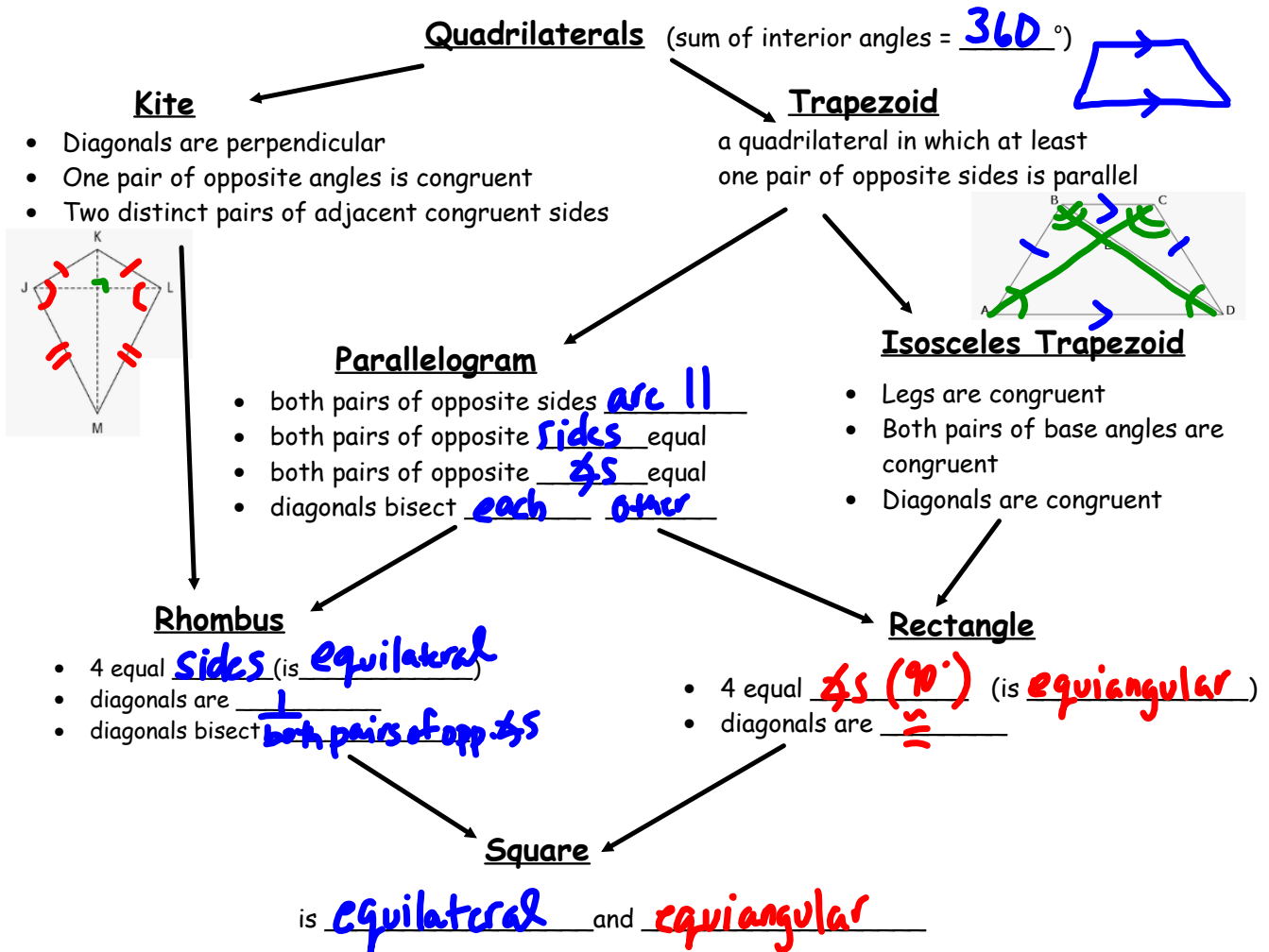


Aim #26: What are the properties of parallelograms?

CC Geometry H

Do Now: Complete the following:



Complete:

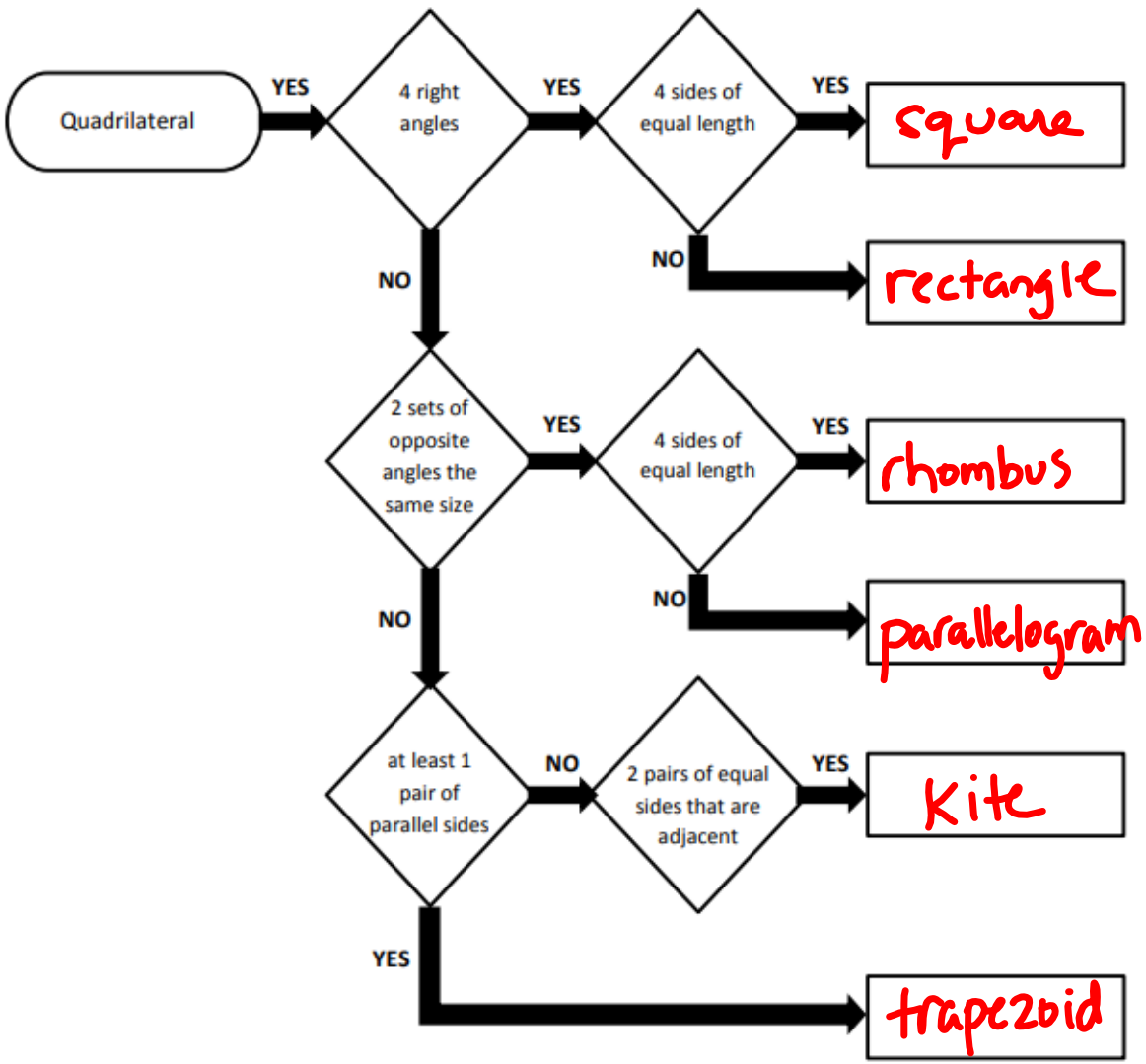
A rhombus has all the properties of a parallelogram and kite.

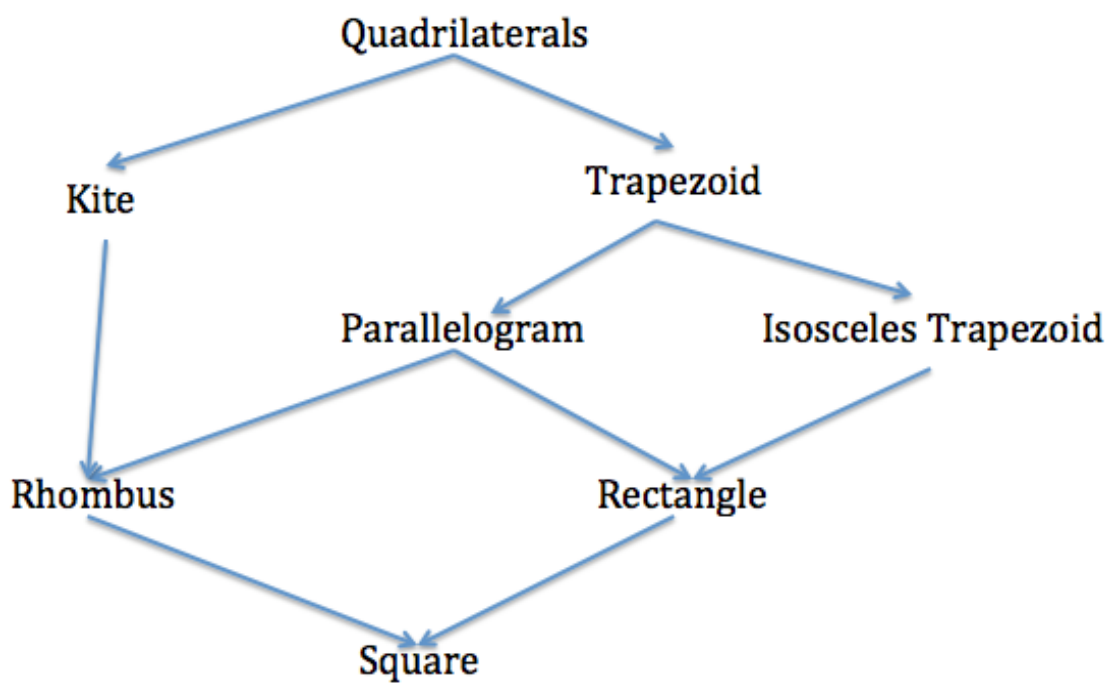
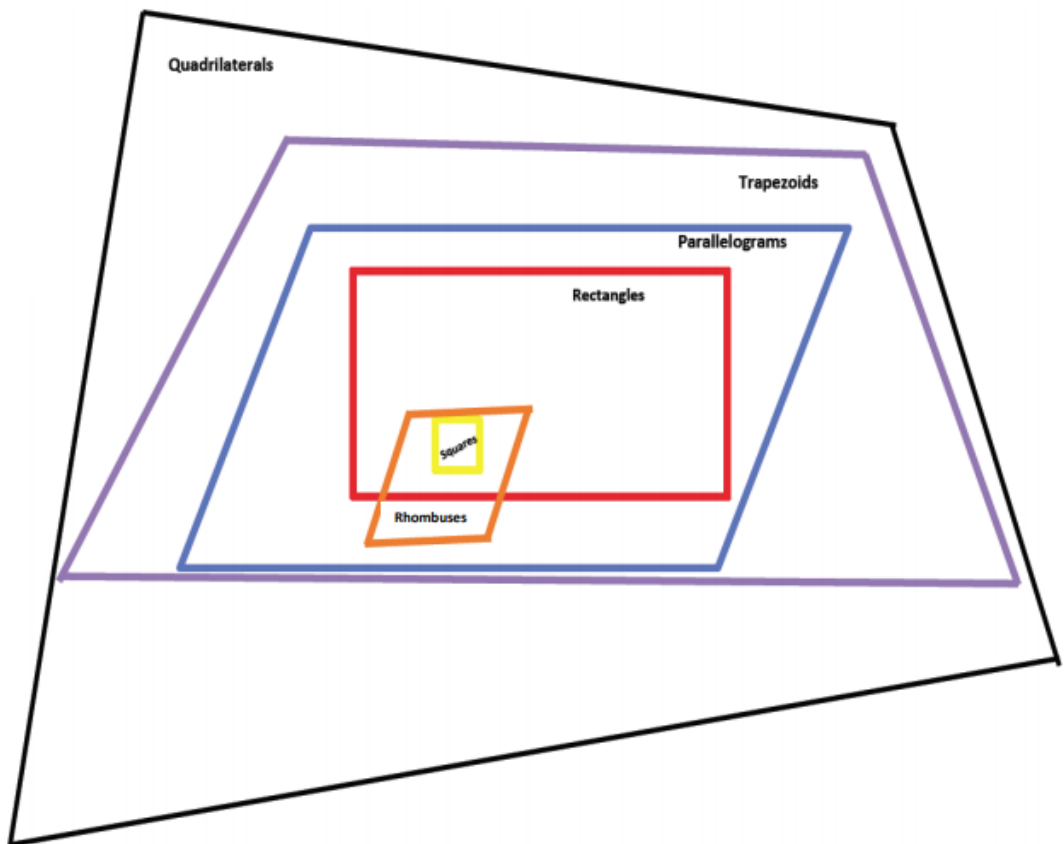
A rectangle has all the properties of a parallelogram and isos. trap.

A square has all the properties of a rectangle and a rhombus.

An equiangular quadrilateral is a rectangle.

An equilateral quadrilateral is a rhombus.

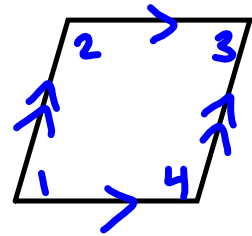




Exercises:

1. True or False?

- a) The sum of the angles of a rhombus is 360° . T
- b) Every rectangle is a parallelogram. T
- c) Every square is a rhombus. T
- d) Every rhombus is a square. F
- e) Every rhombus is a parallelogram. T
- f) The diagonals of a rectangle are equal. T
- g) A quadrilateral with four equal sides is a rhombus. T
- h) The consecutive angles of a rhombus are equal. F
- i) If a quadrilateral is equiangular, it is a rectangle. T
- j) A square is a rectangle and a rhombus. T



2. Determine the most specific name of the quadrilateral based on the markings in the diagram. (Diagram is not drawn to scale.)

a)

both pairs of opp. side \cong

Parallelogram

b)

diag. \perp

opp. \cong

Rhombus

c)

diag. bis. each other

rt. \angle

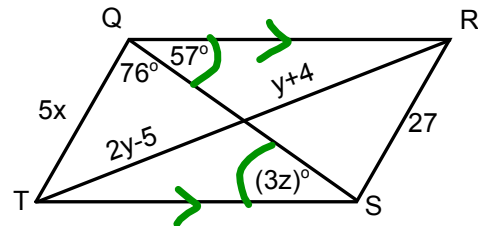
Rectangle

d)

diag. bis + \perp = 2 adj. sides =

Square

3. QRST is a parallelogram. Find x, y, and z.



$$2y - 5 = y + 4$$

$$y = 9$$

$$5x = 27$$

$$x = \frac{27}{5}$$

$$3z = 57$$

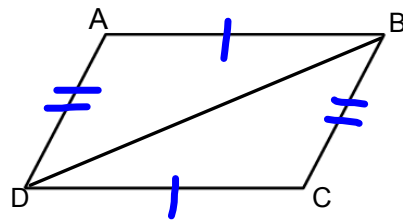
$$z = 19^\circ$$

Proving the properties of parallelograms:

1) If a quadrilateral is a parallelogram, a diagonal divides the parallelogram into two congruent triangles.

Given: Parallelogram ABCD, diagonal \overline{BD}

Prove: $\triangle ABD \cong \triangle CDB$

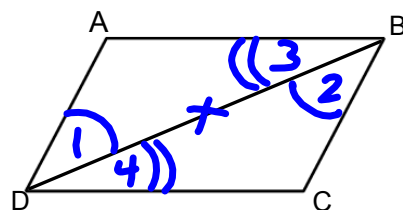


Statements	Reasons
① $\square ABCD$, diag. \overline{BD}	① Givens
② $\overline{AB} \cong \overline{CD}$, $\overline{AD} \cong \overline{CB}$	② Opp. sides of a \square are \cong .
③ $\overline{DB} \cong \overline{BD}$	③ Reflexive Prop.
④ $\triangle ABD \cong \triangle CDB$	④ SSS

2) If a quadrilateral is a parallelogram, then its opposite sides are congruent.

Given: Parallelogram ABCD, diagonal \overline{BD}

Prove: $\overline{AB} \cong \overline{CD}$, $\overline{AD} \cong \overline{CB}$

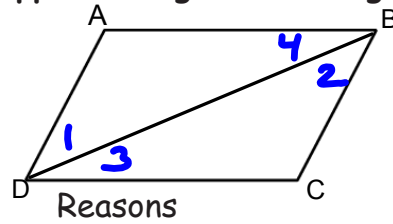


Statements	Reasons
① $\square ABCD$, diag. \overline{BD}	① Givens
② $\overline{AB} \parallel \overline{DC}$, $\overline{AD} \parallel \overline{BC}$	② Opp. sides of a \square are \parallel .
③ $\angle 1 \cong \angle 2$, $\angle 3 \cong \angle 4$	③ When \parallel lines are cut by a transv., alt. int. \angle s are \cong .
④ $\overline{BD} \cong \overline{DB}$	④ Reflex. Prop.
⑤ $\triangle ABD \cong \triangle CDB$	⑤ ASA
⑥ $\overline{AB} \cong \overline{CD}$, $\overline{AD} \cong \overline{CB}$	⑥ Corr. parts of $\cong \triangle$ s are \cong .

3) If a quadrilateral is a parallelogram, then its opposite angles are congruent.

Given: Parallelogram ABCD, diagonal \overline{BD}

Prove: $\angle A \cong \angle C$, $\angle ABC \cong \angle CDA$

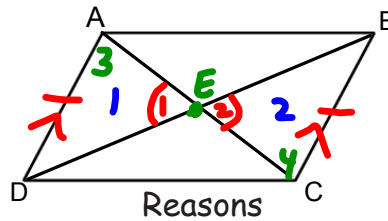


Statements	Reasons
① $\square ABCD$, diag. \overline{BD}	① Given
② $\overline{AB} \cong \overline{CD}$, $\overline{AD} \cong \overline{CB}$	② Opp. sides of a \square are \cong .
③ $\overline{BD} \cong \overline{DB}$	③ Reflex. Prop.
④ $\triangle ADB \cong \triangle BCD$	④ SSS
⑤ $\angle A \cong \angle C$, $\angle 1 \cong \angle 2$, $\angle 3 \cong \angle 4$	⑤ Corr. parts of $\cong \triangle$ s are \cong .
⑥ $\angle CDA \cong \angle 1 + \angle 3$ $\angle ABC \cong \angle 2 + \angle 4$	⑥ A whole = sum of its parts.
⑦ $\angle 1 + \angle 3 \cong \angle 2 + \angle 4$	⑦ Addition Prop.
⑧ $\angle ABC \cong \angle CDA$	⑧ Subst.

4) If a quadrilateral is a parallelogram, then the diagonals bisect each other.

Given: Parallelogram ABCD, diagonal $\overline{BD} + \overline{AC}$

Prove: $\overline{AE} \cong \overline{CE}$, $\overline{DE} \cong \overline{BE}$



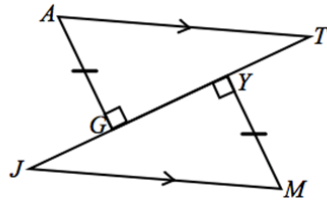
Statements	Reasons
① $\square ABCD$, diag. $\overline{BD} + \overline{AC}$	① Givens
② $\angle 1 \cong \angle 2$	② Vert. \angle s are \cong .
③ $\overline{AD} \cong \overline{CB}$, $\overline{AD} \parallel \overline{CB}$	③ Opp. sides of a \square are \cong & \parallel .
④ $\angle 3 \cong \angle 4$	④ When \parallel lines are cut by a transv., alt. int. \angle s are \cong .
⑤ $\triangle ADE \cong \triangle CBE$	⑤ AAS
⑥ $\overline{AE} \cong \overline{CE}$, $\overline{DE} \cong \overline{BE}$	⑥ Corr. parts of $\cong \triangle$ s are \cong .

Name _____

Date _____

CC Geometry H
HW #26

1. a. If the triangles are congruent, write the congruence statement: _____



b. Which triangle congruence criterion guarantees (a)? _____

c. \overline{TG} corresponds with: _____

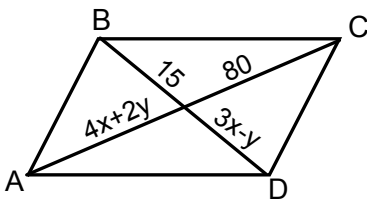
2. Name the quadrilateral as specifically as possible, based on the given characteristics.

- a) an equilateral quadrilateral
- b) an equiangular parallelogram
- c) a regular quadrilateral
- d) a parallelogram with perpendicular diagonals

3. Always, Sometimes, or Never true?

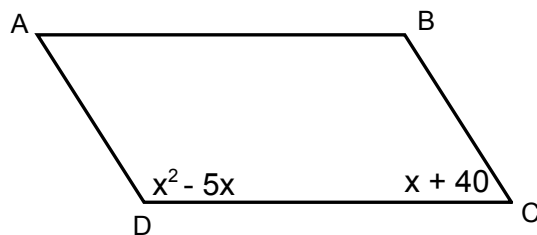
- a) The diagonals of a rhombus are perpendicular.
- b) If the diagonals of a parallelogram are equal, it is a square.
- c) Adjacent sides of a rhombus are unequal.
- d) Consecutive angles of a parallelogram are supplementary.

4. Given parallelogram ABCD with diagonals \overline{AC} and \overline{BD} , solve for x and y.



5. Parallelogram ABCD.

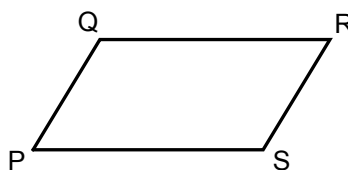
Find all possible measures of $\angle B$.



6. Multiple Choice.

- a) If a quadrilateral has equal diagonals, it must be a
 (1) square (2) rhombus (3) rectangle (4) quadrilateral
- b) If the diagonals of a parallelogram are perpendicular and not equal, the parallelogram is
 (1) rectangle (2) square (3) rhombus (4) kite
- c) Two consecutive angles of a rhombus are
 (1) equal (2) complementary (3) linear (4) supplementary
- d) The diagonals of a rhombus
 (1) are equal (2) are perpendicular (3) are parallel (4) are adjacent
- e) Which statement is not true for every given parallelogram PQRS?

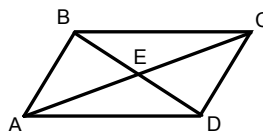
- (1) $PQ = SR$ (3) $\overline{PR} \perp \overline{SQ}$
 (2) $\angle P = \angle R$ (4) $\angle P + \angle S = 180$



- f) Which statement is always true?
 (1) The diagonals of a parallelogram are congruent.
 (2) The diagonals of a parallelogram bisect the angles of the parallelogram.
 (3) The diagonals of a parallelogram bisect each other.
 (4) The diagonals of a parallelogram are perpendicular to each other.

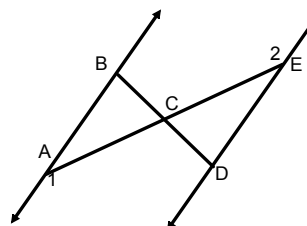
g) In parallelogram ABCD, diagonals \overline{AC} and \overline{BD} intersect at point E. Which statement is always true?

- (1) $\overline{AC} \perp \overline{DB}$ (3) $\triangle ABD \cong \triangle AED$
 (2) $\triangle DEC \cong \triangle BEA$ (4) $\triangle BEC \cong \triangle DEC$



Review:

1) Given: $\angle 1 \cong \angle 2$, \overline{AE} bisects \overline{BD}
 Prove: $\overline{AB} \cong \overline{ED}$



Statements	Reasons