Sum ext. $\angle = 360$

$\frac{360}{72} = 5$ reg. pentagon

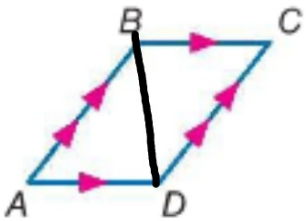
Geometry 6.2 Quadrilaterals

Recognize and apply the properties of sides and angles of a parallelogram

Recognize and apply the properties of diagonals of a parallelogram

consecutive
nonconsecutive
parallel
parallelogram 2 prs // sides
diagonal
activ: exploragons

Note: exterior angles



ABCD

n = no. of Δ's

7. 10^{150° 12

$$n(180) = (n+2)(150)$$

$$180n = 150n + 300$$

$$\frac{30n}{30} = \frac{300}{30}$$

$$n = 10$$

2 diag. → mp

Definition: Quadrilateral with 2 pairs of parallel sides.

Properties:

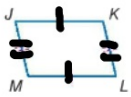
p 403

Theorem Properties of Parallelograms

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

Abbreviation *Opp. sides of a ▱ are ≅.*

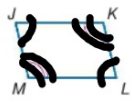
Example If *JKLM* is a parallelogram, then $\overline{JK} \cong \overline{ML}$ and $\overline{JM} \cong \overline{KL}$.



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

Abbreviation *Opp. ∡s of a ▱ are ≅.*

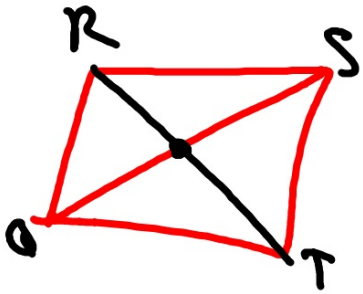
Example If *JKLM* is a parallelogram, then $\angle J \cong \angle L$ and $\angle K \cong \angle M$.



is A a mp? yes

is B a mp?

is C a mp?



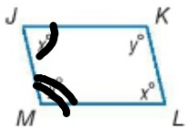
SSI (CIA)

p. 403 $\angle J + \angle M = 180$

6.5 If a quadrilateral is a parallelogram, then its consecutive angles are supplementary.

Abbreviation *Cons. ∡s in a ▱ are supplementary.*

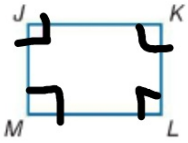
Example If *JKLM* is a parallelogram, then $x + y = 180$.



6.6 If a parallelogram has one right angle, then it has four right angles.

Abbreviation *If a ▱ has 1 rt. ∠, it has 4 rt. ∠s.*

Example In ▱*JKLM*, if $\angle J$ is a right angle, then $\angle K$, $\angle L$, and $\angle M$ are also right angles.



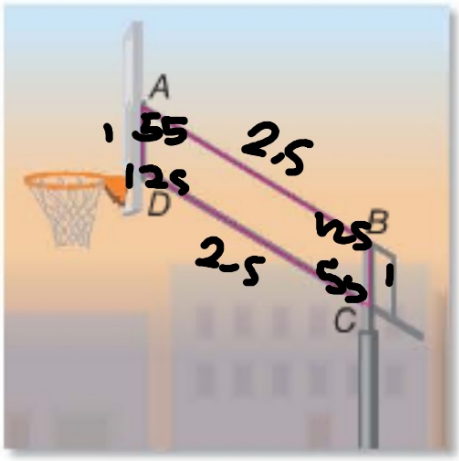
Real-World Example 1 Use Properties of Parallel

BASKETBALL In $\square ABCD$, suppose $m\angle A = 55$, $AB = 2.5$ feet, and $BC = 1$ foot. Find each measure.

a. DC 2.5

b. $m\angle B$ 125

c. $m\angle C$ 55

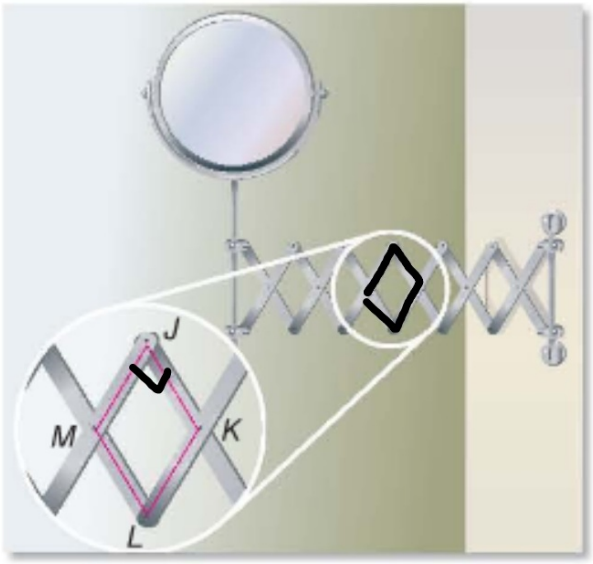


GuidedPractice

1. **MIRRORS** The wall-mounted mirror shown uses parallelograms that change shape as the arm is extended. In $\square JKLM$, suppose $m\angle J = 47$. Find each measure.

   A. $m\angle L$ 47° **B.** $m\angle M$ 133°

   C. Suppose the arm was extended further so that $m\angle J = 90$. What would be the measure of each of the other angles? Justify your answer.



Exploragons:
Measure the two diagonals (mm).
Be as accurate as possible.
Are the diagonals congruent?
Do they bisect each other?

p. 405

2 Diagonals of Parallelograms

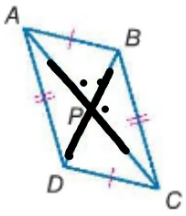
The diagonals of a parallelogram have special properties as well.

Theorem Diagonals of Parallelograms

6.7 If a quadrilateral is a parallelogram, then its diagonals bisect each other.

Abbreviation *Diag. of a ▱ bisect each other.*

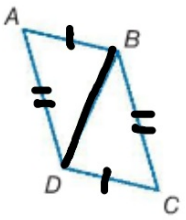
Example If *ABCD* is a parallelogram, then $\overline{AP} \cong \overline{PC}$ and $\overline{DP} \cong \overline{PB}$.

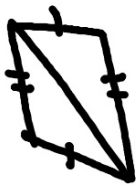


6.8 If a quadrilateral is a parallelogram, then each diagonal separates the parallelogram into two congruent triangles.

Abbreviation *Diag. separates a ▱ into 2 ≅ △.*

Example If *ABCD* is a parallelogram, then $\triangle ABD \cong \triangle CDB$.





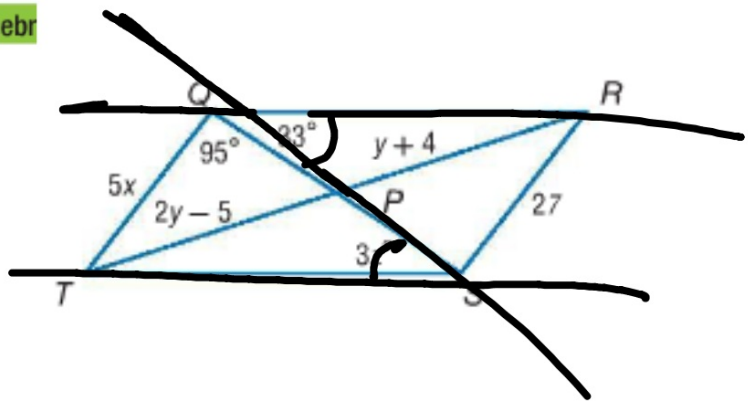
Example 2 Use Properties of Parallelograms and Algebr

ALGEBRA If $QRST$ is a parallelogram, find the value of the indicated variable.

a. x $8x = 27$

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

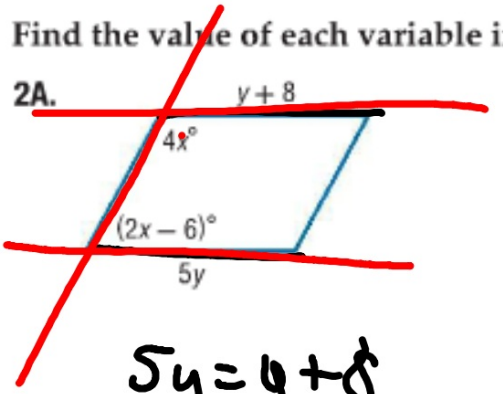
c. z $3z = 33$



GuidedPractice

Find the value of each variable in the given parallelogram.

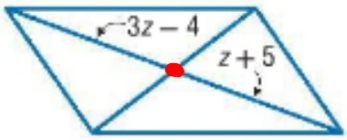
2A.



$5y = y + 8$

$4x + 2x - 6 = 180$

2B.



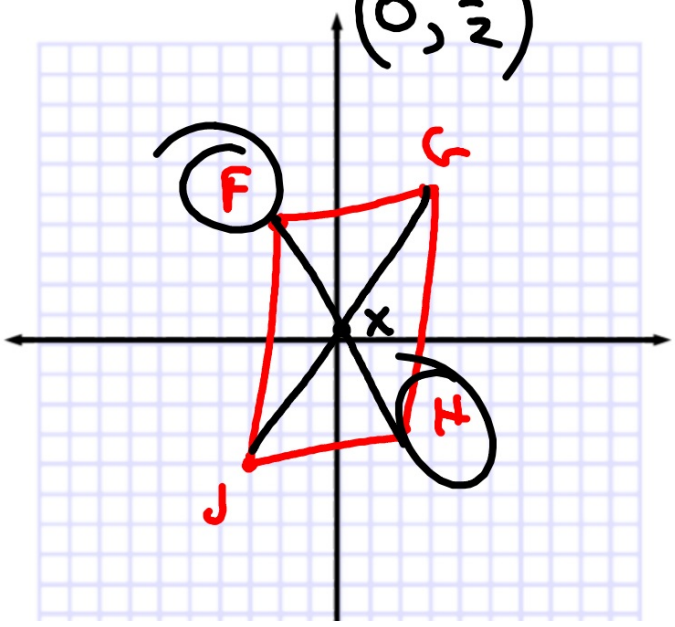
diagonals bisect each other

Example 3 Parallelograms and Coordinate Geometry

COORDINATE GEOMETRY Determine the coordinates of the intersection of the diagonals of $\square FGHJ$ with vertices $F(-2, 4)$, $G(3, 5)$, $H(2, -3)$, and $J(-3, -4)$.

$\frac{-2+2}{2}, \frac{4+-3}{2}$

$(0, \frac{1}{2})$

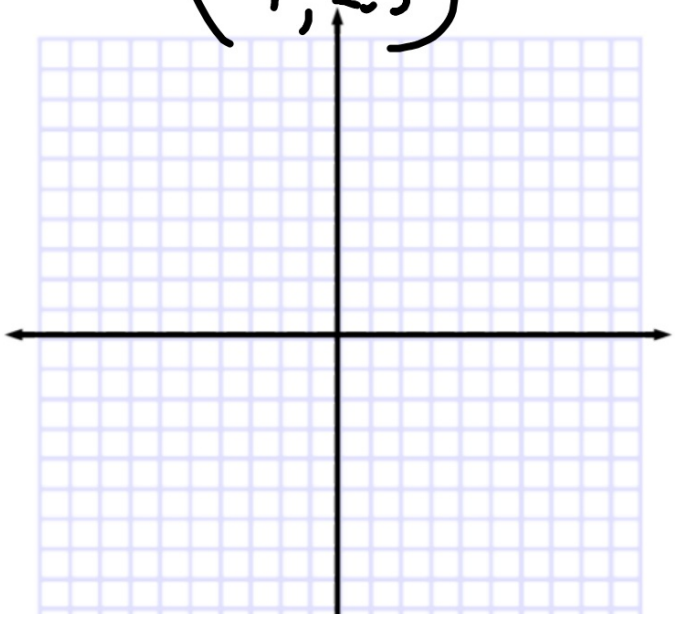


GuidedPractice

3. COORDINATE GEOMETRY Determine the coordinates of the intersection of the diagonals of $RSTU$ with vertices $R(-8, -2)$, $S(-6, 7)$, $T(6, 7)$, and $U(4, -2)$.

$\frac{-8+6}{2} \quad \frac{-2+7}{2}$

$(-1, 2.5)$

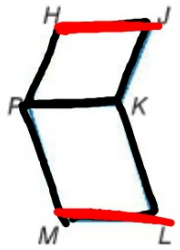


GuidedPractice

4. Write a two-column proof.

Given: $\square HJKP$ and $\square PKLM$

Prove: $\overline{HJ} \cong \overline{ML}$



given

2. $\overline{HJ} \cong \overline{PK}$ — 2. opp sides $\cong$

3. $\overline{PK} \cong \overline{ML}$ — 3. " "

4. $\overline{HJ} \cong \overline{ML}$ — 4. trans

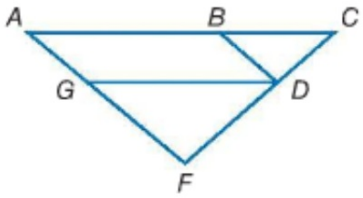
isoc tri

Example 4 Proofs Using the Properties of Parallelograms

Write a paragraph proof.

Given: $\square ABDG$, $\overline{AF} \cong \overline{CF}$

Prove: $\angle BDG \cong \angle C$



Proof: