$(n-2)(180)$

Geometry 6.2

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

Recognize and apply the properties of diagonals of a parallelogram

Quadrilateral - 4 sides

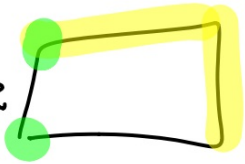
consecutive

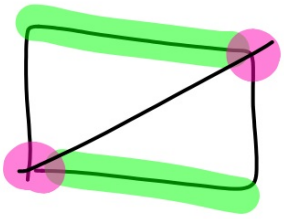
nonconsecutive

parallel Same slope

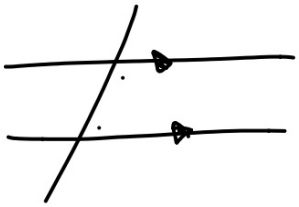
parallelogram Q w. 2 prs // sides

diagonal

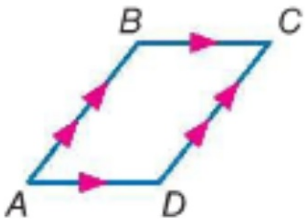




activ: exploragons



Note: exterior angles



$\square ABCD$

Definition: Quadrilateral with 2 pairs of parallel sides.
Properties:

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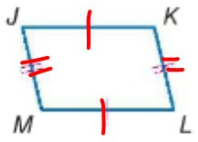
Theorem Properties of Parallelograms

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

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

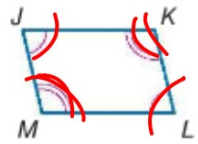
Example If *JKLM* is a parallelogram, then $\overline{JK} \cong \overline{ML}$ and $\overline{JM} \cong \overline{KL}$.



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

Abbreviation *Opp. ∡ of a ▱ are ≅.*

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

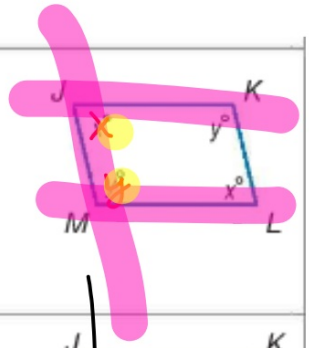


6.5 If a quadrilateral is a parallelogram, then its consecutive angles are supplementary.

$x + y = 180$

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

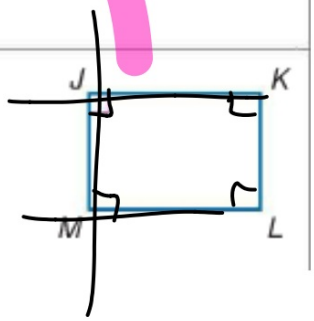
Example If *JKLM* is a parallelogram, then $x + y = 180$.



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 ∠*J* is a right angle, then ∠*K*, ∠*L*, and ∠*M* are also right angles.



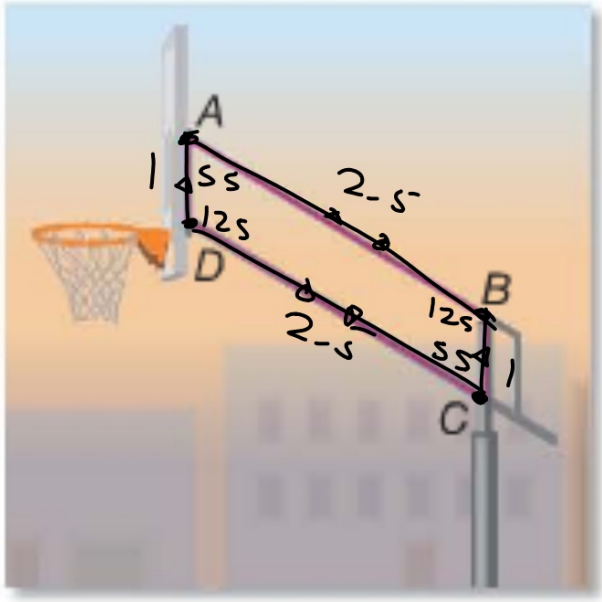
Real-World Example 1 Use Properties of

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

a. DC 2.5 ft

b. $m\angle B$ 125°

c. $m\angle C$ 55°

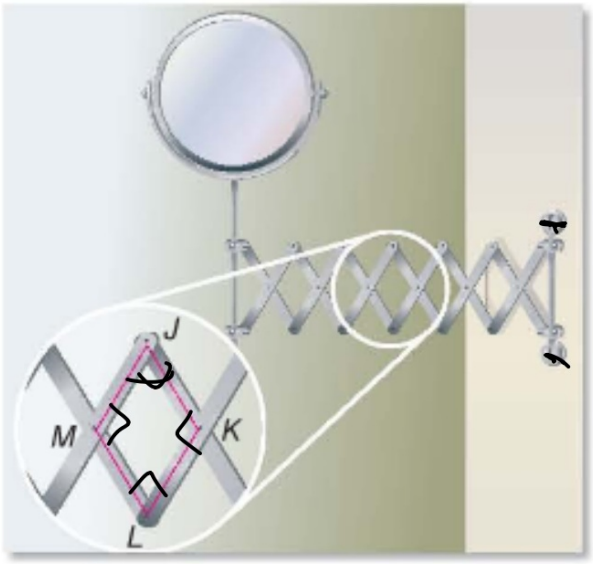


GuidedPractice

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. 90°

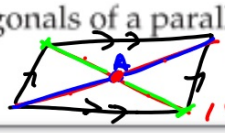


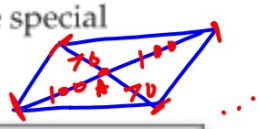
Exploragons:
Measure the two diagonals (mm).
Be as accurate as possible.
Are the diagonals congruent?
Do they bisect each other?

2 Diagonals of Parallelograms

The diagonals of a parallelogram have special properties as well.

mm





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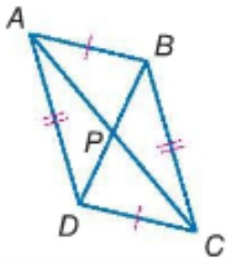
Theorem Diagonals of Parallelograms

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

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

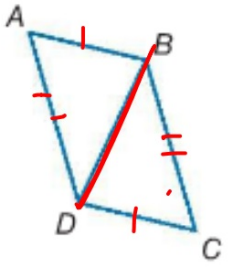
Example If *ABCD* is a parallelogram, then $\overline{AP} \cong \overline{PC}$ and $\overline{DP} \cong \overline{PB}$.



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

$\frac{5x}{5} = \frac{27}{5}$ $x = 5.4$

b. y

$2y - 5 = y + 4$

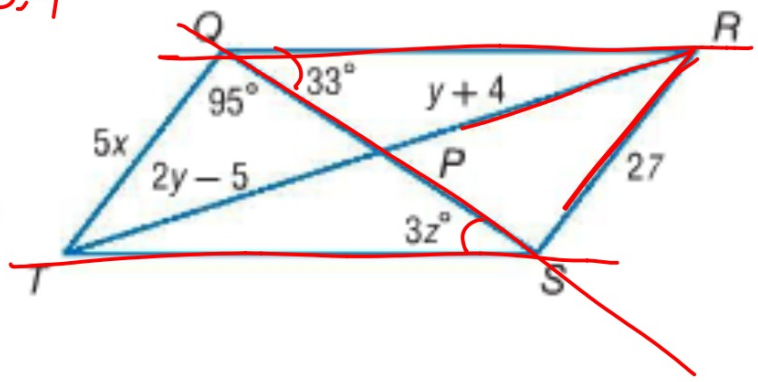
$-y + 5 \quad -y + 5$

$y = 9$

c. z

$3z = 33$

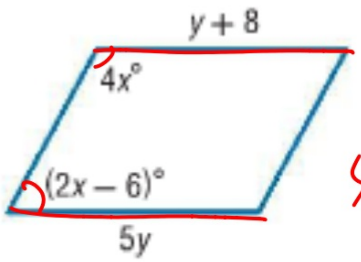
$z = 11$



GuidedPractice

Find the value of each variable in the given parallelogram.

2A.

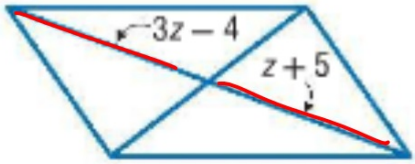


$4x + 2x - 6 = 180$

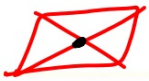
$5y = y + 8$

$y = 2$

2B.

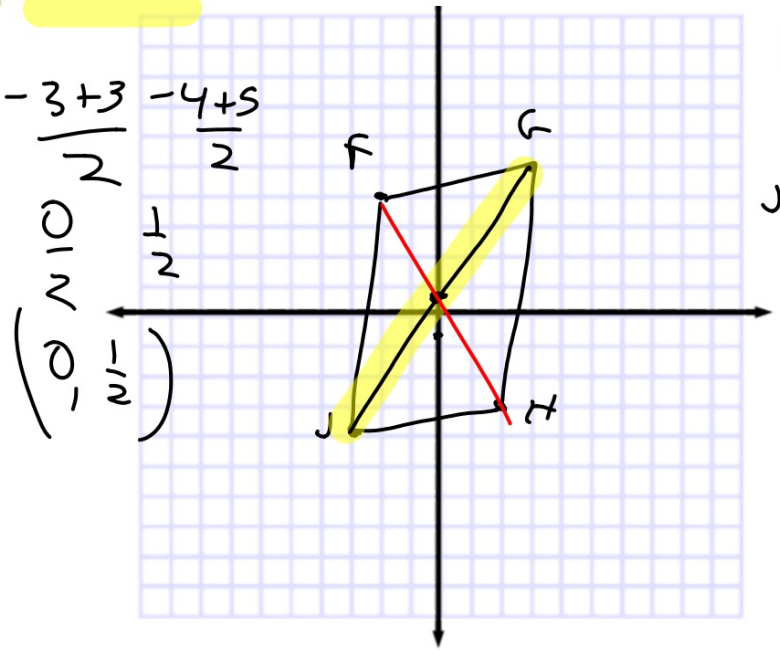


Hint: diagonals bisect each other



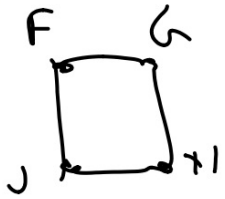
Example 3 Parallelograms and Coordinate Geometry

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 $J(-3, -4)$.



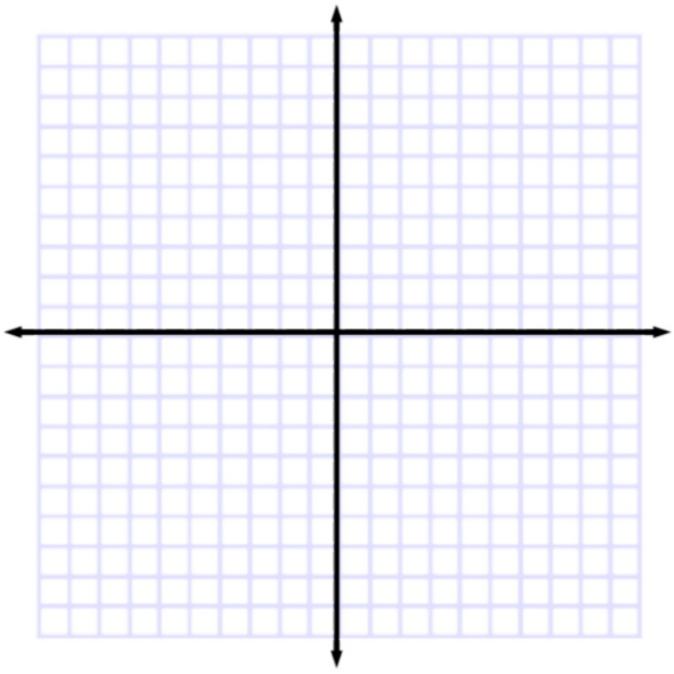
$\frac{-3+3}{2}$ $\frac{-4+5}{2}$

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



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 $U(4, -2)$.

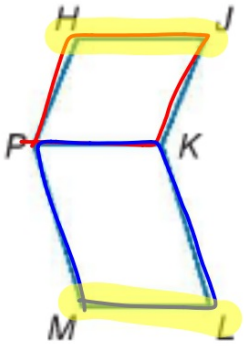


GuidedPractice

4. Write a two-column proof.

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

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



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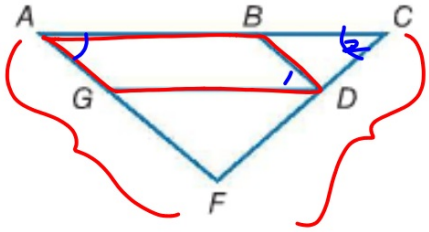
Example 4 Proofs Using the Properties of Parallelograms

Write a paragraph proof.

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

Prove: $\angle BDG \cong \angle 2$



Proof:

1. $\square ABDG$ $\overline{AF} \cong \overline{CF}$	1. given
2. $\angle A \cong \angle 1$	2. prop. of $\square$
3. $\angle A \cong \angle 2$	3. base $\angle$ isos $\triangle$
4. $\angle 1 \cong \angle 2$	4. trans.

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9-22 all

24

31-36 all