Chapter 7 Quadrilaterals

Sunday, March 27, 2022 6:44 PM

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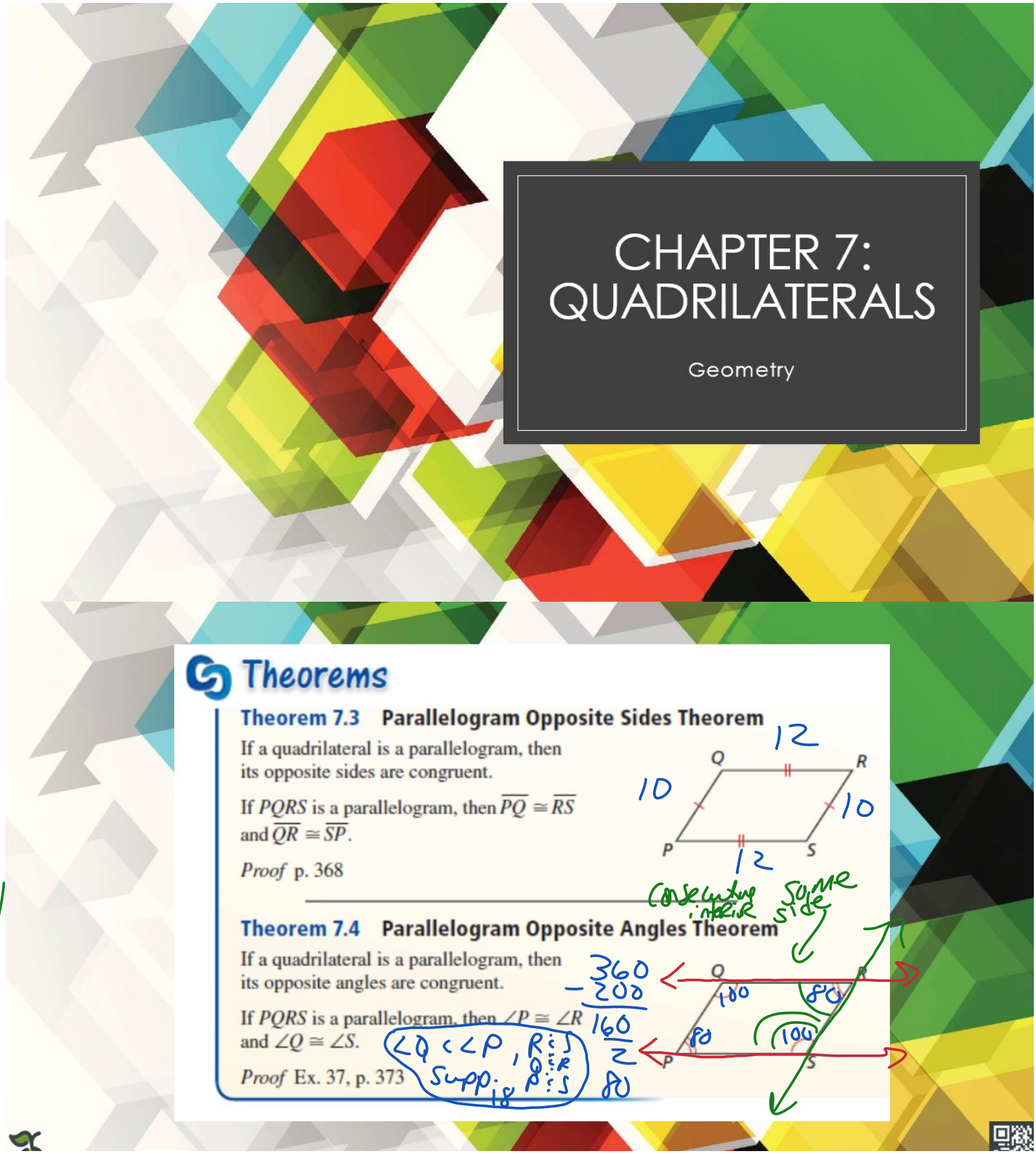
Quadrilat...



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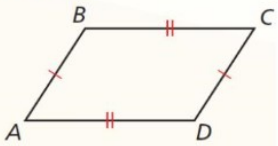
Theorems

Theorem 7.7 Parallelogram Opposite Sides Converse

If both pairs of opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

If $\overline{AB} \cong \overline{CD}$ and $\overline{BC} \cong \overline{DA}$, then $ABCD$ is a parallelogram.

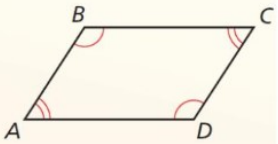


Theorem 7.8 Parallelogram Opposite Angles Converse

If both pairs of opposite angles of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

If $\angle A \cong \angle C$ and $\angle B \cong \angle D$, then $ABCD$ is a parallelogram.

Proof Ex. 39, p. 383



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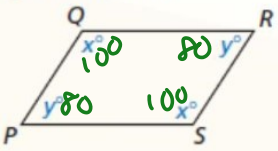
Theorems

Theorem 7.5 Parallelogram Consecutive Angles Theorem

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

If $PQRS$ is a parallelogram, then $x° + y° = 180°$.

Proof Ex. 38, p. 373

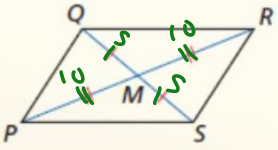


Theorem 7.6 Parallelogram Diagonals Theorem

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

If $PQRS$ is a parallelogram, then $\overline{QM} \cong \overline{SM}$ and $\overline{PM} \cong \overline{RM}$.

Proof p. 370



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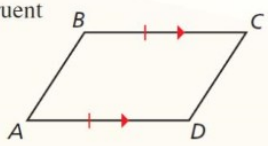
Theorems

Theorem 7.9 Opposite Sides Parallel and Congruent Theorem

If one pair of opposite sides of a quadrilateral are congruent and parallel, then the quadrilateral is a parallelogram.

If $\overline{BC} \parallel \overline{AD}$ and $\overline{BC} \cong \overline{AD}$, then $ABCD$ is a parallelogram.

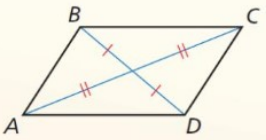


Proof Ex. 40, p. 383

Theorem 7.10 Parallelogram Diagonals Converse

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

If $\overline{BD}$ and $\overline{AC}$ bisect each other, then $ABCD$ is a parallelogram.



Proof Ex. 41, p. 383

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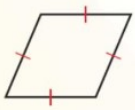
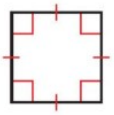
Core Concept

Rhombuses, Rectangles, and Squares



A **rhombus** is a parallelogram with four congruent sides.

A **rectangle** is a parallelogram with four right angles.



A **square** is a parallelogram with four congruent sides and four right angles.

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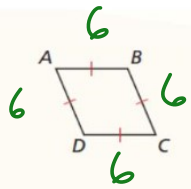
Corollaries

Corollary 7.2 Rhombus Corollary

A quadrilateral is a rhombus if and only if it has four congruent sides.

$ABCD$ is a rhombus if and only if $\overline{AB} \cong \overline{BC} \cong \overline{CD} \cong \overline{AD}$.

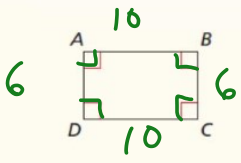


Proof Ex. 81, p. 396

Corollary 7.3 Rectangle Corollary

A quadrilateral is a rectangle if and only if it has four right angles.

$ABCD$ is a rectangle if and only if $\angle A$, $\angle B$, $\angle C$, and $\angle D$ are right angles.



Proof Ex. 82, p. 396

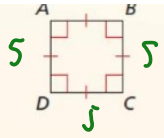
Corollary 7.4 Square Corollary

5

A quadrilateral is a square if and only if it is a rhombus and a rectangle.

$ABCD$ is a square if and only if $\overline{AB} \cong \overline{BC} \cong \overline{CD} \cong \overline{AD}$ and $\angle A$, $\angle B$, $\angle C$, and $\angle D$ are right angles.

Proof Ex. 83, p. 396



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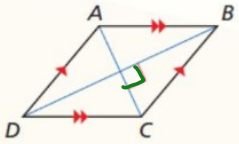
Theorems

Theorem 7.11 Rhombus Diagonals Theorem

A parallelogram is a rhombus if and only if its diagonals are perpendicular.

$\square ABCD$ is a rhombus if and only if $\overline{AC} \perp \overline{BD}$.

Proof p. 390; Ex. 72, p. 395

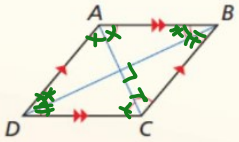


Theorem 7.12 Rhombus Opposite Angles Thoerem

A parallelogram is a rhombus if and only if each diagonal bisects a pair of opposite angles.

$\square ABCD$ is a rhombus if and only if $\overline{AC}$ bisects $\angle BCD$ and $\angle BAD$, and $\overline{BD}$ bisects $\angle ABC$ and $\angle ADC$.

Proof Exs. 73 and 74, p. 395



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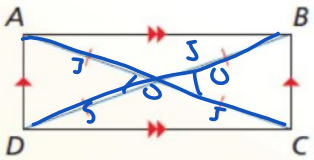
Theorem

Theorem 7.13 Rhombus Diagonals Theorem

A parallelogram is a rectangle if and only if its diagonals are congruent.

$\square ABCD$ is a rectangle if and only if $\overline{AC} \cong \overline{BD}$.

Proof Exs. 87 and 88, p. 396



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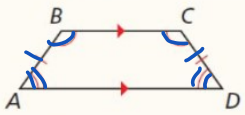
Theorems

Theorem 7.14 Isosceles Trapezoid Base Angles Theorem

If a trapezoid is isosceles, then each pair of base angles is congruent.

If trapezoid $ABCD$ is isosceles, then $\angle A \cong \angle D$ and $\angle B \cong \angle C$.

Proof Ex. 39, p. 405



Theorem 7.15 Isosceles Trapezoid Base Angles Converse

If a trapezoid has a pair of congruent base angles, then it is an isosceles trapezoid.

If $\angle A \cong \angle D$ (or if $\angle B \cong \angle C$), then trapezoid $ABCD$ is isosceles.

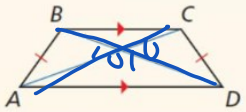
Proof Ex. 40, p. 405

Theorem 7.16 Isosceles Trapezoid Diagonals Theorem

A trapezoid is isosceles if and only if its diagonals are congruent.

Trapezoid $ABCD$ is isosceles if and only if $\overline{AC} \cong \overline{BD}$.

Proof Ex. 51, p. 406



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Theorem

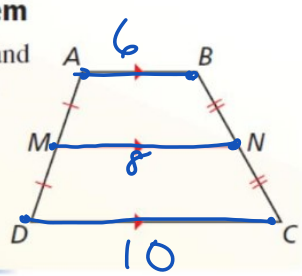
Theorem 7.17 Trapezoid Midsegment Theorem

The midsegment of a trapezoid is parallel to each base, and its length is one-half the sum of the lengths of the bases.

If $\overline{MN}$ is the midsegment of trapezoid $ABCD$, then $\overline{MN} \parallel \overline{AB}$, $\overline{MN} \parallel \overline{DC}$, and $MN = \frac{1}{2}(AB + CD)$.

Proof Ex. 49, p. 406

6+10
½ (16)
8



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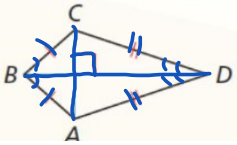
Theorems

Theorem 7.18 Kite Diagonals Theorem

If a quadrilateral is a kite, then its diagonals are perpendicular.

If quadrilateral $ABCD$ is a kite, then $\overline{AC} \perp \overline{BD}$.

Proof p. 401

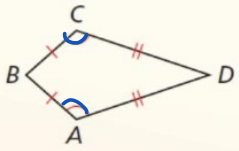


Theorem 7.19 Kite Opposite Angles Theorem

If a quadrilateral is a kite, then exactly one pair of opposite angles are congruent.

If quadrilateral $ABCD$ is a kite and $\overline{BC} \cong \overline{BA}$, then $\angle A \cong \angle C$ and $\angle B \ncong \angle D$.

Proof Ex. 47, p. 406



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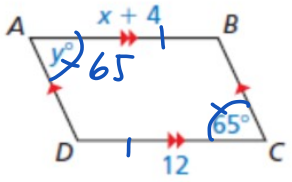
Find the values of x and y.

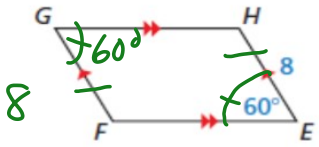
$x + y = 12$
$-y \quad -y$
$x = 8$

65°



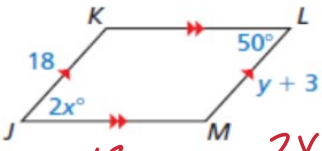
1. Find FG and $m\angle G$.

8 60



2. Find the values of x and y.

25 15



$y + 3 = 18$
$-3 \quad -3$
$y = 15$

$\frac{2x}{2} = \frac{50}{2}$
$x = 25$

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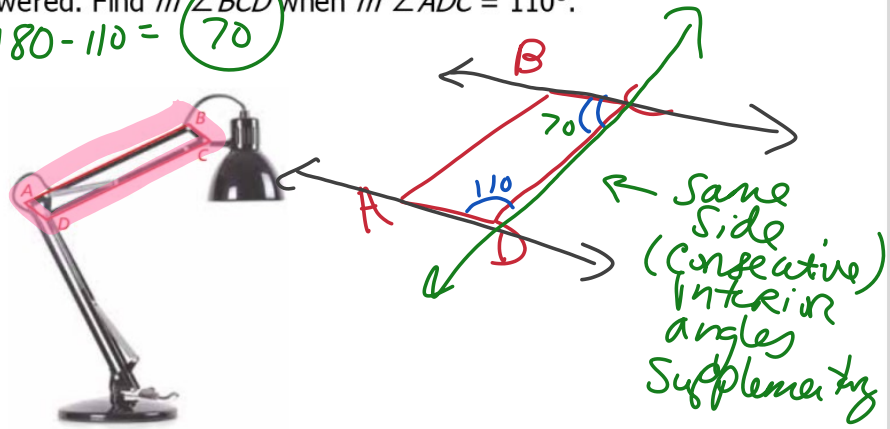
As shown, part of the extending arm of a desk lamp is a parallelogram. The angles of the parallelogram change as the lamp is raised and lowered. Find $m\angle BCD$ when $m\angle ADC = 110°$.

$180 - 110 = 70$



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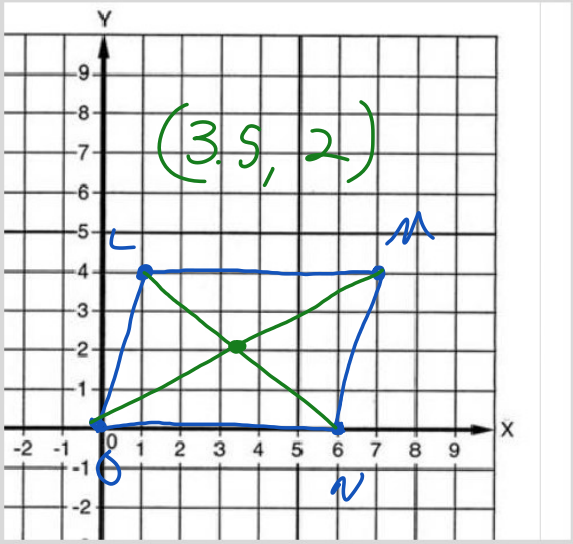
Find the coordinates of the intersection of the diagonals of ▫*LMNO* with vertices *L*(1, 4), *M*(7, 4), *N*(6, 0), and *O*(0, 0).



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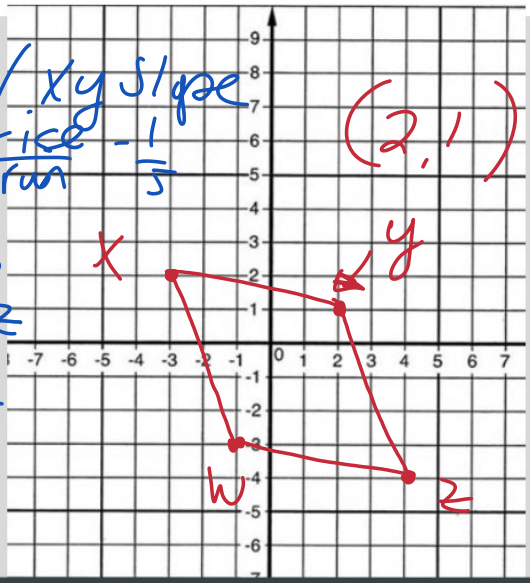
Three vertices of ▫*WXYZ* are *W*(−1, −3), *X*(−3, 2), and *Z*(4, −4). Find the coordinates of vertex *Y*.



Slope up
X W

Rise -5
Run 2

✓ xy slope
rise -1
run 5

✓ Slope WZ
-1/5

1 S

From Z ↑ up 5
Left
← -2

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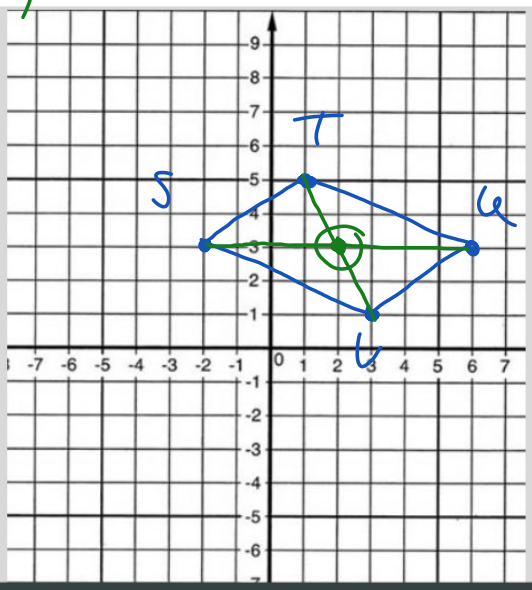
5. Find the coordinates of the intersection of the diagonals of ▫*STUV* with vertices *S*(−2, 3), *T*(1, 5), *U*(6, 3), and *V*(3, 1).

(2, 3)



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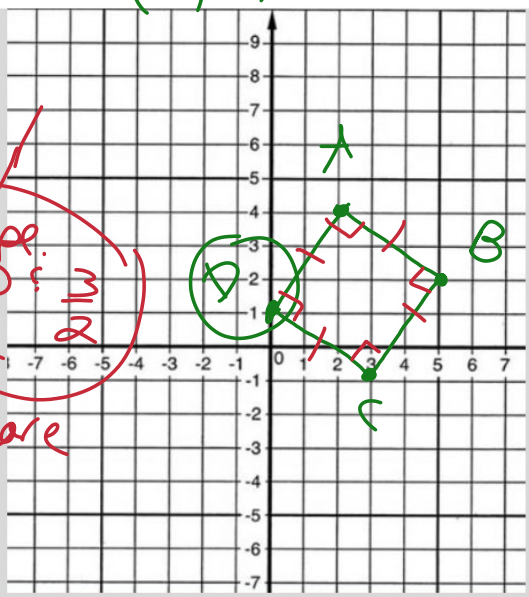
6. Three vertices of ▫*ABCD* are *A* (2, 4), *B* (5, 2), and *C* (3, −1). Find the coordinates of vertex *D*. (0, 1)



Slope of $\overline{AB}$

Rise / Run $= \frac{2}{3}$

negative reciprocals perpendicular Rectangle 90° Square

Slope AD : $\frac{3}{2}$
BC

From C: up 2, left 3 $\left(\frac{2}{-3}\right)$

$-\frac{2}{3}$

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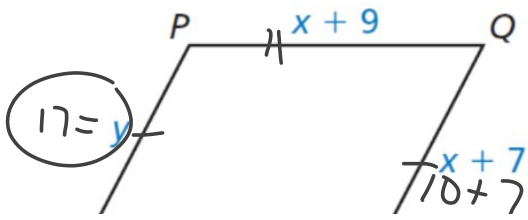
For what values of *x* and *y* is quadrilateral *PQRS* a parallelogram?

$x + 9 = 2x - 1$

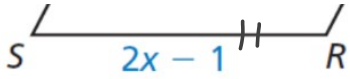
$+1 \quad +1$

$x + 10 = 2x$

$-x \quad -x$



$10 = x$



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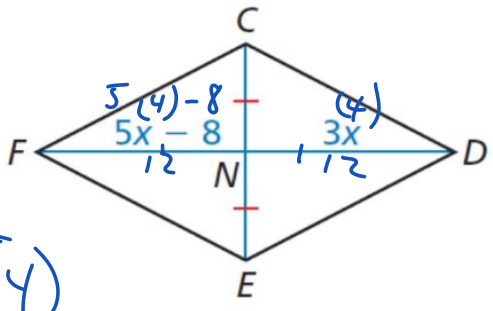
For what value of x is quadrilateral $CDEF$ a parallelogram?

$5x - 8 = 3x$
$+8 \quad +8$
$5x = 3x + 8$
$-3x \quad -3x$
$2x = 8$
$\frac{2x}{2} = \frac{8}{2}$
$x = 4$



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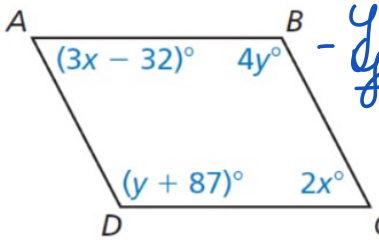
2. For what values of x and y is quadrilateral $ABCD$ a parallelogram? Explain your reasoning.

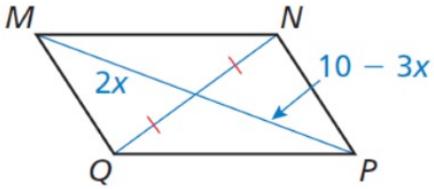
$3x - 32 = 2x$
$+32 \quad +32$
$3x = 2x + 32$
$-2x \quad -2x$
$x = 32$



$y + 87 = 4y$
$-y \quad -y$
$87 = 3y$
$\frac{87}{3} = \frac{3y}{3}$
$29 = y$

6. For what value of x is quadrilateral $MNPQ$ a parallelogram? Explain your reasoning.

$2x = 10 - 3x$
$+3x \quad +3x$
$\frac{5x}{5} = \frac{10}{5}$
$x = 2$



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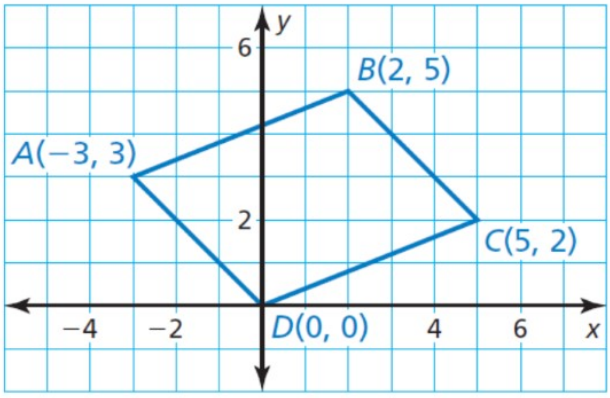
Show that quadrilateral $ABCD$ is a parallelogram.



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Find the measures of the numbered angles in rhombus $ABCD$.