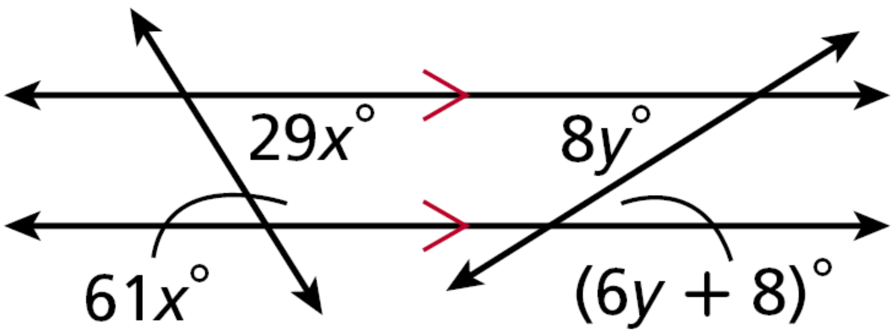
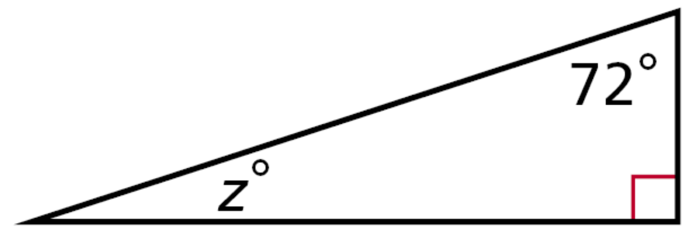
G2a Properties of Parallelograms

Drill

Find the value of each variable.





1. x 2

2. y 4

3. z 18

G2a Properties of Parallelograms

Objective: Students will be able to use and apply properties of parallelograms in order to solve problems

Homework: page 395: 1 – 13, 15 – 24

Quiz next class on sections 6.1-6.3

Bring graph paper for next class

What do you call an urgent message sent across a parallel network?

A parallelogram

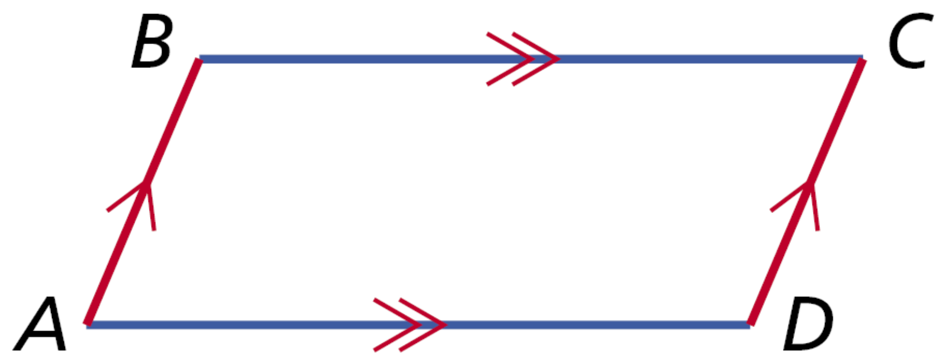
Complete the top of *Just the Facts*. Analyze the quadrilaterals to determine which are parallelograms.

Work with your group to develop a definition of parallelogram.

A quadrilateral with two pairs of parallel sides is a **parallelogram**. To write the name of a parallelogram, you use the symbol $\square$.

Parallelogram *ABCD*

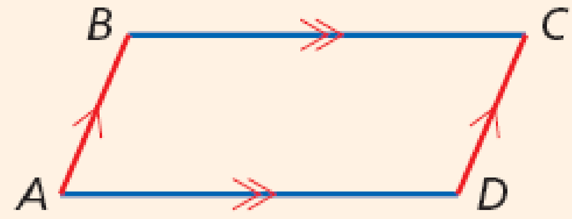
$\square ABCD$



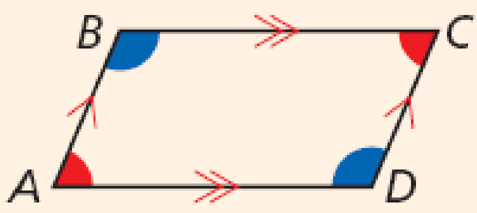
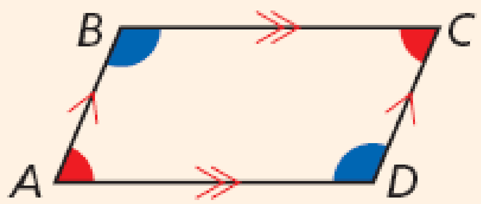
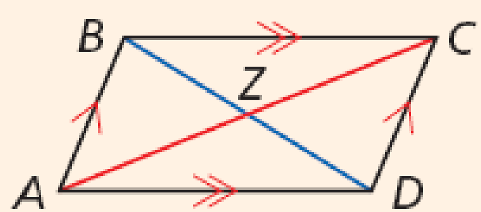
$\overline{AB} \parallel \overline{CD}$, $\overline{BC} \parallel \overline{DA}$

Discovery Activity☺

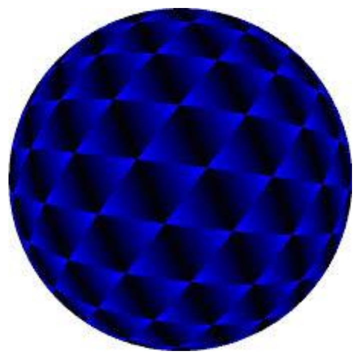
Theorem 6-2-1 Properties of Parallelograms

THEOREM	HYPOTHESIS	CONCLUSION
If a quadrilateral is a parallelogram, then its opposite sides are congruent. (▱ → opp. sides ≅)		$\overline{AB} \cong \overline{CD}$ $\overline{BC} \cong \overline{DA}$

Theorems — Properties of Parallelograms

THEOREM		HYPOTHESIS	CONCLUSION
6-2-2	If a quadrilateral is a parallelogram, then its opposite angles are congruent. (▱ → opp. ∠s ≅)		$\angle A \cong \angle C$ $\angle B \cong \angle D$
6-2-3	If a quadrilateral is a parallelogram, then its consecutive angles are supplementary. (▱ → cons. ∠s supp.)		$m\angle A + m\angle B = 180°$ $m\angle B + m\angle C = 180°$ $m\angle C + m\angle D = 180°$ $m\angle D + m\angle A = 180°$
6-2-4	If a quadrilateral is a parallelogram, then its diagonals bisect each other. (▱ → diags. bisect each other)		$\overline{AZ} \cong \overline{CZ}$ $\overline{BZ} \cong \overline{DZ}$

Can you think of a real world example of why parallelograms and their properties are important?



Race car designers can use a parallelogram-shaped linkage to keep the wheels of the car vertical on uneven surfaces

NASA's Spitzer Space Telescope has captured in unprecedented detail this spiral galaxy twisted into a parallelogram-shaped structure of dust.

Strategies when solving problems

- Draw a picture if you are not given one

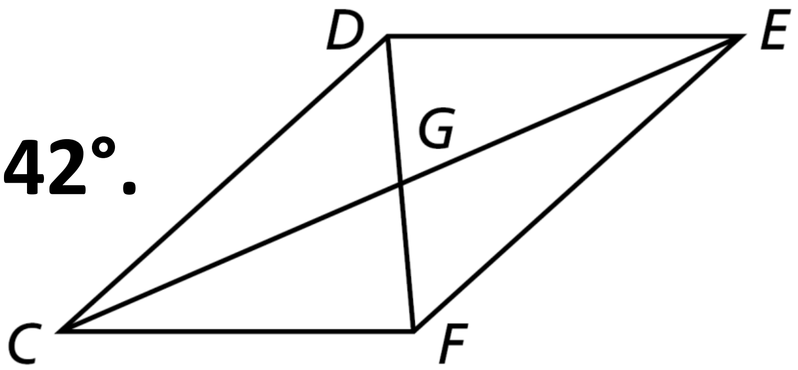
- Be sure to write in all of the angle and side measurements

- Determine the relationship between the sides, angles, or diagonals of the parallelogram that are given.

- Set up an equation and solve

Example 1A: Properties of Parallelograms

In ▱*CDEF*, *DE* = 74 mm,
***DG* = 31 mm, and m∠*FCD* = 42°.**
Find *CF*.



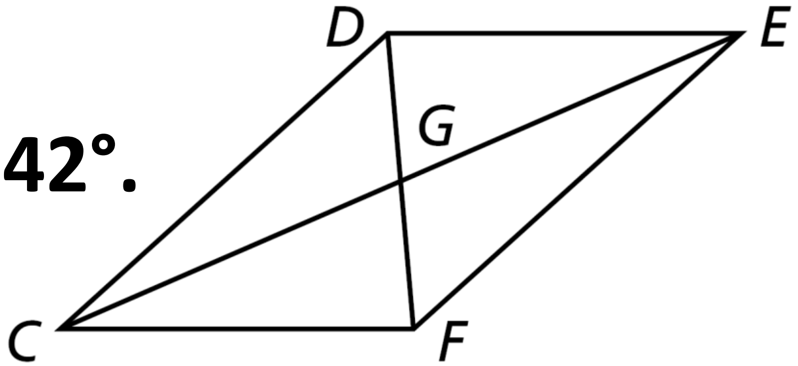
$\overline{CF} \cong \overline{DE}$ — *▱ → opp. sides ≅*

CF = *DE* — *Def. of ≅ segs.*

CF = 74 mm — *Substitute 74 for DE.*

Example 1B: Properties of Parallelograms

In ▱*CDEF*, *DE* = 74 mm,
***DG* = 31 mm, and m∠*FCD* = 42°.**
Find m∠*EFC*.



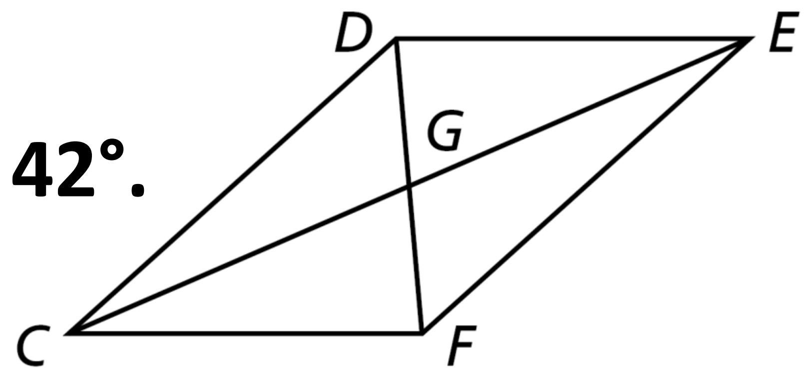
$m\angle EFC + m\angle FCD = 180°$ ▱ → *cons. ∠s supp.*

$m\angle EFC + 42 = 180$ *Substitute 42 for m∠FCD.*

$m\angle EFC = 138°$ *Subtract 42 from both sides.*

Example 1C: Properties of Parallelograms

In ▱*CDEF*, *DE* = 74 mm,
***DG* = 31 mm, and m∠*FCD* = 42°.**
Find *DF*.



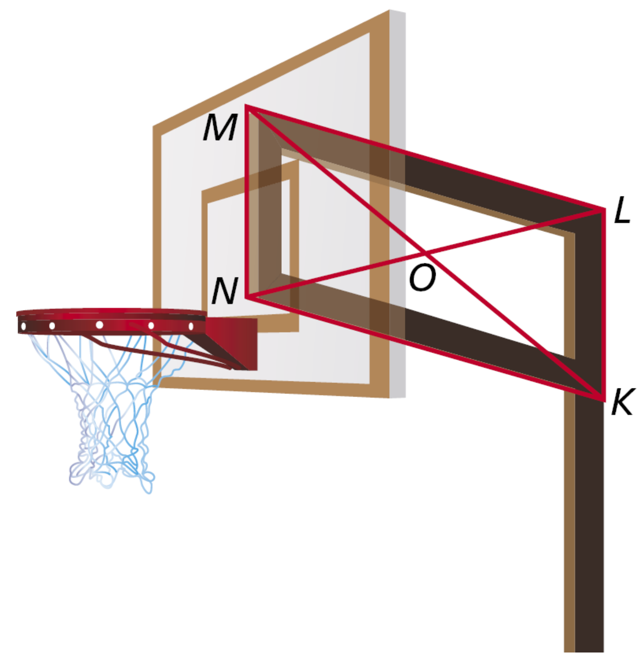
$DF = 2DG$ ▱ → *diags. bisect each other.*

$DF = 2(31)$ *Substitute 31 for DG.*

$DF = 62$ *Simplify.*

Check It Out! Example 1a

In ▱*KLMN*, *LM* = 28 in., *LN* = 26 in., and m∠*LKN* = 74°. Find *KN*.



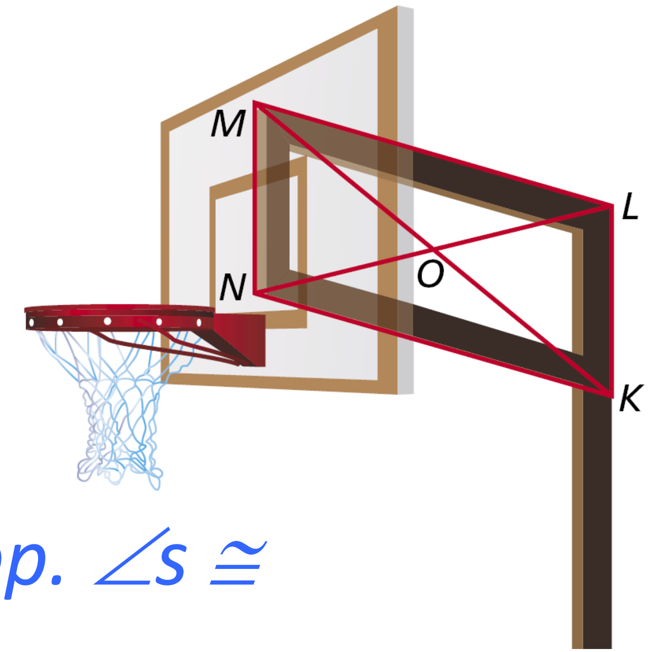
$\overline{LM} \cong \overline{KN}$ — *▱ → opp. sides ≅*

$LM = KN$ — *Def. of ≅ segs.*

$LM = 28$ in. — *Substitute 28 for DE.*

Check It Out! Example 1b

In ▱*KLMN*, *LM* = 28 in., *LN* = 26 in., and m∠*LKN* = 74°. Find m∠*NML*.



$\angle NML \cong \angle LKN$ — ▱ → *opp. ∠s ≅*

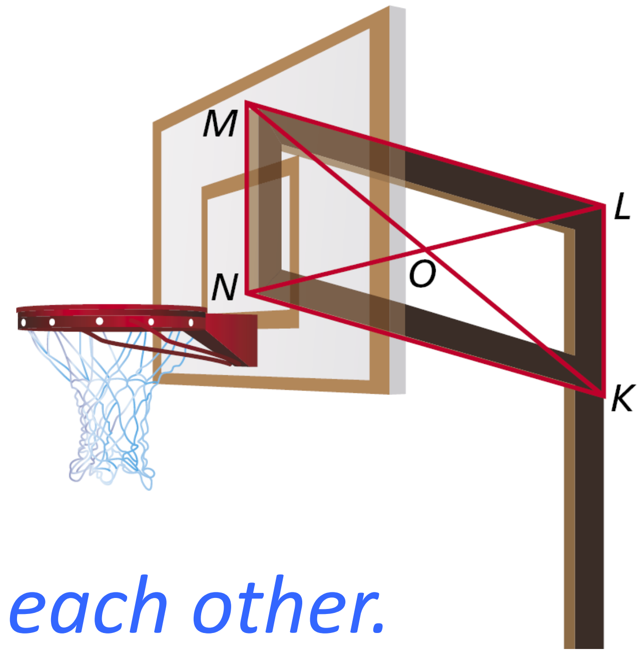
$m\angle NML = m\angle LKN$ — *Def. of ≅ ∠s.*

$m\angle NML = 74°$ — *Substitute 74° for m∠LKN.*

Def. of angles.

Check It Out! Example 1c

In ▱*KLMN*, *LM* = 28 in., *LN* = 26 in., and m∠*LKN* = 74°. Find *LO*.



$LN = 2LO$ ▱ → *diags. bisect each other.*

$26 = 2LO$ *Substitute 26 for LN.*

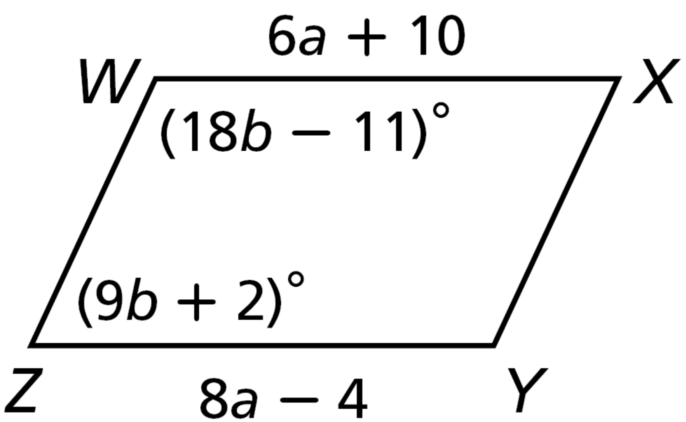
$LO = 13$ in. *Simplify.*

Example 2A: Using Properties of Parallelograms to Find Measures

***WXYZ* is a parallelogram.**

Find m∠*Z* . ***65***

Find *YZ*. ***52***



$\overline{YZ} \cong \overline{XW}$ — *▱ → opp. ∠s ≅*

$YZ = XW$ — *Def. of ≅ segs.*

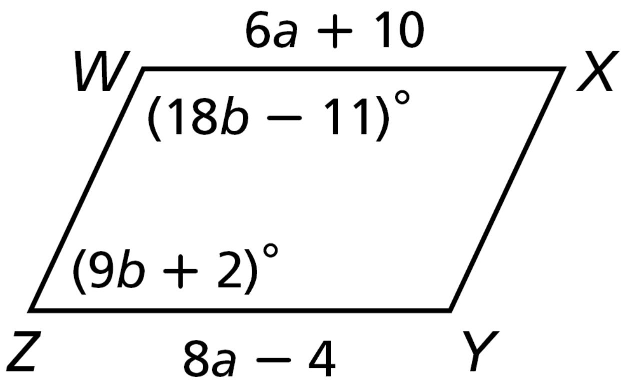
$8a - 4 = 6a + 10$ — *Substitute the given values.*

$2a = 14$ — *Subtract 6a from both sides and add 4 to both sides.*

$a = 7$ — *Divide both sides by 2.*

$YZ = 8a - 4 = 8(7) - 4 = 52$

Example 2B: Using Properties of Parallelograms to Find Measures



WXYZ **is a parallelogram.**

Find m∠*Z* .

$m\angle Z + m\angle W = 180°$ ▱ → *cons. ∠s supp.*

$(9b + 2) + (18b – 11) = 180$ *Substitute the given values.*

$27b – 9 = 180$ *Combine like terms.*

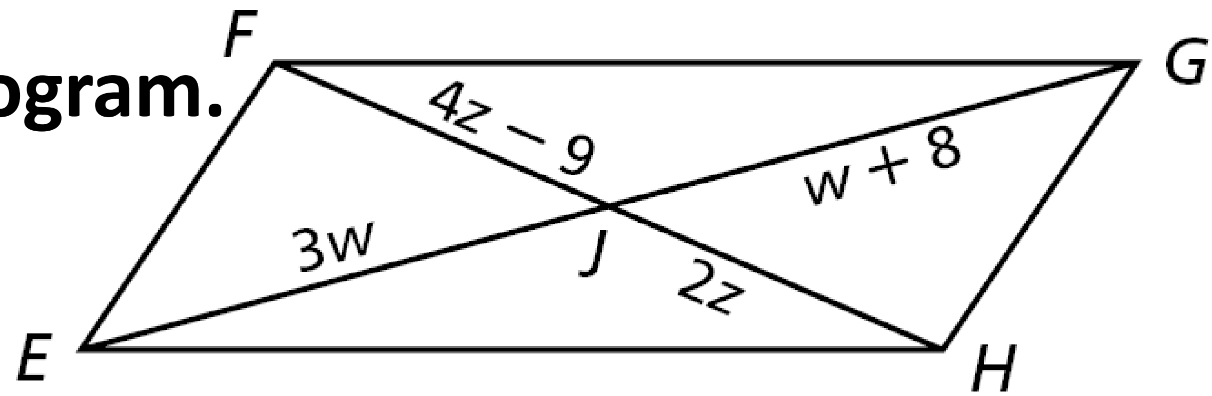
$27b = 189$ *Add 9 to both sides.*

$b = 7$ *Divide by 27.*

$m\angle Z = (9b + 2)° = [9(7) + 2]° = 65°$

Check It Out! Example 2b

EFGH **is a parallelogram.**
Find ***FH*****.**



$\overline{FJ} \cong \overline{JH}$ — ▱ → *diags. bisect each other.*

$FJ = JH$ — *Def. of ≅ segs.*

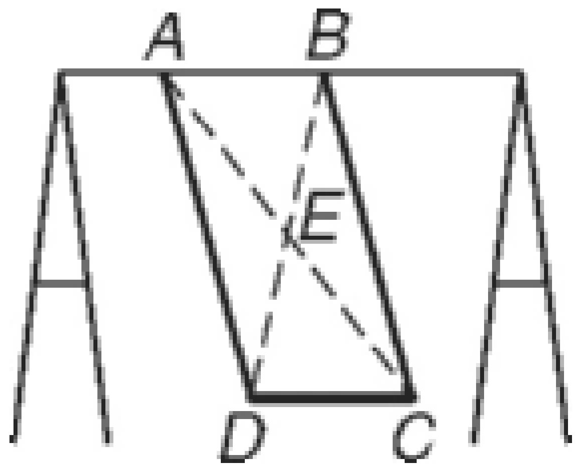
$4z - 9 = 2z$ — *Substitute.*

$2z = 9$ — *Simplify.*

$z = 4.5$ — *Divide both sides by 2.*

$FH = (4z - 9) + (2z) = 4(4.5) - 9 + 2(4.5) = 18$

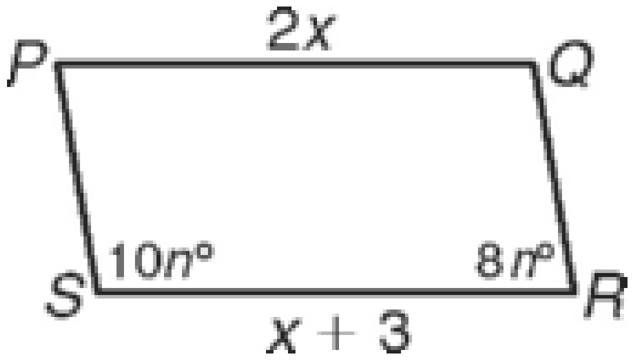
White Boards



ABCD, DC = 2 ft, BE = 4.5**ft, and m∠*****BAD = 75°.***

Find each measure:

AB	2 ft	m∠*ABC*	105°
ED	4.5 ft	m∠*BCD*	75°
BD	9 ft	m∠*ADC*	105°

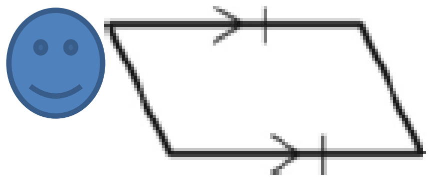


RS 6

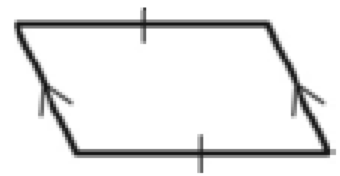
m∠S 100°

m∠R 80°

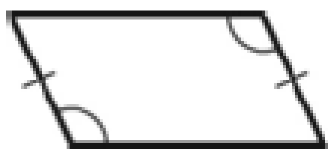
Which quadrilateral MUST be a parallelogram?



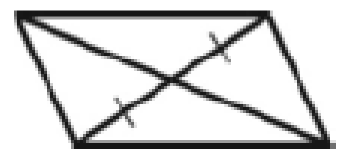
H



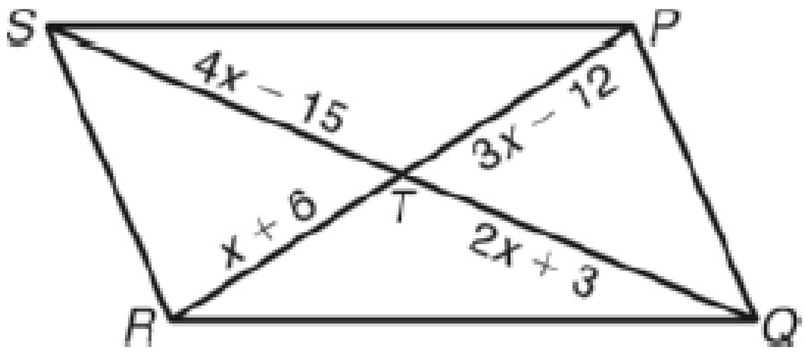
G



J



PQRS is a parallelogram. Find *x*.



F 3

G 7

9

J 15

In quadrilateral $WXYZ$, $\angle W \cong \angle Y$. Which information would help to prove that $WXYZ$ is a parallelogram?

F $WY = XZ$

H $WX = XY$

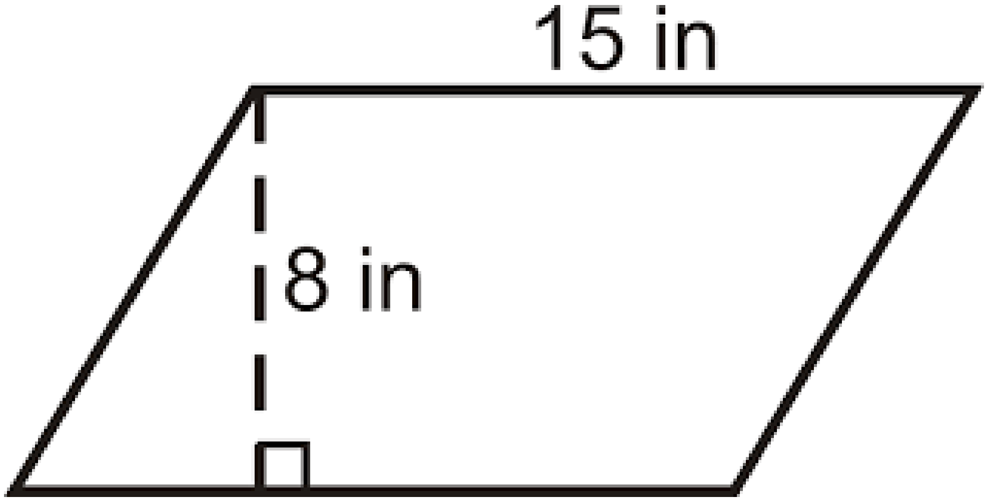
G $\angle X \cong \angle W$

 $\angle X \cong \angle Z$

Three vertices of parallelogram *GHIJ* *are G(0, 0), H(2, 3), and J(6, 1). What are the coordinates of I?*

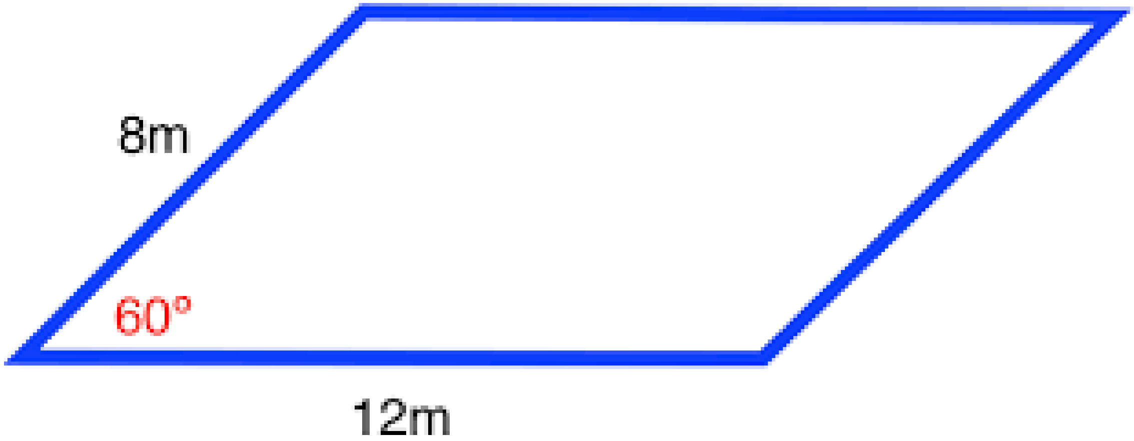
(8, 4)

Find the area



120

Find the area



$$48\sqrt{3} \approx 83.1384$$

Summary

What are the key characteristics of a parallelogram?

How do the characteristics help us solve problems?

How could we use the properties of parallelograms in our own lives?