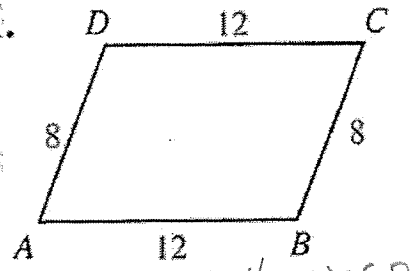
Geometry (H) date KEY

Conditions of the Parallelogram Homework & Practice

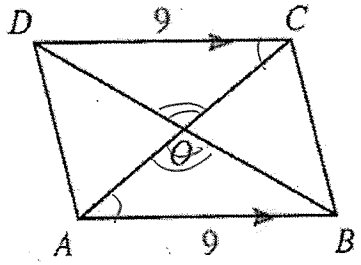
For #1-9, study the markings of each diagram. Decide whether ABCD **must** be a parallelogram. If the answer is yes, state the definition or theorem that applies.

**1.**



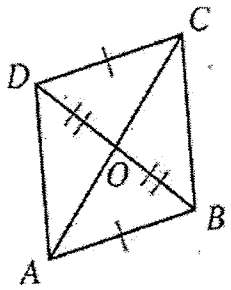

Yes, if both pairs of opp sides are $\cong$ → ▱

**2.**



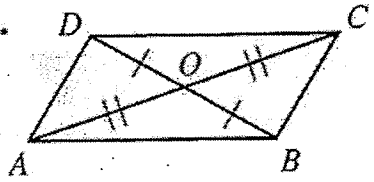

Yes, if one pair of opp sides are both $\cong$ and $\parallel$ → ▱

**3.**



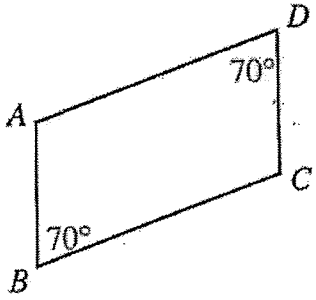

No

**4.**



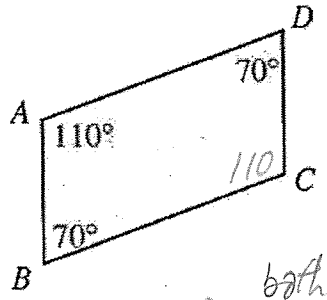

Yes.
If diagonals bisect each other → ▱

**5.**




No

**6.**




$$\begin{array}{r} 110 \\ +\ 140 \\ \hline 250 \end{array}$$

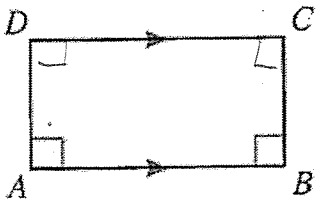
$$\begin{array}{r} 360 \\ -\ 250 \\ \hline 110 \end{array}$$

Yes; if opposite $\angle$s are $\cong$ → ▱ both pairs

or

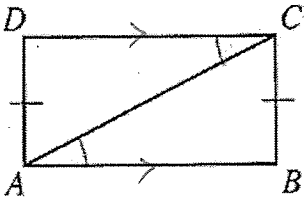
If both pairs of opp sides are $\parallel$, then ▱.

**7.**



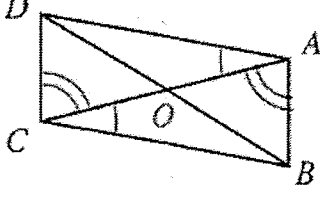

Yes. If 2 lines $\perp$ to the same line, the 2 lines parallel. Opposite sides are parallel → ▱

**8.**



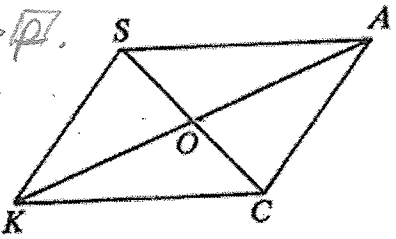

No

**9.**




Yes. Definition: If opposite sides are parallel → ▱.

For #10-14, state the principal definition or theorem that enables you to deduce, from the information given, that quad. SACK is a parallelogram.




10. $\overline{SA} \parallel \overline{KC}$; $\overline{SK} \parallel \overline{AC}$ If both pairs opp sides $\parallel$ → ☐.

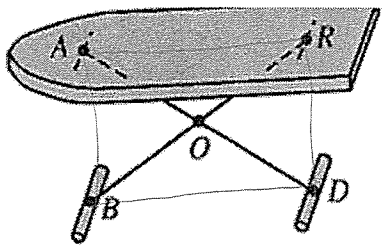
11. $\overline{SA} \cong \overline{KC}$; $\overline{SK} \cong AC$ If both pairs opp sides $\cong$ → ☐

12. $\overline{SA} \cong \overline{KC}$; $\overline{SA} \parallel \overline{KC}$ If 1 pair opp sides $\cong$ & $\parallel$ → ☐

13. $SO = \frac{1}{2}SC$; $KO = \frac{1}{2}KA$ If diagonals bisect each other → ☐

14. $\angle SKC \cong \angle CAS$; $\angle KCA \cong \angle ASK$
If both pairs opp $\angle$s $\cong$ → ☐.

15. The legs of this ironing board are built so that $BO = AO = RO = DO$. What theorem guarantees that the board is parallel to the floor ($\overline{AR} \parallel \overline{BD}$)?




If diagonals bisect each other, then the quad. is a ☐.

On looseleaf paper, prove each of the following theorems. Use the given in your notes.

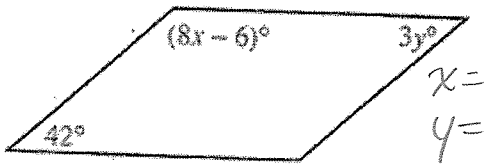
16. If both pairs of opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

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

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

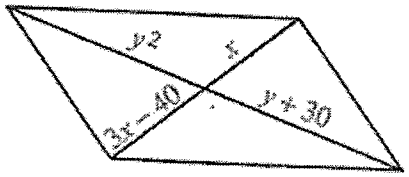
**What values must $x$ and $y$ have to make the quadrilateral a parallelogram?**

19.



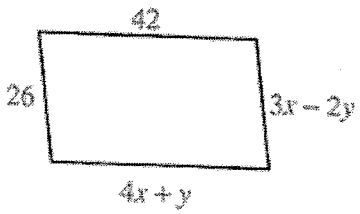

$x = 18$
$y = 14$

20.



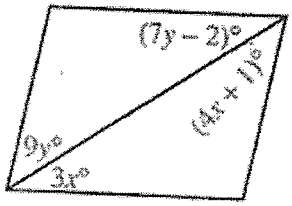

$x = 20$
$y = 6$
$y = -5$

21.




$x = 10$
$y = 2$

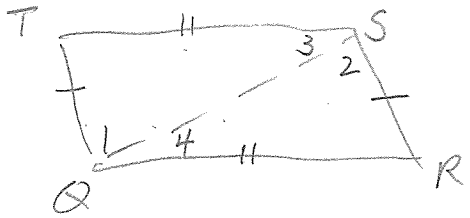
22.




$x = 11$
$y = 5$

# Theorem Proofs: Proving quads are ▱s

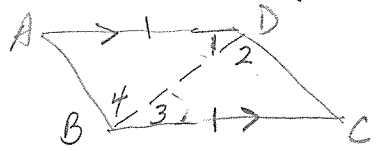
(16) Thm: If both pairs of opp. sides of quad ≅ → ▱.




① $\overline{TS} \cong \overline{QR}$, $\overline{TQ} \cong \overline{SR}$; ② $\overline{QS} \cong \overline{QS}$ → ③ $\triangle TQS \cong \triangle RSQ$ → ④ $\angle 1 \cong \angle 2$, $\angle 3 \cong \angle 4$ → ⑤ $\overline{TQ} \parallel \overline{SR}$, $\overline{TS} \parallel \overline{QR}$ → ⑥ ▱ QRST

① Given
② Reflexive Prop
③ SSS Thm
④ CPCTC
⑤ 2 lines w/ alt. int. $\angle$s ≅ → ∥ lines
⑥ 2 prs opp sides ∥ → ▱.

(17) Thm: If one pr. opp sides of quad ≅ and ∥ → ▱.




① $\overline{AD} \parallel \overline{BC}$ → ② $\angle 1 \cong \angle 3$, ③ $\overline{AD} \cong \overline{BC}$, ④ $\overline{BD} \cong \overline{BD}$ → ⑤ $\triangle ADB \cong \triangle CBD$ → ⑥ $\angle 4 \cong \angle 2$ → ⑦ $\overline{AB} \parallel DC$ → ⑧ Quad ABCD is ▱.

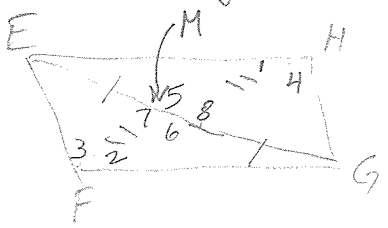
① Given
② 2 ∥ lines → alt. int. $\angle$s ≅.
③ Given
④ Reflexive Prop.
⑤ SAS thm
⑥ CPCTC
⑦ 2 lines w/ alt. int. $\angle$s ≅ → 2 ∥ lines
⑧ 2 prs. opp sides ∥ → ▱.

Thm: 2 prs of opp ∠s of quad ≅ → ▱

| Statements | Reasons |
|---|---|
| ① $x+y+x+y=360$ | ① Sum of meas. of quad = 360 |
| ② $2(x+y)=360$ | ② Distributive Prop ← use for Proof (see Book) |
| ③ $x+y=180$ | ③ Division Prop |
| ④ ∠A and ∠D Suppl<br>∠A and ∠B Suppl | ④ Suppl. ∠s are 2 ∠s that total 180. |
| ⑤ $\overline{AB} \parallel \overline{CD}$, $\overline{BC} \parallel \overline{AD}$ | ⑤ 2 lines ∥ if alt. int ∠s ≅ → 2 ∥ lines |
| ⑥ ABCD is ▱. | ⑥ |

*

(18) Thm: Diag bisect each other → ▱.




① $\overline{EG}$ and $\overline{HF}$ bisect each other. → ② $\overline{EM} \cong \overline{MG}$, $\overline{FM} \cong \overline{MH}$ → ④ $\triangle EMH \cong \triangle GMF$

③ ∠5 ≅ ∠6

⑤ ∠1 ≅ ∠2 → ⑥ $\overline{EH} \parallel \overline{FG}$

⑦ ∠7 ≅ ∠8 → ⑧ $\triangle EFM \cong \triangle GHM$ → ⑨ ∠3 ≅ ∠4 → ⑩ $\overline{EF} \parallel \overline{HG}$

⑪ EFGH is ▱.

① Given
② Segmt bisector ÷ Segmt into 2 ≅ parts.
③ Vertical ∠s ≅.
④ SAS Thm
⑤ CPCTC
⑥ 2 lines w/ alt. int ∠s ≅ → 2 ∥ lines.
⑦ Vertical ∠s ≅.
⑧ SAS Thm
⑨ CPCTC
⑩ 2 lines w/ alt. int ∠s ≅ → 2 ∥ lines.
⑪ 2 prs. opp sides ∥ → ▱.