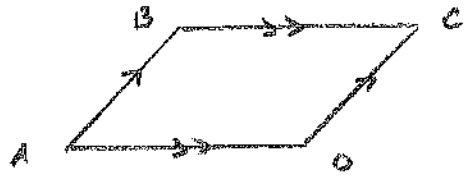
Geometry Notes

Section 6-2: Properties of Parallelograms
Section 6-3: Proving that a Quadrilateral is a Parallelogram

Parallelogram:

quadrilateral with both pairs of opposite sides parallel (▱)

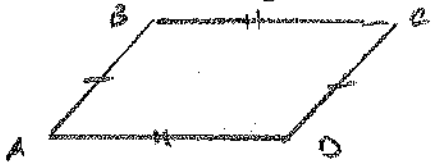


$\overline{AB} \parallel \overline{CD}$

$\overline{BC} \parallel \overline{AD}$

Sides of a Parallelogram

Opposite sides of a ▱ are congruent



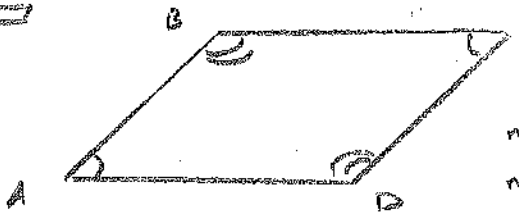
$\overline{AB} \cong \overline{CD}$

$\overline{BC} \cong \overline{AD}$

Angles of a Parallelogram

Opposite angles of a ▱ are congruent.

Consecutive angles of a ▱ are supplementary.



$\angle A \cong \angle C$

$\angle B \cong \angle D$

$m\angle A + m\angle B = 180°$

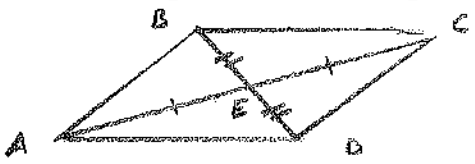
$m\angle B + m\angle C = 180°$

$m\angle C + m\angle D = 180°$

$m\angle D + m\angle A = 180°$

Diagonals of a Parallelogram

Diagonals of a ▱ bisect each other



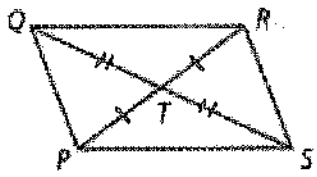
$\overline{AE} \cong \overline{CE}$

$\overline{BE} \cong \overline{DE}$

Algebra Find the values of x and y in ▱$PQRS$.

14. $PT = 2x,\ TR = y + 4,\ QT = x + 2,\ TS = y$

15. $PT = x + 2,\ TR = y,\ QT = 2x,\ TS = y + 3$



Solving a System by Substitution

(14) $2x = y + 4$ $\quad |x+2| = y$

$2x = (x + 2) + 4$

$2x = x + 2 + 4$

$2x = x + 6$

$-x \quad -x$

$|x = 6|$

$6 + 2 = y$

$|8 = y|$

(15) $|x+2| = y$ $\quad 2x = y + 3$

$5 + 2 = y$

$|7 = y|$

$2x = (x + 2) + 3$

$2x = x + 2 + 3$

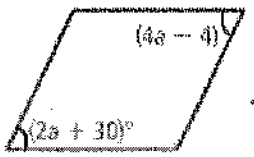
$2x = x + 5$

$-x \quad -x$

$|x = 5|$

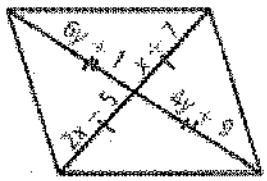
Algebra Find the value(s) of the variable(s) in each parallelogram.

26.



$4a - 4 = 2a + 30$
$-2a \quad -2a$
$2a - 4 = 30$
$+4 \quad +4$
$\frac{2a}{2} = \frac{34}{2}$
$a = 17$

27.

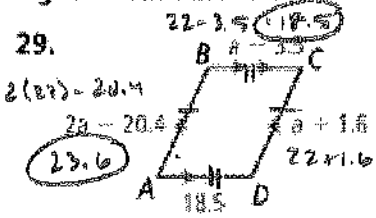


$2x - 5 = x + 7$
$-x \quad -x$
$x - 5 = 7$
$+5 \quad +5$
$x = 12$

$6y + 1 = 4y + 9$
$-4y \quad -4y$
$2y + 1 = 9$
$-1 \quad -1$
$\frac{2y}{2} = \frac{8}{2}$
$y = 4$

Algebra Find the value of a. Then find each side length or angle measure.

29.

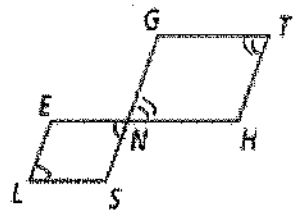


$a - 3.5 = 18.5$
$+3.5 \quad +3.5$
$a = 22$

Proof

33. Given: $\square LENS$ and $\square NGTH$

Prove: $\angle L \cong \angle T$

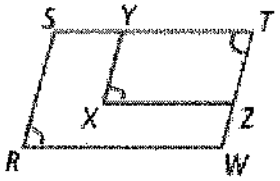


S	R
(1) $\square$ LENS and $\square$ NGTH	(1) Given
(2) $\angle L \cong$ LENS, $\angle T \cong \angle$GNH	(2) Opp $\angle$s of $\square \cong$
(3) LENS $\cong \angle$GNH	(3) Vert. $\angle$s Thm
(4) $\angle L \cong \angle T$	(4) Transitive Prop

Proof

36. Given: $\square RSTW$ and $\square XYTZ$

Prove: $\angle R \cong \angle X$



S	R
(1) $\square$ RSTW and $\square$ XYTZ	(1) Given
(2) $\angle R \cong \angle T$, $\angle T \cong \angle X$	(2) Opp $\angle$s of $\square \cong$
(3) $\angle R \cong \angle X$	(3) Trans. Thm Prop

Find the measures of the numbered angles for each parallelogram.

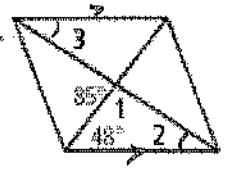
38.

$m\angle 3 = 110°$ (Opp $\angle$s $\cong$)

$m\angle 1 = 38°$ (Alt. Int $\angle$s)

$110 + 38 = 148$
$180 - 148 = 32$
$m\angle 2 = 32°$

40.

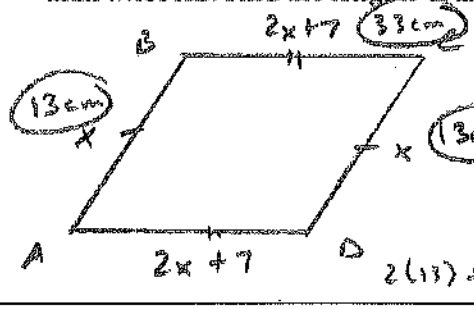


$180 - 85 = 95°$
$m\angle 1 = 95°$

$95 + 48 = 143$
$180 - 143 = 37$
$m\angle 2 = 37°$

$m\angle 3 = 37°$ (Alt. Int $\angle$s)

41. Algebra The perimeter of $\square ABCD$ is 92 cm. AD is 7 cm more than twice AB. Find the lengths of all four sides of $\square ABCD$.



$x + 2x + 7 + x + 2x + 7 = 92$

$6x + 14 = 92$

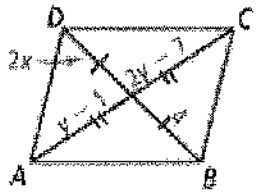
$-14 \quad -14$

$\frac{6x}{6} = \frac{78}{6} \rightarrow x = 13$

$2(13) + 7 = 33$ cm

Algebra For what values of x and y must $ABCD$ be a parallelogram?

8.



$\frac{2x}{2} = \frac{4}{2}$

$x = 2$

$y - 1 = 2y - 7$

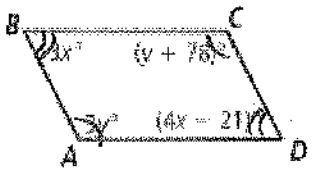
$-y \quad -y$

$-1 = y - 7$

$+7 \quad +7$

$6 = y$

9.



$3x = 4x - 21$

$-4x \quad -4x$

$-1x = -21$

$x = 21$

$3y = y + 78$

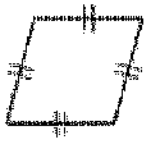
$-y \quad -y$

$\frac{2y}{2} = \frac{78}{2}$

$y = 39$

Can you prove that the quadrilateral is a parallelogram based on the given information? Explain.

13.



Yes b/c both pairs of opposite sides are congruent

14.

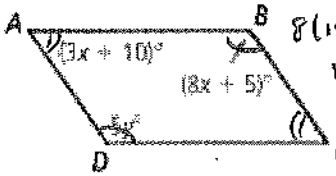
No b/c only one diagonal is bisected

15.

Yes b/c both pairs of opposite angles are congruent

Algebra For what values of the variables must $ABCD$ be a parallelogram?

22.



$8(15) + 5$

125

$3x + 10 + 8x + 5 = 180$

$11x + 15 = 180$

$-15 \quad -15$

$11x = 165$

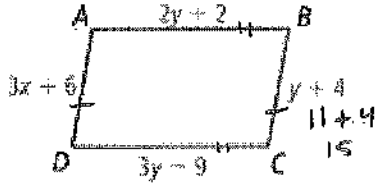
$\frac{11}{11} = \frac{165}{11}$

$x = 15$

$\frac{5y}{5} = \frac{125}{5}$

$y = 25$

23.



$11 + 4$

15

$3x + 6 = 15$

$-6 \quad -6$

$\frac{3x}{3} = \frac{9}{3}$

$x = 3$

$2y + 2 = 3y - 9$

$-2y \quad -2y$

$2 = y - 9$

$+9 \quad +9$

$11 = y$