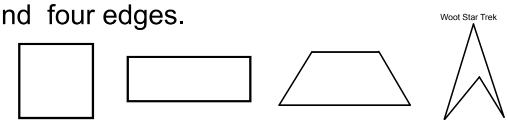
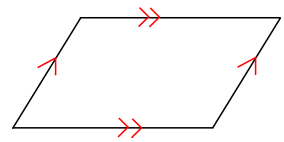
3-3 Parallelograms

Definitions:

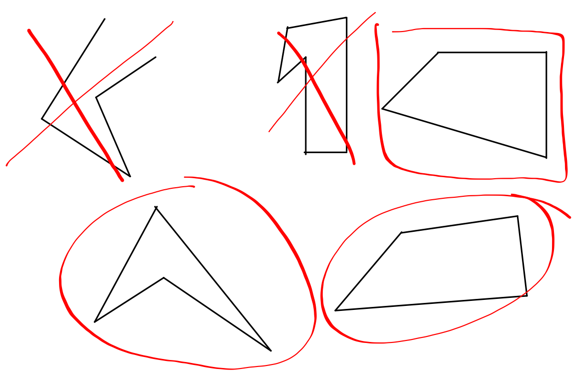
Quadrilateral - A polygon with four vertices and four edges.



Parallelogram - A quadrilateral with both pairs of opposite sides parallel.



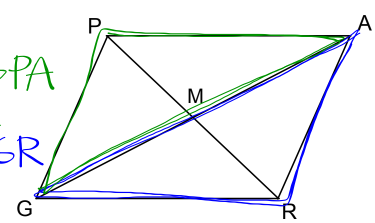
Which of the following are quadrilaterals?



To show opposite sides of a parallelogram *P* are congruent, which triangles would you show are congruent?

SSS
SAS
ASA
AAS

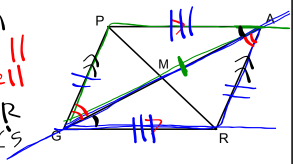
$\triangle GPA \cong \triangle AGR$



Use ΔPGR and ΔRAP in the parallelogram from Question 3 to prove that opposite sides of a parallelogram are congruent . Prove the statement $\overline{PG} \cong \overline{AR}$ and $\overline{GR} \cong \overline{PA}$.

Given: Parallelogram $PARG$ with diagonals $\overline{PR}$ and $\overline{AG}$ intersecting at point M

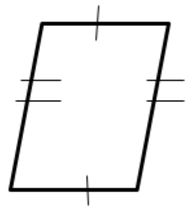
Prove: $\overline{PG} \cong \overline{AR}$ and $\overline{GR} \cong \overline{PA}$



Fancy Format	Your version
given PARG is a parallelogram $\overline{PA} \parallel \overline{GR}$ & $PG \parallel AR$.	$\overline{PA}$ & $\overline{GR}$ are $\parallel$
$\angle PAG \cong \angle AGR$ by alternate interior angle congruency Theorem.	PG & AR are $\parallel$
	$\angle PAG \cong \angle AGR$ Alt. Int. $\angle$'s
	& $\angle GAR \cong \angle PGA$
	$\overline{GA} \cong \overline{GA}$
	By ASA $\Delta PGA \cong \Delta GRA$
	Hence, $\overline{PG} \cong \overline{AR}$ & $\overline{GR} \cong \overline{PA}$

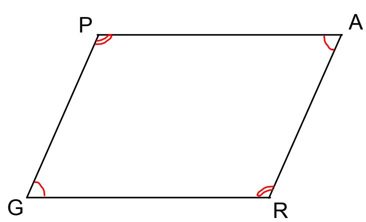
Now we can say for certain that:

In a parallelogram opposite sides are congruent



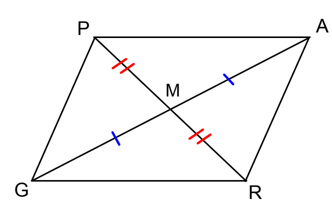
Our next parallelogram theorem tell us that:

Opposite angles of a parallelogram are congruent.



The next parallelogram theorem tells us that:

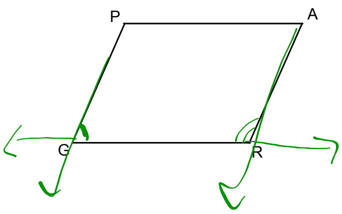
Diagonals bisect each other, which means that the opposite sides are congruent.



This theorem takes 2 seconds to prove 🙂

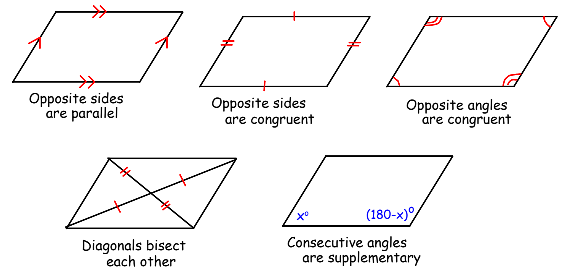
Given: PARG is a parallelogram

Prove: $m\angle PGR + m\angle GRA = 180°$

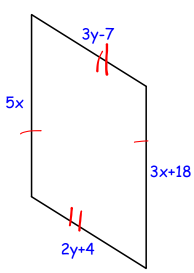


Recap: The 5 things we know about Parallelograms

In a parallelogram...



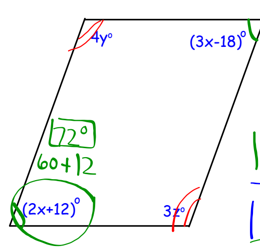
Find the value of each variable in the parallelogram.



$5x = 3x + 18$
$-3x \quad -3x$
$2x = 18$
$/2 \quad /2$
$\boxed{x = 9}$

$3y - 7 = 2y + 4$
$-2y \quad -2y$
$y - 7 = 4$
$+7 \quad +7$
$\boxed{y = 11}$

Find the value of each variable in the parallelogram.



$2x + 12 = 3x - 18$
$-2x \quad -2x$
$12 = x - 18$
$+18 \quad +18$
$\boxed{30 = x}$

$108 = 4y$
$/4 \quad /4$
$\boxed{27 = y}$

$180 = 72 + 3z$
$-72 \quad -72$
$108 = 3z$
$/3 \quad /3$
$\boxed{36 = z}$

Use what you know about parallelograms to find the length of all the sides.

$\overline{PG} =$

$\overline{PA} = 34$

$\overline{AR} =$

$\overline{GR} = 34$

$\overline{PM} =$

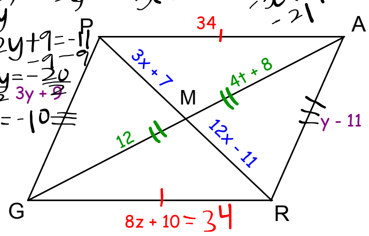
$\overline{MR} =$

$\overline{GM} = 12$

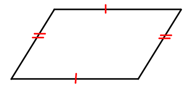
$\overline{MA} = 12$

$3y + 9 = y - 11$
$-y \quad -y$
$2y + 9 = -11$
$-9 \quad -9$
$\frac{2y}{2} = \frac{-20}{2}$
$y = -10$

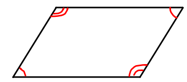
$3(-10) + 9$
$-30 + 9$
-21



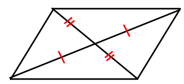
There are other converse theorems to prove that a quadrilateral is a parallelogram. We don't have time to prove them all. You will do one of them in your homework.



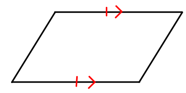
If opposite sides are congruent...



If opposite angles are congruent...



If the diagonals bisect each other...



If opposite sides are congruent and parallel...

...then the quadrilateral is a parallelogram.

Are you given enough information to determine whether the quadrilateral is a parallelogram? (Remember what it is labeled is more important then what it looks like.)