

MYSTERY PICTURE

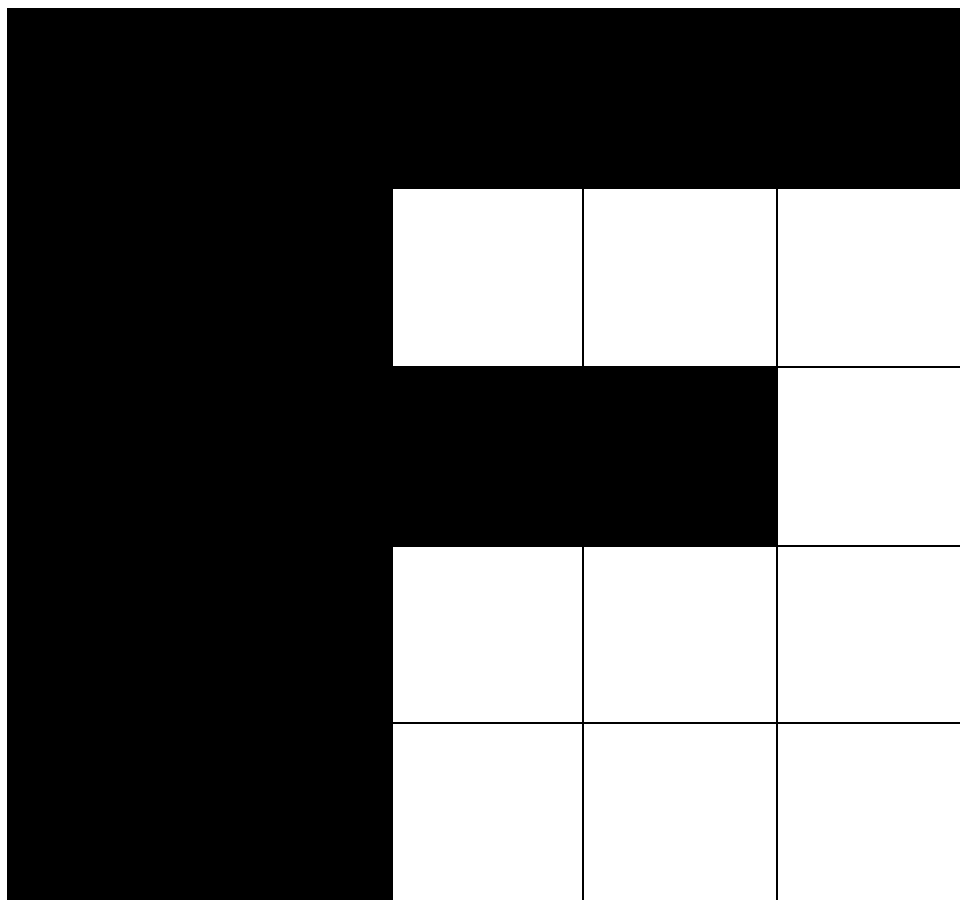


PROPERTIES OF PARALLELOGRAMS

Must These Two Angles Be Equal?

25 parallelograms · equal in every one, or not?

FREE



1. **Hand out page 3**, one per student. Pencils. Nothing else is needed.
2. **Say this once:** *“The arrowheads say only that the shape is a parallelogram. Must $\angle 1$ and $\angle 2$ be equal in every parallelogram, even a very slanted one? If yes, fill the square with slanted lines. If no, leave it white. Do not trust your eyes.”*
3. **When a student finishes, look at the picture.** If it is not the letter F, a square is wrong. The student finds it and checks it again.

Student sheet	page 3, one per student. At the top it shows the three reasons two angles of a parallelogram are always equal, as three small drawings.
Answers	page 4: the finished picture and the reason for every square.

This sheet practices one question: must these two angles be equal in every parallelogram?

Two angles are always equal for one of three reasons. They are across from each other in the parallelogram (four squares). They are the two angles of a Z made by a diagonal and two parallel sides (six squares). Or they are across from each other where the diagonals cross (five squares). Those fifteen squares are filled.

Each white square shows a pair that students often think is equal. Two corners next to each other add to 180° (two squares). Two angles at the ends of a diagonal but on the same side of it do not make a Z (two squares). A diagonal does not cut a corner in half, except in a rhombus (two squares). Two angles side by side at the crossing add to 180° , because the diagonals are not always perpendicular (two squares). In two squares one angle is a corner and one is at the crossing.

Six white squares are drawn close to a rectangle or a rhombus on purpose, so their two angles look equal. A student who trusts the drawing fills them. The arrowheads say only “parallelogram”, so those squares stay white. Guessing does not work: every simple rule, such as filling every square with no diagonal, gets at least nine squares wrong.



This is the free lesson this activity came from. The worksheet, the full answers and the lesson plan are on it, at three levels of difficulty.
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Mystery Picture

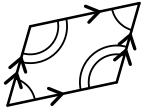
Must $\angle 1$ and $\angle 2$ be equal?

Name _____

Period _____

Date _____

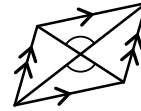
The arrowheads say each shape is a parallelogram, and nothing else. Must $\angle 1$ and $\angle 2$ be equal in every parallelogram? If yes, fill the square with slanted lines. If no, leave it white. Then look at the picture. If part of it is missing, check that square again.



Angles across from each other are equal.



A diagonal and two parallel sides make a **Z**. Its two angles are equal.



Where the diagonals cross, **angles across** from each other are equal.

Only these three reasons make two angles always equal. Do not trust your eyes. Some shapes look like a rectangle or a rhombus.

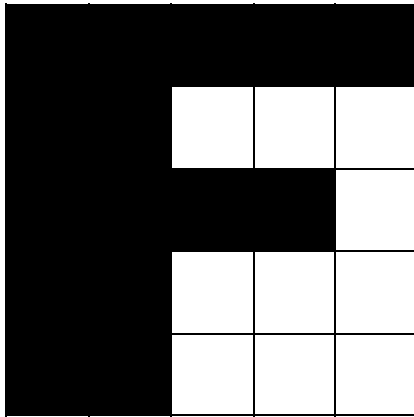
1 	2 	3 	4 	5
6 	7 	8 	9 	10
11 	12 	13 	14 	15
16 	17 	18 	19 	20
21 	22 	23 	24 	25



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Mystery Picture — answers

For the teacher



The finished picture is **the letter F**: a full bar across the top row, a shorter bar across the middle row, and a stem two squares wide down the left.

A square is filled when $\angle 1$ and $\angle 2$ are equal in every parallelogram: across from each other in the figure, the two angles of a Z, or across from each other at the crossing. It is white when they are equal only in some parallelograms, such as a rectangle or a rhombus.

To check a square with a student, ask: “Which reason makes these two angles equal? Is it one of the three at the top of the sheet?”

1–5	1 · FILL They are the two angles of a Z: a diagonal between two parallel sides.	2 · FILL Angles across from each other in a parallelogram are equal.	3 · FILL They are across from each other where the diagonals cross.	4 · FILL They are the two angles of a Z: a diagonal between two parallel sides.	5 · FILL Angles across from each other in a parallelogram are equal.
6–10	6 · FILL They are across from each other where the diagonals cross.	7 · FILL They are the two angles of a Z: a diagonal between two parallel sides.	8 · white A diagonal cuts a corner in half only in a rhombus. This drawing is close to a rectangle or a rhombus, so $\angle 1$ and $\angle 2$ look equal.	9 · white They share a side, so they add to 180° .	10 · white Side by side at the crossing, they add to 180° . This drawing is close to a rectangle or a rhombus, so $\angle 1$ and $\angle 2$ look equal.
11–15	11 · FILL Angles across from each other in a parallelogram are equal.	12 · FILL They are across from each other where the diagonals cross.	13 · FILL They are the two angles of a Z: a diagonal between two parallel sides.	14 · FILL They are across from each other where the diagonals cross.	15 · white Both are on one side of the diagonal, so they are not a Z. This drawing is close to a rectangle or a rhombus, so $\angle 1$ and $\angle 2$ look equal.
16–20	16 · FILL They are the two angles of a Z: a diagonal between two parallel sides.	17 · FILL Angles across from each other in a parallelogram are equal.	18 · white One is a corner and one is at the crossing. No rule links them.	19 · white A diagonal cuts a corner in half only in a rhombus. This drawing is close to a rectangle or a rhombus, so $\angle 1$ and $\angle 2$ look equal.	20 · white They share a side, so they add to 180° . This drawing is close to a rectangle or a rhombus, so $\angle 1$ and $\angle 2$ look equal.
21–25	21 · FILL They are across from each other where the diagonals cross.	22 · FILL They are the two angles of a Z: a diagonal between two parallel sides.	23 · white Both are on one side of the diagonal, so they are not a Z.	24 · white Side by side at the crossing, they add to 180° . This drawing is close to a rectangle or a rhombus, so $\angle 1$ and $\angle 2$ look equal.	25 · white One is a corner and one is at the crossing. No rule links them.