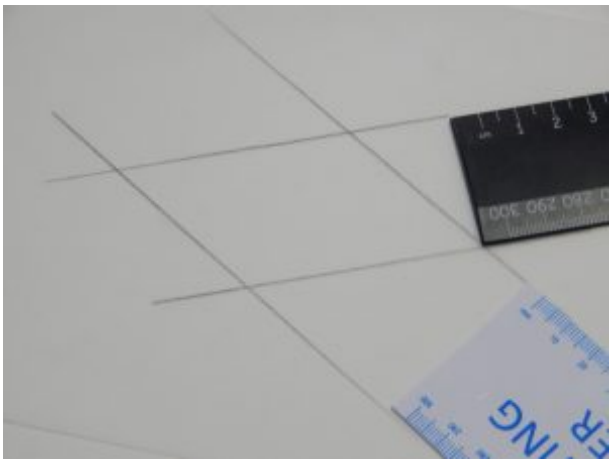
Properties of Parallelograms



We take it that you know that in a parallelogram both pairs of opposite sides are parallel.

In this investigation you will discover some other properties of parallelograms.

Step 1: Use two rulers with different widths to draw a parallelogram on tracing paper or baking paper.

Make sure that it is not a rhombus and that the adjacent sides are not equal in length.

Step 2: Place a second piece of tracing paper over the first and copy the parallelogram.

Step 3: Slide the second tracing paper over the first to compare the lengths of the opposite sides of the parallelogram.

How do the lengths of the opposite sides compare?

Now make your own finding or Conjecture 1: Both pairs of opposite sides of a parallelogram are ....

Step 4: Rotate or flip the second paper to compare the sizes of the opposite angles of the parallelogram.

How do the sizes of the opposite angles compare?

Now make your own finding or Conjecture 2: Both pairs of opposite angles of a parallelogram are ....

What can you discover about the point of intersection of the diagonals?

Step 5: Draw or fold the two diagonals of the parallelogram. Place a dot on their intersection.

Step 6: Fold to compare the lengths of the two segments on each diagonal.

Your next finding or Conjecture 3 could be:

The point of intersection of the diagonals of a parallelogram .....

Step 7: Now fold the diagonals of one of the sheets and compare angles formed by the diagonals. Are the angles equal in size?

Do the diagonals bisect the angles? Justify your answer.

Step 8: Use the paper with the folded diagonal, rotate it and see if it the area of the triangle formed by the diagonal fits on to the triangles of the second paper.

Your next finding or Conjecture 4 could be:

The diagonal of a parallelogram ……

(Idea taken from: Michael Serra, "Patty Paper Geometry", Key Curriculum Press, 1994, pp 88 - 89).

SOLUTION

Conjecture 1: Both pairs of opposite sides of a parallelogram are **equal.**

Conjecture 2: Both pairs of opposite angles of a parallelogram are **equal.**

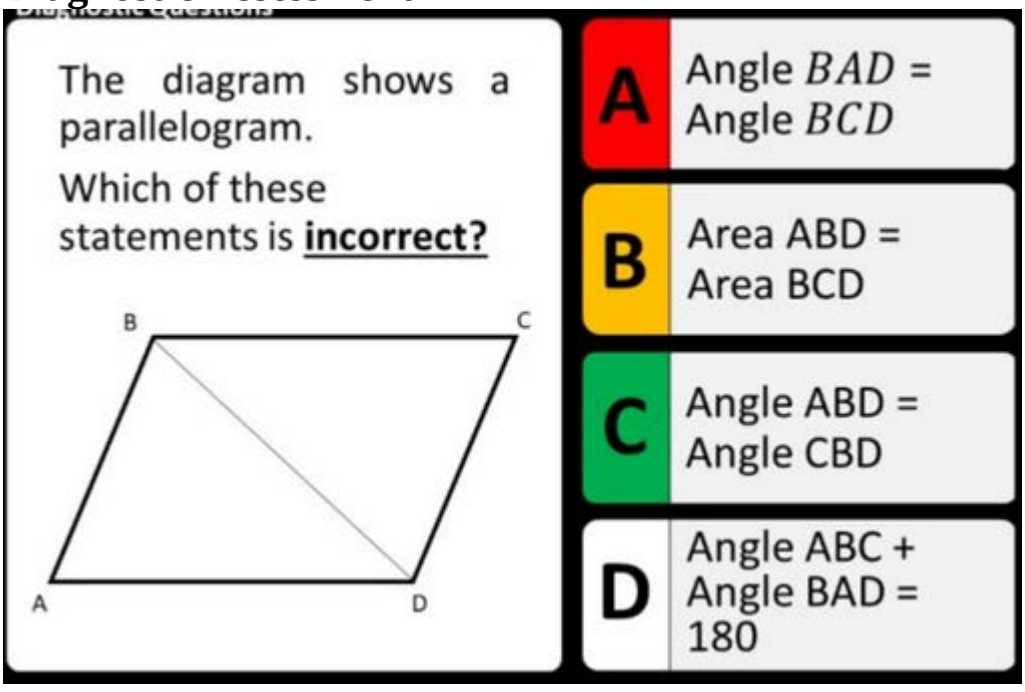
Conjecture 3: The point of intersection of the diagonals of a parallelogram **bisects each diagonal**.

Note that the two diagonals are not equal in length.

Conjecture 4: The diagonal of a parallelogram bisects it's area

NOTES FOR TEACHERS

Diagnostic Assessment



This should take about 5–10 minutes.

1. Write the question on the board, say to the class:
   "Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 fingers for D".
2. Notice how the learners responded. Ask a learner who gave answer A to explain why he or she gave that answer and DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.
3. Then do the same for answers B, C and D. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.
4. **Ask the class again to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change**

and who gave right and wrong answers. It is important for learners to explain the reason for their answer otherwise many learners will just make a guess.

5. If the concept is needed for the lesson to follow, explain the right answer or give a remedial task.

The correct answer is C and possible misconceptions:

A. If A is selected, then wrong angles selected.
B. If B is selected, then did not answer the question or guest the answer.
C. If C is selected it is the correct answer as diagonals do not bisect the angles.
D. If D is selected, then did not answer the question or guest the answer.

https://diagnosticquestions.com

Why do this activity? This activity will convince the learners that the properties of parallelograms are true.

Learning objectives: To discover the properties of parallelograms.

Generic competences: To use the correct vocabulary. Getting into the habit of checking and asking themselves whether the answer makes sense.

Suggestions for teaching: Tracing paper can be quite expensive. Baking paper could be a much cheaper option to buy in rolls and cut into smaller pieces.

Key questions

Did you answer the question? Here they are looking for the incorrect answer.
What did you discover about the opposite sides or angles of a parallelogram?
If the opposite sides are parallel, which angles are equal?
If the opposite sides are parallel, which angles add up to 180^0?
What did you discover about the diagonals of a parallelogram and the angles they form?

Possible extension *(Note – this is provision for the abler students)*
https://aiminghigh.aimssec.ac.za/grades-8-10-properties-of-quadrilaterals/
Or https://aiminghigh.aimssec.ac.za/grades-7-to-12-tessellating-quadrilaterals/
Possible support *(Note – this is provision for students who have difficulties)*
Refer to the Key questions above, or ask a student to help.

Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA, to Years 4 to 12 in the UK and up to Secondary 5 in East Africa. New material will be added for Secondary 6.
For resources for teaching A level mathematics see https://nrich.maths.org/12339
Note: The mathematics taught in Year 13 (UK) and Secondary 6 (East Africa) is **beyond** the school curriculum for Grade 12 SA.

	Lower Primary or Foundation Phase Age 5 to 9	Upper Primary Age 9 to 11	Lower Secondary Age 11 to 14	Upper Secondary Age 15+
South Africa	Grades R and 1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
USA	Kindergarten and G1 to 3	Grades 4 to 6	Grades 7 to 9	Grades 10 to 12
UK	Reception and Years 1 to 3	Years 4 to 6	Years 7 to 9	Years 10 to 13
East Africa	Nursery and Primary 1 to 3	Primary 4 to 6	Secondary 1 to 3	Secondary 4 to 6