Problem of the Week
Problem A and Solution
Paper Folding

Problem

Start with a square piece of paper, and label the corners A, B, C, and D, starting with the top-left corner and moving clockwise.

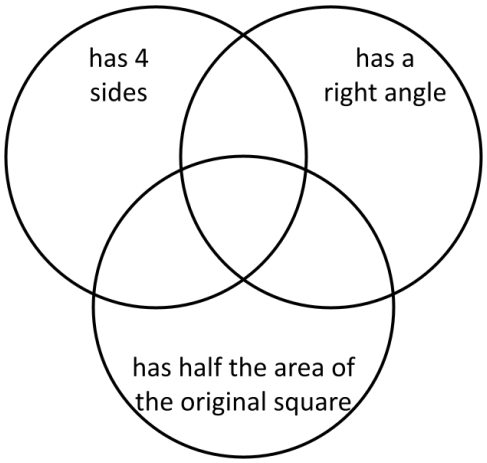
(a) Fold the paper so that corner A touches corner C. What shape did you make?

(b) Open the paper up so that you are back to the square, but with a diagonal crease. Fold the paper so that the edge between corners A and B lines up with the diagonal crease. Then fold the paper so that the edge between corners C and D lines up with the diagonal crease. What shape did you make?

(c) Open the paper up so that you are back to the square. Fold the paper so that corner D touches corner A and corner C touches corner B. What shape did you make?

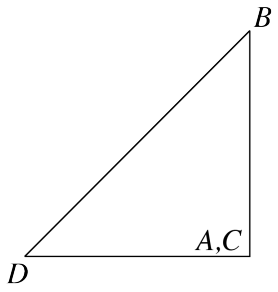
(d) Continuing from the shape you made in part (c), fold the paper so that corners B and C touch the fold line. What shape did you make?

(e) Fill in the Venn diagram below with the letters a, b, c, and d, representing the shape you made in each part.

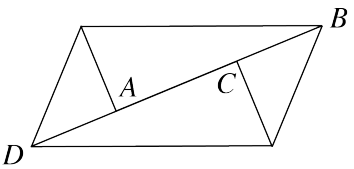


Solution

(a) Since the angle at corners A and C is a right angle, the shape made is a right-angled triangle.

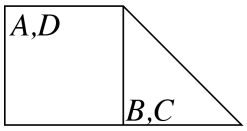


(b) Since the pairs of opposite sides are parallel and equal in length, the shape made is a parallelogram.



(c) Since the pairs of opposite sides are parallel and equal in length, and all angles are right angles, the shape made is a rectangle.

(d) Since one pair of opposite sides is parallel, the shape made is a trapezoid. To be more specific, we can call it a right trapezoid since it contains two right angles.



(e) We will look at each shape one by one to decide where it should go in the Venn diagram.

In part (a), we folded the paper in half along the diagonal between corners B and D, so the shape made has half the area of the original square. The shape has a right angle, but has 3 sides, not 4. So in the Venn diagram, this shape would go in the overlap between the circle labeled "has a right angle" and the circle labeled "has half the area of the original square".

In part (b), the paper is not folded in half, so the shape made does not have half the area of the original square. The shape has 4 sides but does not have a right angle. So in the Venn diagram, this shape would go in the circle labeled "has 4 sides".

In part (c), we folded the paper in half along the middle line between the top and bottom sides. The shape has 4 sides and 4 right angles. So in the Venn diagram, this shape would go in the overlap between all three circles.

In part (d), we started with the paper folded in half and then folded it further, so the shape made does not have half the area of the original square. The shape has 4 sides and 2 right angles. So in the Venn diagram, this shape would go in the overlap between the circle labeled "has 4 sides" and the circle labeled "has a right angle".

The completed Venn diagram is shown.