

# CUT & GLUE SORT



## ANGLE BISECTORS AND THE INCENTER

### The Same Distance From What?

Sides or corners · two or three · no numbers

FREE

|                                                                              |                                                                                               |                                                                                          |                                                                                      |
|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1<br>A lamp must be the same distance from the three walls of a room.        | 2<br>A well must be the same distance from three houses on a farm.                            | 3<br>A tree must be the same distance from the north wall and the east wall of a garden. | 4<br>A post must be the same distance from the three corners where the streets meet. |
| 5<br>A light must be the same distance from the gate at A and the gate at B. | 6<br>A sprinkler must just reach each of the three fences between the corner posts of a lawn. | 7<br>A mailbox must be the same distance from Oak Street and Elm Street.                 | 8<br>A bench must be the same distance from the three streets around a park.         |
| 9<br>A circle must pass through the three corners of a triangular sign.      | 10<br>The biggest round pool must fit inside a triangular yard and touch all three edges.     | 11<br>A flagpole must be the same distance from the three gates in the fence of a park.  | 12<br>A lamp must be the same distance from corner P and corner Q of a yard.         |

## Cut & Glue Sort — how to run it

20 minutes, including the cutting

1. **Hand out pages 3 and 4**, one of each per student, with scissors and glue. Nothing else is needed.
2. **Say this once:** *“Read what the thing must be the same distance from. Is it sides, or corners? Then count how many are named.”*
3. **Check a sheet in ten seconds:** every row gets four pieces.

|                       |                                                                                                                      |
|-----------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>Student sheets</b> | pages 3 and 4, one of each per student. Page 3 shows the incenter and the circumcenter as two small marked drawings. |
| <b>Answers</b>        | page 5.                                                                                                              |

**This sheet practices one decision: which point does a problem ask for?** A point the same distance from three *sides* (lines such as walls, fences or streets) is the incenter, where the angle bisectors meet. A point the same distance from three *corners* (points such as gates, houses or towns) is the circumcenter, where the perpendicular bisectors meet. Students often answer with whichever point they met most recently. Here the words decide.

**Watch the words.** “A post must be the same distance from the three corners where the streets meet.” names streets, but it asks about the corners where the streets meet. So it is the circumcenter. In everyday English the two phrases sound the same.

**The last row is the most important.** Its pieces name only two sides or only two corners. A point the same distance from two sides can be anywhere on one angle bisector. A point the same distance from two corners can be anywhere on one perpendicular bisector. So no single point is named. It takes two of the three bisectors to find the point. A student who looks only at the nouns puts seven of the twelve pieces in the right row, and the last row stays empty. Guessing does not work: every simple guessing rule places at most six pieces correctly.



**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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# Sides or corners?

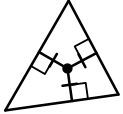
Where must it go?

Name \_\_\_\_\_

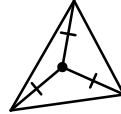
Period \_\_\_\_\_

Date \_\_\_\_\_

Cut out the twelve pieces on the next page. Each piece tells where something must go. **Read what it must be the same distance from. Then glue the piece in the right row.**



The **incenter**: the same distance from the three **sides**. It is where the angle bisectors meet.



The **circumcenter**: the same distance from the three **corners**. It is where the perpendicular bisectors meet.

Sides are lines, like walls, fences, edges and streets. Corners are points, like gates, houses and the places where two streets meet. Count how many are named.

**The incenter.** The thing must be the same distance from the three **sides**. Draw the angle bisectors.

**The circumcenter.** The thing must be the same distance from the three **corners**. Draw the perpendicular bisectors.

**No single point.** Only **two** sides, or two corners, are named. The thing can go anywhere along one line.

# The twelve pieces

*Cut along the dotted lines*

|                                                                              |                                                                                               |                                                                                          |                                                                                      |
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## Cut & Glue Sort — answers

*For the teacher*

|                         |                                                                                                  |                                                                                                           |                                                                                                  |                                                                                                                  |
|-------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <b>The incenter</b>     | <b>1.</b> Walls are the sides of the room. The same distance from three sides is the incenter.   | <b>6.</b> Reaching each fence is the same distance from three sides. That is the incenter.                | <b>8.</b> The streets are the sides of the park, not its corners. That is the incenter.          | <b>10.</b> The pool touches the three sides, so its center is the same distance from them: the incenter.         |
| <b>The circumcenter</b> | <b>2.</b> Three houses are three points, the corners of a triangle. That is the circumcenter.    | <b>4.</b> The words say “where the streets meet”: the corners, not the streets. That is the circumcenter. | <b>9.</b> Its center is the same distance from the three corners. That is the circumcenter.      | <b>11.</b> Three gates are three points, like corners. The same distance from three corners is the circumcenter. |
| <b>No single point</b>  | <b>3.</b> Only two walls are named. Every point on the bisector of the angle between them works. | <b>5.</b> Only two gates are named. Every point on the perpendicular bisector of AB works.                | <b>7.</b> Only two streets are named. Every point on a bisector of the angle between them works. | <b>12.</b> Only two corners are named. Every point on the perpendicular bisector of PQ works.                    |

**Every row holds four pieces.** A piece goes in the first row when the thing must be the same distance from three sides. It goes in the second row when the thing must be the same distance from three corners, or when a circle must pass through three corners. It goes in the last row when only two sides or two corners are named.

To check a piece with a student, ask: “What must it be the same distance from? Can you touch that thing with one finger, like a corner, or run your finger along it, like a wall?”