

CUT & GLUE SORT



PERPENDICULAR BISECTORS AND THE CIRCUMCENTER

Is P the Circumcenter?

Yes, no, or cannot tell · marks, lengths and angles

FREE

1 $PA = 6, PB = 6, PC = 6$	2 $PA = 4, PB = 4, PC = 9$	3 $PA = 8, PB = 8$	4 The angle at C is 115°.
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1. **Hand out pages 3 and 4**, one of each per student, with scissors and glue. Nothing else is needed.
2. **Say this once:** *“The circumcenter is the same distance from all three corners. Two equal distances are not enough. Use only what is marked or written. Do not measure.”*
3. **Check a sheet in ten seconds:** every row gets four pieces.

Student sheets	pages 3 and 4, one of each per student. Page 3 shows a perpendicular bisector and the circumcenter of three kinds of triangle as small drawings.
Answers	page 5.

What the three rows test. The circumcenter is the one point that is the same distance from all three corners. A piece goes in the first row when all three distances are shown to be equal: by numbers, by equal ticks, or by two perpendicular bisectors crossing at P. In a right triangle, the middle of the longest side is the circumcenter, so that also counts.

The second row uses two facts of the lesson. If two printed distances differ, P is not the circumcenter. And the type of triangle tells where the circumcenter is: inside an acute triangle, at the middle of the longest side of a right triangle, and outside an obtuse triangle. A point in the wrong place cannot be it.

The last row is the hardest. Two equal distances only put P on one perpendicular bisector, which is a whole line of points. And a point inside an acute triangle is in the right area, but so are many other points. Students who think “two equal distances are enough,” or “inside means it is the center,” put these pieces in the first row. Every simple guessing rule, such as sorting by where P is, places at most six of the twelve 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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Is P the circumcenter?

Yes, no, or cannot tell

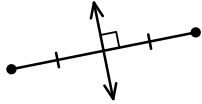
Name _____

Period _____

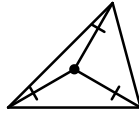
Date _____

Cut out the twelve pieces on the next page. Each piece shows a triangle and a point P. **Decide which row the piece belongs in, and glue it there.**

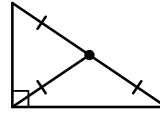
The **circumcenter** (the dot) is the one point that is the same distance from all three **corners**. The ticks show the three equal distances.



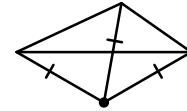
Perpendicular bisector of a side: a right-angle square **and** equal ticks.



Acute triangle: the circumcenter is **inside**.



Right triangle: it is the **middle of the longest side**.



Obtuse triangle: it is **outside**.

Use only what is marked or written on the piece. Do not measure. Two equal distances are not enough: all three must be equal.

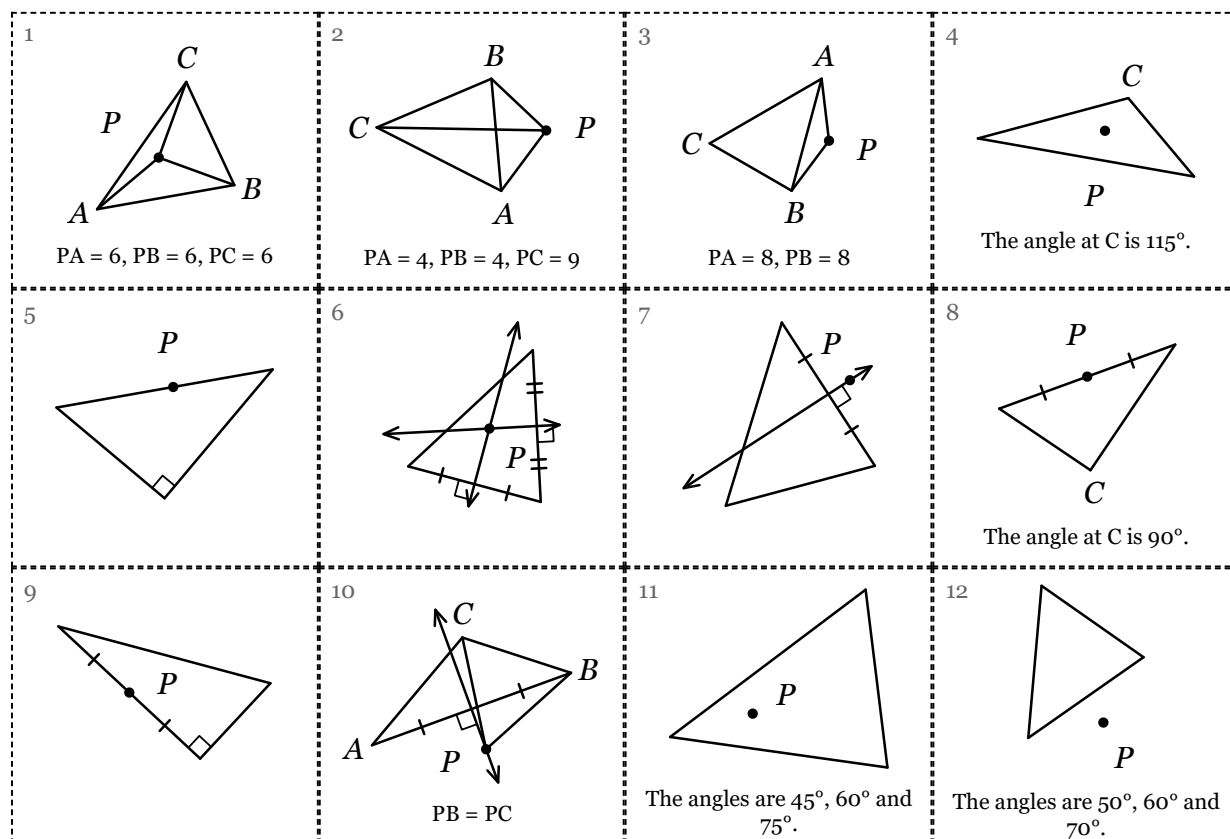
Yes. P must be the circumcenter.

No. P cannot be the circumcenter.

Cannot tell. What is shown is not enough to decide.

The twelve pieces

Cut along the dotted lines



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Cut & Glue Sort — answers

For the teacher

Yes	1 — All three distances from P to the corners are 6.	6 — Two perpendicular bisectors (a square and ticks on each) cross at P. Two are enough: P is the same distance from the two ends of each of those sides, so from all three corners.	8 — The angle at C is a right angle, and the ticks make P the middle of the longest side. In a right triangle that point is the circumcenter.	10 — P is on the perpendicular bisector of AB, so $PA = PB$. The words say $PB = PC$. So all three are equal. P is outside, which is right for an obtuse triangle.
No	2 — PC is 9, not 4. The circumcenter is the same distance from all three corners.	4 — The triangle is obtuse, so its circumcenter is outside it. This P is inside.	9 — The square marks a right angle, so the circumcenter is the middle of the longest side. This P is the middle of a shorter side.	12 — All three angles are acute, so the circumcenter is inside the triangle. This P is outside.
Cannot tell	3 — Only two distances are given. P is on the perpendicular bisector of AB, but every point of that line is the same distance from A and B. Nothing is known about PC.	5 — P is on the longest side and looks like its middle, where the circumcenter of a right triangle is. But no ticks show that P is the middle, and a drawing is not a measurement.	7 — P is on one perpendicular bisector only, so it is the same distance from the two ends of that side. One line is not enough. Two perpendicular bisectors are needed.	11 — The triangle is acute, so its circumcenter is inside, and this P is inside. But many points are inside. Nothing shows the three distances are equal.

Every row holds four pieces. To check a piece with a student, ask: “How many of the three distances from P to the corners do you know are equal?” If the answer is three, it is Yes. Then ask: “Is anything shown that makes P wrong, such as a different number or P in the wrong place for this kind of triangle?” If so, it is No. Otherwise it is Cannot tell.