

CUT & GLUE SORT



TRIANGLE ANGLE SUM AND THE EXTERIOR ANGLE THEOREM

Remote, Next To It, or Not One at All

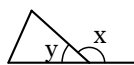
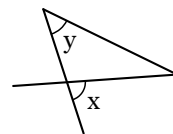
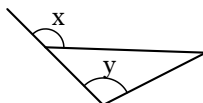
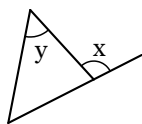
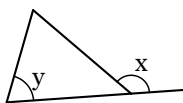
25 minutes, ten of them cutting · no numbers anywhere · one sheet per student

FREE



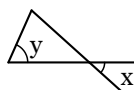
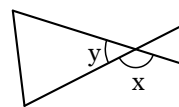
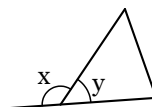
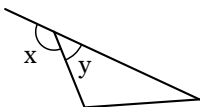
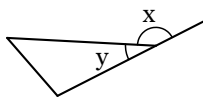
y is one of the two FAR angles

so $x = y + \text{the third angle}$



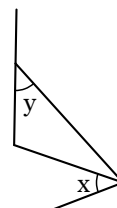
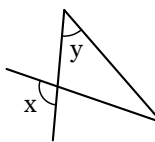
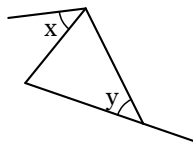
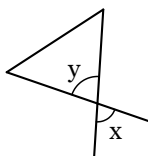
y is the angle NEXT TO x

so x and y make 180° — y is never in the sum



x is NOT an exterior angle

so no rule here can be used



Cut & Glue Sort — how to run it

25 minutes, ten of them cutting

1. **Hand out pages 3 and 4**, one of each per student. Each student needs scissors and glue. You do not cut anything.
2. **Say this once:** *“ x is outside the triangle. Ask two things about it, in this order. First, is it really an exterior angle? One arm has to be a side of the triangle. The other arm has to be that side carried straight on past the corner. Only then, ask: is y at the same corner as x , or somewhere else?”*
3. **4 pieces go in every bin.** A bin with more or fewer pieces has a mistake in it. The student can see that before you do.

To cut up	page 3, one per student. It has 12 pieces and takes five to eight minutes to cut.
To glue on	page 4, one per student. It has the three bins, each with a picture of what it means.
Answers	page 5, 12 letters in three lines.

There is no number on any of the 12 pieces. The arithmetic in this lesson is one addition or one subtraction. What goes wrong is the choice of the two angles. The most common mistake is to pair the outside angle with the interior angle *beside* it. That is the one angle that is never in the sum. This sheet asks for that choice 12 times, with no adding.

The third bin is the hard one. Pieces C, F, H, K have an x that is outside the triangle but is *not* an exterior angle. On C and H, x lies between the two sides carried on past the same corner. It is equal to the triangle's own angle at that corner, so it is not an exterior angle. Students often mark this angle once they learn that an exterior angle is “outside.” On F and K, one arm of x lies along a line that is not a side of the triangle. **Being outside the triangle is not enough.** A student who does not know this leaves the third bin empty and puts too many pieces in the other two.

If a student is stuck on a piece, do not give the answer. Ask them to put a finger on each arm of the arc marked x and say what it is: a side of the triangle, a side carried on past the corner, or neither. That question is the definition, and it sorts every piece on the sheet.

Marking takes ten seconds. Count the pieces in each bin. 4 in every bin is right. Any other count is wrong, and it shows you which bin to check first.



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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Cut these out

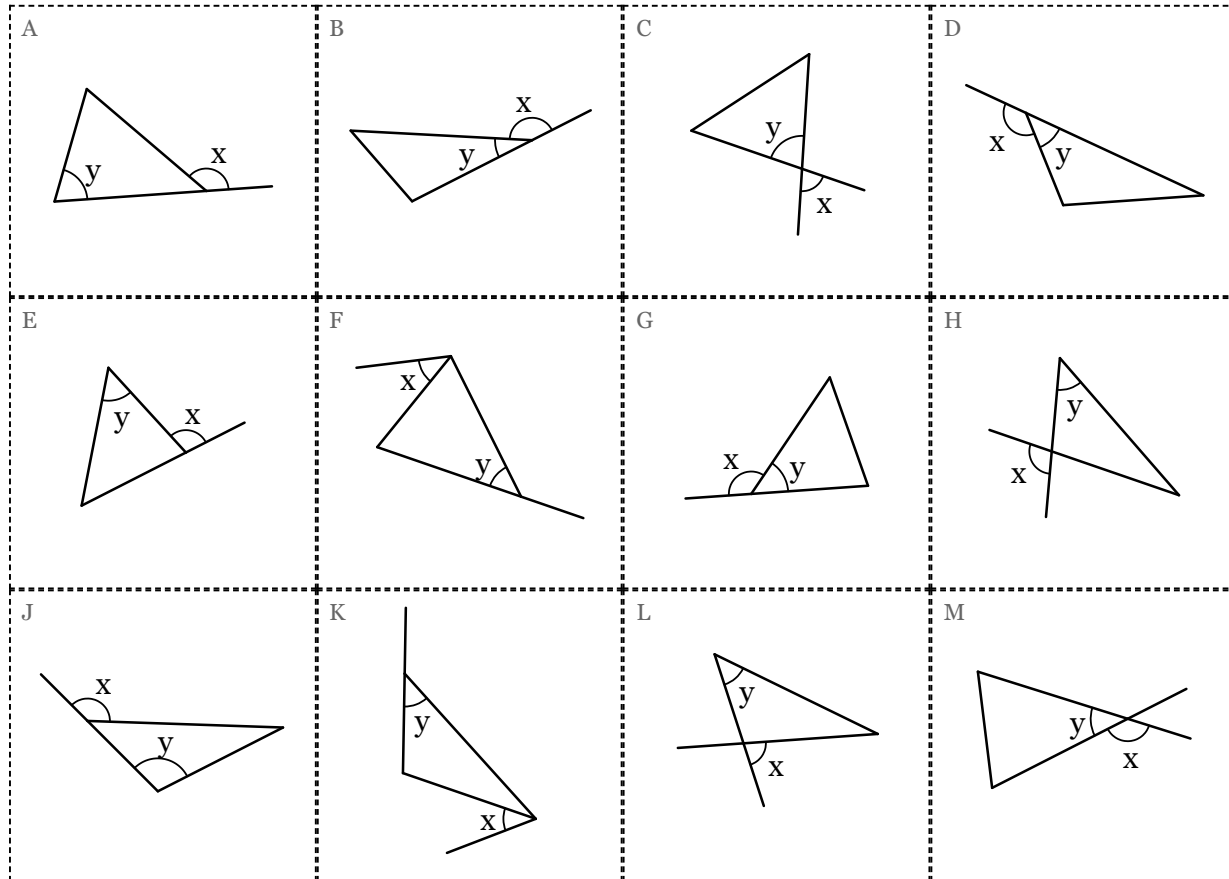
12 pieces

Name _____

Period _____

Date _____

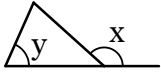
Cut along the dashed lines. x is outside the triangle. y is one of the triangle's own angles. Do not measure anything. Do not write a number. Every piece is one decision about where the two arcs stand.



Glue them here

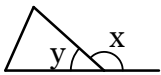
4 in every bin

Ask about x first: is it really an exterior angle? One arm is a side. The other is that triangle's other side carried straight on past the corner. If not, the piece goes in the bottom bin, no matter what y is. **4 in every bin.** Five means one is wrong.



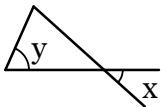
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Cut & Glue Sort — answers

For the teacher

Three bins, 4 pieces in each. Count first. A bin with the wrong number of pieces is where to look.

Bin	Pieces	Why they go there
y is one of the two FAR angles <i>so $x = y + \text{the third angle}$</i>	A E J L	One arm of x is a side of the triangle, and the other is the other side at that corner, carried straight on, so x is an exterior angle. The arc marked y is inside the triangle at a different corner, so y is one of the two far angles.
y is the angle NEXT TO x <i>so x and y make 180° — y is never in the sum</i>	B D G M	One arm of x is a side of the triangle, and the other is the other side at that corner, carried straight on, so x is an exterior angle. The arc marked y is inside the triangle at the same corner, so y is the angle next to x .
x is NOT an exterior angle <i>so no rule here can be used</i>	C F H K	C, H: Both arms of x are sides carried on past the same corner. Neither arm is a side of the triangle, so x is not an exterior angle. It is equal to the triangle's own angle at that corner. F, K: One arm of x runs along a line that is not a side of the triangle and is not a side carried on. So x is not an exterior angle.

The exterior angle rule gives a wrong number on C, F, H, K. No number is printed on the pieces, but they are drawn so that, on each of these, adding the two far angles misses the real size of x by at least 15° .

“Is y at the same corner as x ?” is the second question, not the first. Pieces B, C, D, G, M all have y at the same corner as x . But C is in the third bin, because x is not an exterior angle there.

The first two bins state the theorem. An exterior angle equals the sum of the two interior angles that are *not* at its corner. The interior angle that *is* at its corner makes a straight angle with it, so it is never in the sum.