

CUT & GLUE SORT

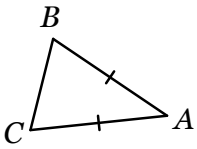
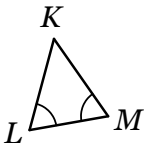
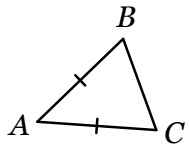
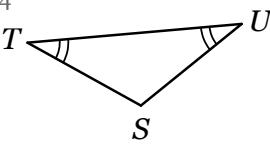


ISOSCELES AND EQUILATERAL TRIANGLES

The Theorem, the Converse, or Neither?

Equal sides give equal angles · equal angles give equal sides · but only the right ones

FREE

1  So $\angle B \cong \angle C$.	2  So $KL \cong KM$.	3  So $\angle A \cong \angle B$.	4  So $SU \cong ST$.
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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:** *“Equal sides give equal angles, and equal angles give equal sides. But the equal parts are always opposite each other. Check that the conclusion names the right two.”*
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 the theorem and its converse as two small drawings.
Answers	page 5.

The first two rows are the two directions. The base angles theorem starts from two equal sides (ticks) and gives the two angles opposite them. Its converse starts from two equal angles (arcs) and gives the two sides opposite them. Students often hold these as one fact and use it in either direction without noticing. One piece in each of these rows has all three sides or all three angles marked. It still belongs there: any two of its angles, or any two of its sides, are equal.

The last row is the most important. Every piece in it has marks, and its conclusion looks like the others. But the conclusion names the wrong pair: the angle where the two equal sides meet, or the side between the two equal angles. Or the marks are one tick and two ticks, or one arc and two arcs, which are not marked equal. The commonest mistake in this lesson is to use the theorem when its condition is not on the page.

How to see the mistake. A student who sorts only by the kind of mark (ticks in the first row, arcs in the second) gets eight of the twelve pieces right, and the last row stays empty. Ask that student to point to each side with a tick and name the angle across from it. Every other 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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Which theorem gives it?

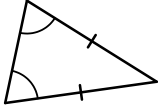
The base angles theorem and its converse

Name _____

Period _____

Date _____

Cut out the twelve pieces on the next page. Each piece shows a triangle and a conclusion under it. The sign $\cong$ means the two parts are equal. **Decide which row the piece belongs in, and glue it there.**



Two sides are equal. So the two angles **opposite** them are equal.



Two angles are equal. So the two sides **opposite** them are equal.

Sides with the same number of ticks are equal. Angles with the same number of arcs are equal.

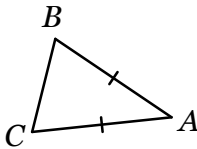
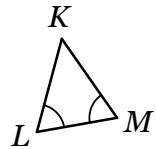
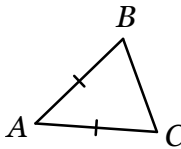
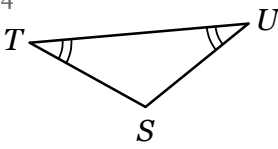
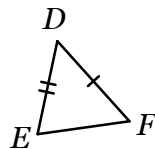
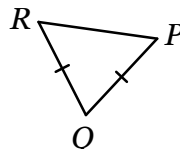
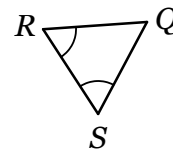
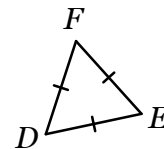
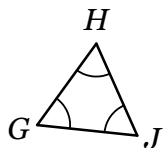
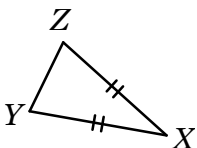
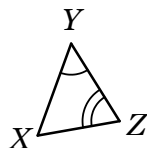
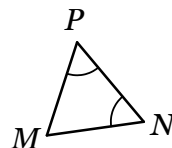
Correct: the base angles theorem. Two sides are marked equal, and the conclusion names the two angles opposite them.

Correct: the converse. Two angles are marked equal, and the conclusion names the two sides opposite them.

Wrong: the marks do not give this conclusion.

The twelve pieces

Cut along the dotted lines

1  So $\angle B \cong \angle C$.	2  So $KL \cong KM$.	3  So $\angle A \cong \angle B$.	4  So $SU \cong ST$.
5  So $\angle E \cong \angle F$.	6  So $\angle P \cong \angle R$.	7  So $RS \cong RQ$.	8  So $\angle D \cong \angle E$.
9  So $HG \cong HJ$.	10  So $\angle Z \cong \angle Y$.	11  So $XZ \cong XY$.	12  So $MN \cong MP$.



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Cut & Glue Sort — answers

For the teacher

The theorem	1 · So $\angle B \cong \angle C$. AB and AC have ticks. $\angle C$ is opposite AB and $\angle B$ is opposite AC.	6 · So $\angle P \cong \angle R$. QP and QR have ticks. The angles opposite them are $\angle R$ and $\angle P$. The triangle is upside down.	8 · So $\angle D \cong \angle E$. All three sides have ticks. EF and DF are equal, and $\angle D$ and $\angle E$ are opposite them.	10 · So $\angle Z \cong \angle Y$. XY and XZ have two ticks each. $\angle Z$ is opposite XY and $\angle Y$ is opposite XZ.
The converse	2 · So $KL \cong KM$. $\angle L$ and $\angle M$ have arcs. The sides opposite them are KM and KL.	4 · So $SU \cong ST$. $\angle T$ and $\angle U$ have two arcs each. SU is opposite $\angle T$ and ST is opposite $\angle U$.	9 · So $HG \cong HJ$. All three angles have arcs. $\angle J$ and $\angle G$ are equal, and HG and HJ are opposite them.	12 · So $MN \cong MP$. $\angle N$ and $\angle P$ have arcs. MN is opposite $\angle P$ and MP is opposite $\angle N$. The triangle rests on MN.
Wrong	3 · So $\angle A \cong \angle B$. AB and AC have ticks, so $\angle B$ and $\angle C$ are the equal pair. $\angle A$ is where the equal sides meet.	5 · So $\angle E \cong \angle F$. DF has one tick and DE has two, so these sides are not marked equal. So $\angle E$ and $\angle F$, opposite them, need not be equal.	7 · So $RS \cong RQ$. $\angle R$ and $\angle S$ have arcs, so the sides opposite them, QS and QR, are equal. RS is the side between the equal angles, so RS and RQ need not be equal.	11 · So $XZ \cong XY$. $\angle Y$ has one arc and $\angle Z$ has two, so these angles are not marked equal. So XZ and XY, opposite them, need not be equal.

Every row holds four pieces. A piece goes in the first row when two sides have the same number of ticks and the conclusion names the two angles opposite those sides. It goes in the second row when two angles have the same number of arcs and the conclusion names the two sides opposite those angles. It goes in the last row when the conclusion names any other pair, or when the marks on the two parts are not the same.

To check a piece with a student, point to each part in the conclusion and ask which part is across from it. Then ask whether those two parts carry the same marks.