

CUT & GLUE SORT



MEDIANS AND THE CENTROID

Double It, Halve It, or Can You Not Tell?

Long piece or short piece? Decide before any arithmetic

FREE

1	2	3	4
G is the centroid of triangle ABC. L is the midpoint of BC. GL = 7 . How long is AG?	G is the centroid of triangle JKL. M is the midpoint of JK. LG = 18 . How long is GM?	In triangle ABC, L is the midpoint of BC. P is a point on AL. PL = 6 . How long is AP?	K is the centroid of triangle XYZ. L is the midpoint of XZ. KY = 9 . How long is LK?

Cut & Glue Sort — how to run it

25 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:** *“Do not work out any numbers. For each piece, find the long piece and the short piece of the median. Then decide: to find the question mark, do you double the number, halve it, or can you not tell?”*
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 median and the centroid as two small drawings, with the rule in three forms.

Answers page 5.

The sheet practices one decision, made before any arithmetic. The centroid cuts each median into a long piece at the corner and a short piece at the midpoint, and the long piece is twice the short one. Each piece names a triangle and the midpoint of one side. The median runs from the corner across from that side to the midpoint. If the number is the short piece, the student doubles it. If it is the long piece, the student halves it. The most common mistake on this topic is to turn this upside down.

The last row is the most important. The rule is only about the centroid, and only about the two pieces of one median. In one piece the point is only “a point on” the median. In one, the point on the side is not called the midpoint. In the other two, the number and the question mark are on two different medians. Many students believe the centroid is the same distance from every corner. It is not.

How to see the mistake. A student who halves whenever the number’s letters include a corner, and doubles otherwise, gets eight of the twelve pieces right. That student leaves the last row empty. Ask them: “Are both lengths on the same median? Is this point really the centroid?” Other guessing rules place 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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Double, halve, or cannot tell?

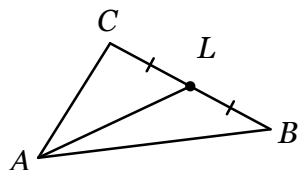
Medians and the centroid

Name _____

Period _____

Date _____

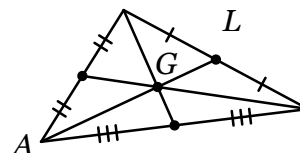
Cut out the twelve pieces on the next page. Each piece gives one length and asks for another. **Do not work out the ?**. Decide how you would find it: **double the number, halve it, or you cannot tell**. Glue the piece in that row.



A **median** joins a corner to the midpoint of the side across.

On every median, the piece at the corner is **long** and the piece at the midpoint is **short**.

$$AG = 2 \times GL \cdot AG = \frac{2}{3} \text{ of } AL \cdot GL = \frac{1}{3} \text{ of } AL$$



The three medians meet at one point, the **centroid G**.

First find the corner across from the midpoint. The median joins them. The piece at the corner is long and the piece at the midpoint is short. Are both lengths on that one median?

The ? is 2 times the number. The number is the short piece, at the midpoint.

The ? is half the number. The number is the long piece, at the corner.

Cannot tell. The point is not the centroid, or the two lengths are on different medians.

The twelve pieces

Cut along the dotted lines

1 G is the centroid of triangle ABC. L is the midpoint of BC. GL = 7. How long is AG?	2 G is the centroid of triangle JKL. M is the midpoint of JK. LG = 18. How long is GM?	3 In triangle ABC, L is the midpoint of BC. P is a point on AL. PL = 6. How long is AP?	4 K is the centroid of triangle XYZ. L is the midpoint of XZ. KY = 9. How long is LK?
5 K is the centroid of triangle XYZ. N is the midpoint of XY. XK = 12. How long is KN?	6 K is the centroid of triangle PQR. M is the midpoint of PR. MK = 4.5. How long is KQ?	7 G is the centroid of triangle DEF. L is the midpoint of EF. GD = 10. How long is EG?	8 G is the centroid of triangle DEF. N is the midpoint of DE. NG = 11. How long is GF?
9 P is the centroid of triangle ABC. N is the midpoint of AB. CP = 26. How long is PN?	10 P is the centroid of triangle STU. D is the midpoint of TU. PD = 15. How long is SP?	11 G is the centroid of triangle STU. M is a point on TU. SG = 8. How long is GM?	12 G is the centroid of triangle RST. M is the midpoint of RT. GS = 5. How long is MG?



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Cut & Glue Sort — answers

For the teacher

The ? is 2 times the number	1 — A is the corner across from BC, so AG is the long piece and GL the short piece. The number is the short piece, so the long piece is $2 \times 7 = 14$.	6 — Q is the corner across from PR, so QK is the long piece and KM the short piece. The number is the short piece, so the long piece is $2 \times 4.5 = 9$.	8 — F is the corner across from DE, so FG is the long piece and GN the short piece. The number is the short piece, so the long piece is $2 \times 11 = 22$.	10 — S is the corner across from TU, so SP is the long piece and PD the short piece. The number is the short piece, so the long piece is $2 \times 15 = 30$.
The ? is half the number	2 — L is the corner across from JK, so LG is the long piece and GM the short piece. The number is the long piece, so the short piece is $18 \div 2 = 9$.	4 — Y is the corner across from XZ, so YK is the long piece and KL the short piece. The number is the long piece, so the short piece is $9 \div 2 = 4.5$.	9 — C is the corner across from AB, so CP is the long piece and PN the short piece. The number is the long piece, so the short piece is $26 \div 2 = 13$.	12 — S is the corner across from RT, so SG is the long piece and GM the short piece. The number is the long piece, so the short piece is $5 \div 2 = 2.5$.
Cannot tell	3 — P is only a point on the median AL. Nothing says it is the centroid, so nothing says AP is twice PL.	5 — N is the midpoint of XY, so KN is on the median from Z. XK is on the median from X. They are different medians.	7 — GD is on the median from D. EG is on the median from E, a different median. The rule links two pieces of one median.	11 — M is a point on TU, but the words do not say it is the midpoint. So SM may not be a median, and G may not be on it.

Every row holds four pieces. A piece goes in the first row when the number is the short piece of a median (from the centroid to the midpoint) and the question mark is the long piece of the same median: the long piece is twice as long. It goes in the second row when the number is the long piece and the question mark is the short piece. It goes in the last row when the point is not known to be the centroid, or when the two lengths are on different medians.

To check a piece with a student, ask two questions. “Which corner is across from the midpoint?” and “Are the number and the question mark on the median from that corner?”