

CUT & GLUE SORT



PARTITIONING A DIRECTED LINE SEGMENT

Which End Is P Nearer?

Ratios, fractions of the way and weights · read the start · three rows

FREE

On the segment from A to B , $AP : PB = 1 : 4$.

P is $\frac{1}{4}$ of the way from one end of the segment to the other end.

On the segment from A to B , $AP : PB = 3 : 2$.

Row 1. P is nearer to A than to B .

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Row 2. P is nearer to B than to A .

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Row 3. Cannot tell. The words do not say which end P is measured from, or which part is next to which end.

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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. No calculator is needed.
2. **Say this once:** *“Do not find any coordinates. Read where the trip starts and how big P’s share is. Is P nearer A, nearer B, 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 has the three rows. Page 4 has the pieces and a box with a segment cut into equal steps.
Answers	page 5.

Each piece describes a point P on the segment between A and B, in one of three ways: a ratio such as $AP : PB = 1 : 4$, a fraction of the way such as $1/5$ of the way from B to A, or weights such as $P = 3/4 A + 1/4 B$. On this sheet $AP : PB = 2 : 1$ means the trip starts at A and P is $2/3$ of the way from A to B. Some textbooks use other definitions, so tell the class which ones this sheet uses.

Row 3 holds the pieces that name no start, such as “P is $1/4$ of the way from one end to the other.” Measured from A, that point is nearer A; measured from B, it is nearer B. So there is no way to tell. Students often take the first letter they read as the start; these pieces teach them to look for the start. No piece has the ratio $1 : 1$, because the midpoint is the same point from both ends.

The weights are the hardest pieces. $P = 3/4 A + 1/4 B$ is nearer A, because a point near A is made mostly of A. Many students expect the opposite. Guessing does not work: a simple rule, such as sorting by which number comes first, 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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Cut & Glue Sort — which end is P nearer?

Partitioning a segment

Name _____

Period _____

Date _____

Each piece on the next page tells you about a point P on the segment between A and B . Do not find any coordinates. **Read the piece. Is P nearer to A , nearer to B , or can you not tell? Glue the piece in its row.**

Row 1. P is nearer to A than to B .

Row 2. P is nearer to B than to A .

Row 3. Cannot tell. The words do not say which end P is measured from, or which part is next to which end.

Cut & Glue Sort — the pieces

Cut along the dashed lines

Cut out the twelve pieces. Glue each one in its row on the other sheet.

A ———— P ———— B
2 steps 1 step

$AP : PB = 2 : 1$ means: start at A. Cut the trip from A to B into $2 + 1 = 3$ equal steps.
P is 2 steps from A, so P is $\frac{2}{3}$ of the way from A to B.

As weights, $P = \frac{1}{3}A + \frac{2}{3}B$. P is nearer B, so B gets the larger weight.

The trip starts at the first letter of the ratio, so $BP : PA$ starts at B. A ratio or a fraction of the way needs a start. If the words name no start, you cannot tell which end P is nearer.

1 On the segment from A to B, $AP : PB = 1 : 4$.	2 P is $\frac{1}{4}$ of the way from one end of the segment to the other end.	3 On the segment from A to B, $AP : PB = 3 : 2$.	4 P cuts the segment between A and B into two parts. One part is 3 times as long as the other.
5 $P = \frac{3}{4}A + \frac{1}{4}B$.	6 $P = \frac{2}{5}A + \frac{3}{5}B$.	7 The two parts of the segment between A and B are 2 cm and 5 cm long.	8 On the segment between A and B, P is $\frac{3}{4}$ of the way from A to B.
9 On the segment from B to A, $BP : PA = 5 : 2$.	10 P is $\frac{1}{5}$ of the way from B to A.	11 P is on the segment between A and B. It is twice as far from one end as from the other end.	12 On the segment between A and B, P is $\frac{3}{5}$ of the way from B to A.



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Each row holds four pieces. Every piece is printed again here, with the reason.

1 **P is nearer to A than to B.**

1. On the segment from A to B, $AP : PB = 1 : 4$. *Why:* The trip starts at A. P is 1 step of 5 from A and 4 from B, so P is nearer A.
5. $P = \frac{3}{4}A + \frac{1}{4}B$. *Why:* The weights are $\frac{3}{4}$ on A and $\frac{1}{4}$ on B. The larger weight is on A, so P is nearer A.
9. On the segment from B to A, $BP : PA = 5 : 2$. *Why:* The trip starts at B. P is 5 steps of 7 from B and 2 from A, so P is nearer A.
12. On the segment between A and B, P is $\frac{3}{5}$ of the way from B to A. *Why:* The trip starts at B. P is 3 steps of 5 from B, so P is nearer A.

2 **P is nearer to B than to A.**

3. On the segment from A to B, $AP : PB = 3 : 2$. *Why:* The trip starts at A. P is 3 steps of 5 from A and 2 from B, so P is nearer B.
6. $P = \frac{2}{5}A + \frac{3}{5}B$. *Why:* The weights are $\frac{2}{5}$ on A and $\frac{3}{5}$ on B. The larger weight is on B, so P is nearer B.
8. On the segment between A and B, P is $\frac{3}{4}$ of the way from A to B. *Why:* The trip starts at A. P is 3 steps of 4 from A, so P is nearer B.
10. P is $\frac{1}{5}$ of the way from B to A. *Why:* The trip starts at B. P is 1 step of 5 from B, so P is nearer B.

3 **Cannot tell. The words do not say which end P is measured from, or which part is next to which end.**

2. P is $\frac{1}{4}$ of the way from one end of the segment to the other end. *Why:* The words name no start. Measured from A, P is nearer A. Measured from B, P is nearer B. So the piece cannot be placed.
4. P cuts the segment between A and B into two parts. One part is 3 times as long as the other. *Why:* The words name no start. Measured from A, P is nearer A. Measured from B, P is nearer B. So the piece cannot be placed.
7. The two parts of the segment between A and B are 2 cm and 5 cm long. *Why:* The words name no start. Measured from A, P is nearer A. Measured from B, P is nearer B. So the piece cannot be placed.
11. P is on the segment between A and B. It is twice as far from one end as from the other end. *Why:* The words name no start. Measured from A, P is nearer A. Measured from B, P is nearer B. So the piece cannot be placed.

To check a piece with a student, ask: “Where does the trip start? Is P’s share from the start less than half or more than half? If the words name no start, which end is it?”