

ANSWER MAZE



PARTITIONING A DIRECTED LINE SEGMENT

Partitioning a Segment: One Change at a Time

The same points twice · a new start or a turned ratio · one page · nothing to prepare

FREE

5

$A(0, 8)$ and $B(-8, 4)$. P is on the segment from A to B , and $AP : PB = 3 : 1$. Where is P ?

$P = (-2, 7) \rightarrow$ go to box 6

$P = (-6, 5) \rightarrow$ go to box 2

Hint: Count the steps from the start, A . Which end should P be nearer?

2

$A(0, 8)$ and $B(-8, 4)$. P is on the segment from B to A , and $BP : PA = 3 : 1$. Where is P ?

$P = (-2, 7) \rightarrow$ go to box 7

$P = (-6, 5) \rightarrow$ go to box 6

Hint: Read the first letter of the ratio. The trip starts at that letter.

1. **Hand out page 3**, one per student, and scrap paper. No calculator is needed.
2. **Say this once:** *“Start at box 5. Read where the trip starts. Add the two ratio numbers to get the number of steps. Write every box number in the row at the bottom as you go.”*
3. **Check a sheet quickly.** A student with no mistakes writes **5 2 7 4 1 8**: six boxes, then out.

Student sheet page 3, one per student, and scrap paper for working.
Answers page 4.

The route uses three pairs of points, and each pair comes twice in a row. The second time, one thing changes: the trip starts at the other end, or the ratio is turned round. That one change moves P. On this sheet $AP : PB = 2 : 1$ means the trip starts at A and P is $\frac{2}{3}$ of the way from A to B. The change from A to B is $B - A$, one coordinate at a time: for $A(0, 8)$ and $B(-8, 4)$ it is $(-8 - 0, 4 - 8) = (-8, -4)$. Some textbooks use other definitions, so tell the class which ones this sheet uses. Every answer is a pair of whole numbers.

Every wrong answer comes from a common mistake. On the second box of a pair, the wrong answer is the answer to the box before: the student did not see the change. On box 5 the wrong answer comes from swapping the two fractions, which puts P nearer the wrong end. These wrong answers send the student to box 6. On the other first boxes, the wrong answer comes from losing the minus sign of a negative coordinate or reading a ratio such as $4 : 1$ as 4 instead of $\frac{4}{5}$. These send the student to box 3. Both of these boxes lead back to the route.

The row at the bottom is the check. A clean run is six numbers. Each wrong answer adds at least one more. Guessing does not get a student out: every simple guessing rule, such as always taking the point nearer A, goes wrong within the first three boxes.



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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Answer Maze — one change at a time

Start at box 5

Name _____

Period _____

Date _____

Start at box 5. Find P , pick one answer, and go to the box it names. Read each box carefully: the start or the ratio may change. Write each box number in the row at the bottom as you go.

$AP : PB = 2 : 1$ 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 .

To find P : take $\frac{2}{3}$ of the change from A to B , and add it to A . Do x and y the same way.

The trip starts at the first letter of the ratio, so $BP : PA$ starts at B . From A to B is not the same trip as from B to A . Write each answer as a point (x, y) . Every answer here is a pair of whole numbers. No fractions or decimals.

1 $A(6, -6)$ and $B(1, -1)$. P is on the segment from A to B, and $AP : PB = 4 : 1$. Where is P? $P = (2, -2) \rightarrow$ go to box 8 $P = (-14, 14) \rightarrow$ go to box 3 <i>Hint: Add the two ratio numbers. The sum is the number of steps in the whole trip.</i>	2 $A(0, 8)$ and $B(-8, 4)$. P is on the segment from B to A, and $BP : PA = 3 : 1$. Where is P? $P = (-2, 7) \rightarrow$ go to box 7 $P = (-6, 5) \rightarrow$ go to box 6 <i>Hint: Read the first letter of the ratio. The trip starts at that letter.</i>
3 $A(5, -1)$ and $B(1, -5)$. P is on the segment from A to B, and $AP : PB = 3 : 1$. Where is P? $P = (-7, -13) \rightarrow$ go to box 7 $P = (2, -4) \rightarrow$ go to box 4 <i>Hint: Count all the steps of the trip first. Then take a share of the change from A to B.</i>	4 $A(-7, 9)$ and $B(7, -5)$. P is on the segment from A to B, and $AP : PB = 3 : 4$. Where is P? $P = (1, 1) \rightarrow$ go to box 6 $P = (-1, 3) \rightarrow$ go to box 1 <i>Hint: Which ratio number goes with the start? Which end is P nearer?</i>
5 $A(0, 8)$ and $B(-8, 4)$. P is on the segment from A to B, and $AP : PB = 3 : 1$. Where is P? $P = (-2, 7) \rightarrow$ go to box 6 $P = (-6, 5) \rightarrow$ go to box 2 <i>Hint: Count the steps from the start, A. Which end should P be nearer?</i>	6 $A(0, 6)$ and $B(-7, -8)$. P is on the segment from A to B, and $AP : PB = 3 : 4$. Where is P? $P = (-3, 0) \rightarrow$ go to box 2 $P = (-4, -2) \rightarrow$ go to box 5 <i>Hint: Find the midpoint. On which side of it should P stand?</i>
7 $A(-7, 9)$ and $B(7, -5)$. P is on the segment from A to B, and $AP : PB = 4 : 3$. Where is P? $P = (-7, 1) \rightarrow$ go to box 3 $P = (1, 1) \rightarrow$ go to box 4 <i>Hint: Find the change from A to B. Subtracting a negative number means adding it.</i>	8 $A(6, -6)$ and $B(1, -1)$. P is on the segment from B to A, and $BP : PA = 4 : 1$. Where is P? $P = (5, -5) \rightarrow$ you are out $P = (2, -2) \rightarrow$ go to box 6 <i>Hint: Read where the trip starts. Count the steps from that end.</i>

Write every box number here, in order.

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The route, in order. Boxes 3 and 6 are not on it. A student reaches them only by a wrong answer. They are the last two rows of the table.

5 → 2 → 7 → 4 → 1 → 8 → out

	The box's question	Right answer, and why	Wrong answer, and why a student picks it
1	Box 5 A(0, 8) and B(-8, 4). P is on the segment from A to B, and AP : PB = 3 : 1. Where is P?	(-6, 5). Start at A. $3 + 1 = 4$ steps. The change from A to B is (-8, -4). $3/4$ of it is (-6, -3). $A + (-6, -3) = (-6, 5)$.	"(-2, 7)" goes to box 6. The two fractions are swapped: $1/4$ of the change puts P nearer A. P is 3 steps of 4 from A, so it is nearer B.
2	Box 2 A(0, 8) and B(-8, 4). P is on the segment from B to A, and BP : PA = 3 : 1. Where is P?	(-2, 7). Start at B. $3 + 1 = 4$ steps. The change from B to A is (8, 4). $3/4$ of it is (6, 3). $B + (6, 3) = (-2, 7)$.	"(-6, 5)" goes to box 6. This is the answer to the box before. Here the trip now starts at B, so P is 3 steps of 4 from B, and the point moves.
3	Box 7 A(-7, 9) and B(7, -5). P is on the segment from A to B, and AP : PB = 4 : 3. Where is P?	(1, 1). Start at A. $4 + 3 = 7$ steps. The change from A to B is (14, -14). $4/7$ of it is (8, -8). $A + (8, -8) = (1, 1)$.	"(-7, 1)" goes to box 3. A minus sign is lost: $B - A$ is worked as if A's negative coordinate were positive, which gives the change (0, -14). Subtracting a negative number means adding it.
4	Box 4 A(-7, 9) and B(7, -5). P is on the segment from A to B, and AP : PB = 3 : 4. Where is P?	(-1, 3). Start at A. $3 + 4 = 7$ steps. The change from A to B is (14, -14). $3/7$ of it is (6, -6). $A + (6, -6) = (-1, 3)$.	"(1, 1)" goes to box 6. This is the answer to the box before. Here the ratio is turned round, so P is 3 steps of 7 from A, and the point moves.
5	Box 1 A(6, -6) and B(1, -1). P is on the segment from A to B, and AP : PB = 4 : 1. Where is P?	(2, -2). Start at A. $4 + 1 = 5$ steps. The change from A to B is (-5, 5). $4/5$ of it is (-4, 4). $A + (-4, 4) = (2, -2)$.	"(-14, 14)" goes to box 3. The ratio 4 : 1 is read as the fraction $4/1$, so the point goes past B. The trip has $4 + 1 = 5$ steps, so the share is $4/5$.
6	Box 8 A(6, -6) and B(1, -1). P is on the segment from B to A, and BP : PA = 4 : 1. Where is P?	(5, -5). Start at B. $4 + 1 = 5$ steps. The change from B to A is (5, -5). $4/5$ of it is (4, -4). $B + (4, -4) = (5, -5)$.	"(2, -2)" goes to box 6. This is the answer to the box before. Here the trip now starts at B, so P is 4 steps of 5 from B, and the point moves.
	Box 3 A(5, -1) and B(1, -5). P is on the segment from A to B, and AP : PB = 3 : 1. Where is P?	(2, -4). Start at A. $3 + 1 = 4$ steps. The change from A to B is (-4, -4). $3/4$ of it is (-3, -3). $A + (-3, -3) = (2, -4)$.	"(-7, -13)" goes to box 7. The ratio 3 : 1 is read as the fraction $3/1$, so the point goes past B. The trip has $3 + 1 = 4$ steps, so the share is $3/4$.
	Box 6 A(0, 6) and B(-7, -8). P is on the segment from A to B, and AP : PB = 3 : 4. Where is P?	(-3, 0). Start at A. $3 + 4 = 7$ steps. The change from A to B is (-7, -14). $3/7$ of it is (-3, -6). $A + (-3, -6) = (-3, 0)$.	"(-4, -2)" goes to box 5. The two fractions are swapped: $4/7$ of the change puts P nearer B. P is 3 steps of 7 from A, so it is nearer A.

How to check any box. P lies between the two ends, coordinate by coordinate. It is nearer the start when the first ratio number is the smaller one, and nearer the end when it is the larger one.

A student can find the last three boxes of the route by following the arrows backward from "you are out." So ask a student with a clean row to explain one box.