

CUT & GLUE SORT



THE DISTANCE AND MIDPOINT FORMULAS

Distance, Midpoint, or Along the Grid?

Twelve questions about two points · pick the tool before computing · three rows

FREE

to $(4, -5)$. It must stay on the streets, which follow the grid lines. How far does it drive?

A drone flies in a straight line from $(-1, 6)$ to $(5, -2)$. How far does it fly?

exactly halfway between two gates at $(-6, 1)$ and $(2, 5)$. Where does the bench go?

Row 1. Use the distance formula. The question asks how long a straight line is.

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Row 2. Use the midpoint formula. The question asks for the point exactly halfway. The answer is a pair.

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Row 3. Use neither formula. The path runs along the grid lines, so add across and up.

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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 the answer. Read the question. Does it want a straight length, the point halfway, or a path along the grid lines?”*
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 the distance formula on a right triangle.
Answers	page 5.

Each piece gives two points and a question. The student decides only which tool answers it. The distance formula gives the length of the straight line between the points. The midpoint formula gives the point exactly halfway, and its answer is a pair. Students often use the right formula on the wrong question, because both formulas use the same four numbers.

Row 3 is for a path that must stay on the grid lines, like a taxi on city streets. Its length is across + up, which is longer than the straight distance. Many students believe the distance between two points is across + up. This row shows where that is true, and why the straight line is different. No piece has its two points on one grid line, because there the two lengths are the same.

Read the words with the class if needed. Two pieces use the word “straight” without asking for the straight distance. Guessing does not work: a simple rule, such as sorting by one word, 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 tool answers it?

Distance and midpoint

Name _____

Period _____

Date _____

Each piece on the next page asks a question about two points. Do not find the answer. **Read the question. Which tool answers it? Glue the piece in its row.**

Row 1. Use the distance formula. The question asks how long a straight line is.

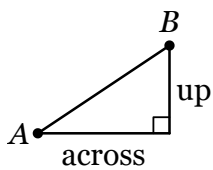
Row 2. Use the midpoint formula. The question asks for the point exactly halfway. The answer is a pair.

Row 3. Use neither formula. The path runs along the grid lines, so add across and up.

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 straight line: distance = $\sqrt{(\text{across}^2 + \text{up}^2)}$. The answer is a length.

The point halfway: midpoint = $((x_1 + x_2) \div 2, (y_1 + y_2) \div 2)$. The answer is a pair.

A path along the grid lines: length = across + up. It is longer than the straight line.

1 A taxi drives from $(-2, 3)$ to $(4, -5)$. It must stay on the streets, which follow the grid lines. How far does it drive?	2 A drone flies in a straight line from $(-1, 6)$ to $(5, -2)$. How far does it fly?	3 On the grid, a bench goes exactly halfway between two gates at $(-6, 1)$ and $(2, 5)$. Where does the bench go?	4 Segment PQ runs from $P(-3, 8)$ to $Q(5, -2)$. Which point cuts PQ into two equal halves?
5 Maya walks from $(-5, -1)$ to $(2, 4)$ along the grid lines. She never cuts across a square. What is the length of her walk?	6 Triangle ABC has $A(1, -4)$ and $B(-3, 2)$. How long is side AB?	7 A circle has its center at $(-1, 2)$. It passes through $(3, -1)$. What is its radius?	8 A circle has a diameter from $(-4, -2)$ to $(6, 4)$. Find the center of the circle.
9 A cable runs from $(3, 1)$ to $(-2, 7)$. It goes straight across to $(-2, 1)$, then straight up. How long is the cable?	10 A robot moves only left, right, up and down on the grid. How far must it move to get from $(1, -4)$ to $(-6, 2)$?	11 Two friends at $(1, -7)$ and $(-5, 3)$ meet at the middle of the straight path between them. Where do they meet?	12 On the grid, a zip line runs straight from $(-6, 4)$ to $(2, -2)$. How long is the cable?



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Each row holds four pieces. Every piece is printed again here, with the reason and the answer, though the students do not find it. Lengths are exact.

- 1 **Use the distance formula. The question asks how long a straight line is.**
 2. A drone flies in a straight line from $(-1, 6)$ to $(5, -2)$. How far does it fly? *Why:* It is a straight line, so use the distance formula: $\sqrt{6^2 + 8^2} = 10$. A path along the grid lines would be 14.
 6. Triangle ABC has $A(1, -4)$ and $B(-3, 2)$. How long is side AB? *Why:* It is a straight line, so use the distance formula: $\sqrt{4^2 + 6^2} = 2\sqrt{13}$. A path along the grid lines would be 10.
 7. A circle has its center at $(-1, 2)$. It passes through $(3, -1)$. What is its radius? *Why:* It is a straight line, so use the distance formula: $\sqrt{4^2 + 3^2} = 5$. A path along the grid lines would be 7.
 12. On the grid, a zip line runs straight from $(-6, 4)$ to $(2, -2)$. How long is the cable? *Why:* It is a straight line, so use the distance formula: $\sqrt{8^2 + 6^2} = 10$. A path along the grid lines would be 14.
- 2 **Use the midpoint formula. The question asks for the point exactly halfway. The answer is a pair.**
 3. On the grid, a bench goes exactly halfway between two gates at $(-6, 1)$ and $(2, 5)$. Where does the bench go? *Why:* It asks for the point exactly halfway, so use the midpoint formula. The answer is the pair $(-2, 3)$.
 4. Segment PQ runs from $P(-3, 8)$ to $Q(5, -2)$. Which point cuts PQ into two equal halves? *Why:* It asks for the point exactly halfway, so use the midpoint formula. The answer is the pair $(1, 3)$.
 8. A circle has a diameter from $(-4, -2)$ to $(6, 4)$. Find the center of the circle. *Why:* It asks for the point exactly halfway, so use the midpoint formula. The answer is the pair $(1, 1)$.
 11. Two friends at $(1, -7)$ and $(-5, 3)$ meet at the middle of the straight path between them. Where do they meet? *Why:* It asks for the point exactly halfway, so use the midpoint formula. The answer is the pair $(-2, -2)$.
- 3 **Use neither formula. The path runs along the grid lines, so add across and up.**
 1. A taxi drives from $(-2, 3)$ to $(4, -5)$. It must stay on the streets, which follow the grid lines. How far does it drive? *Why:* The path stays on the grid lines, so its length is across + up = $6 + 8 = 14$. The straight line, 10, is shorter, but the path cannot take it.
 5. Maya walks from $(-5, -1)$ to $(2, 4)$ along the grid lines. She never cuts across a square. What is the length of her walk? *Why:* The path stays on the grid lines, so its length is across + up = $7 + 5 = 12$. The straight line, $\sqrt{74}$, is shorter, but the path cannot take it.
 9. A cable runs from $(3, 1)$ to $(-2, 7)$. It goes straight across to $(-2, 1)$, then straight up. How long is the cable? *Why:* The path stays on the grid lines, so its length is across + up = $5 + 6 = 11$. The straight line, $\sqrt{61}$, is shorter, but the path cannot take it.
 10. A robot moves only left, right, up and down on the grid. How far must it move to get from $(1, -4)$ to $(-6, 2)$? *Why:* The path stays on the grid lines, so its length is across + up = $7 + 6 = 13$. The straight line, $\sqrt{85}$, is shorter, but the path cannot take it.

To check a piece with a student, ask: “What does the question want: a length or a point? If a length, can the path go straight, or must it stay on the grid lines?”