

Grade 8 · Distance in the Coordinate Plane · Lesson

Common Core 8.G.B.8 · mathovore.fr

To find the distance between two points on a coordinate plane, draw a right triangle whose legs are the horizontal and vertical changes, then apply the Pythagorean Theorem:

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. Add the side lengths found this way to get the perimeter of any figure on a grid.

Grade 8 Common Core: 8.G.B.8

Key facts:

- Standard 8.G.B.8: apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
- The horizontal and vertical changes are the legs of a right triangle; the segment is the hypotenuse.
- Distance formula: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.
- The order of the points does not matter, because squares are never negative.
- Perimeter on a grid: find each side length, then add them.

What is the distance between two points on a coordinate plane?

The **distance** between two points is the length of the straight segment that joins them. Each point has an x-coordinate and a y-coordinate. The horizontal and vertical changes between them are the legs of a right triangle, so the Pythagorean Theorem gives the distance.

Vocabulary

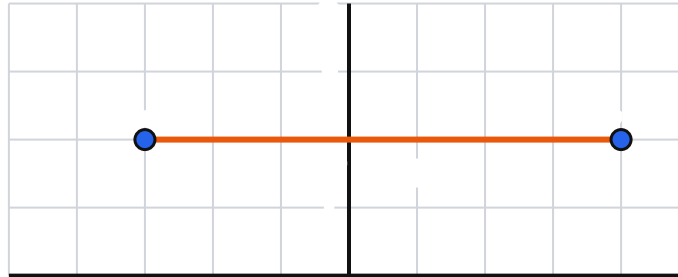
Horizontal change: $|x_2 - x_1|$, how far apart the points are left to right.

Vertical change: $|y_2 - y_1|$, how far apart the points are up and down.

Distance formula: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

How do you find a horizontal or vertical distance?

When two points share the same y -coordinate, subtract the x -coordinates and use the absolute value. For $(-3,2)$ and $(4,2)$, the distance is $|4 - (-3)| = 7$. The same idea works for points with equal x -coordinates.

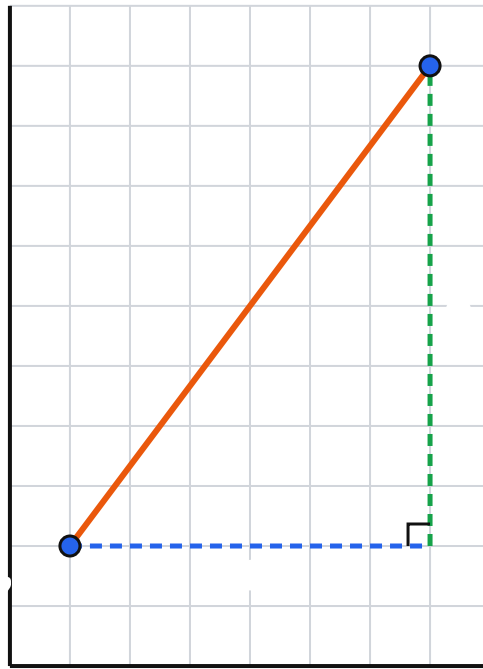


Both points have $y = 2$, so the distance is $|4 - (-3)| = 7$.

How does the Pythagorean Theorem give the distance?

1. Plot both points and draw the segment between them.
2. Draw a horizontal leg and a vertical leg to form a right triangle.
3. Find each leg by subtracting coordinates.
4. Use $a^2 + b^2 = d^2$ and take the positive square root.

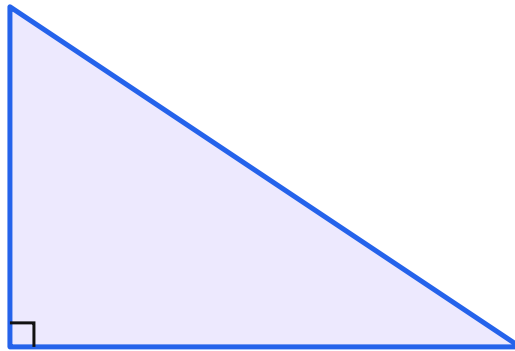
Worked example. For $A(1,2)$ and $B(7,10)$, the legs are 6 and 8. Then $d^2 = 6^2 + 8^2 = 36 + 64 = 100$, so $d = 10$.



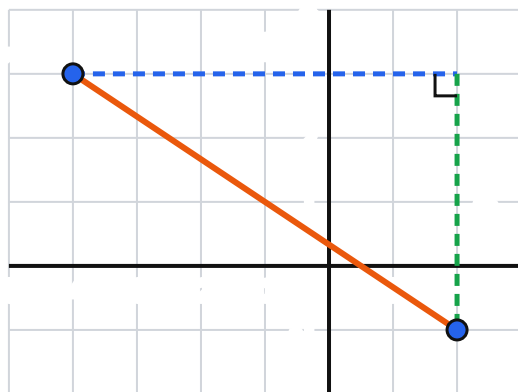
The legs are $7-1=6$ and $10-2=8$. The segment AB is the hypotenuse d .

What is the distance formula?

Writing the same steps with symbols gives $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. Squaring removes negative signs, so the order of the points does not matter. For $C(-4, 3)$ and $D(2, -1)$: $d^2 = 6^2 + (-4)^2 = 36 + 16 = 52$, so $d = \sqrt{52} \approx 7.2$.



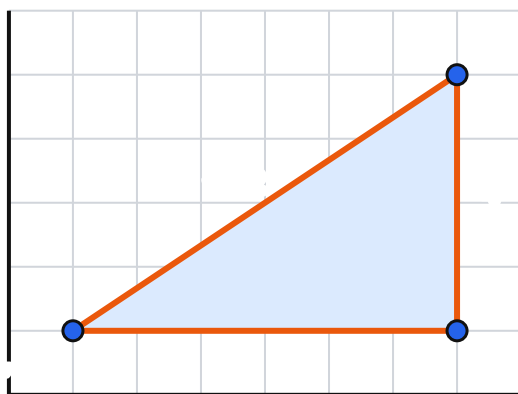
Any two points form a right triangle whose legs are the horizontal and vertical changes.



The legs are $|2 - (-4)| = 6$ and $|-1 - 3| = 4$.

How do you find the perimeter of a figure on a grid?

Find the length of every side, then add them. Horizontal and vertical sides are found by counting or subtracting. Slanted sides need the distance formula. For triangle PQR , $PQ = 6$, $QR = 4$ and $PR = \sqrt{52} \approx 7.2$, so the perimeter is about $6 + 4 + 7.2 = 17.2$.



Sides $PQ = 6$ and $QR = 4$ are straight, and $PR = \sqrt{52} \approx 7.2$ is slanted.

Distance in the Coordinate Plane: frequently asked questions

How do you find the distance between two points?

Subtract the x -coordinates and the y -coordinates to get the two legs of a right triangle. Square them, add the squares, and take the square root to get the distance.

Does it matter which point comes first?

No. Subtracting in the opposite order only changes the sign of a leg, and squaring a negative

number gives a positive number. Both orders give the same distance.

How is the distance formula related to the Pythagorean Theorem?

It is the Pythagorean Theorem written with coordinates. The expressions $x_2 - x_1$ and $y_2 - y_1$ are the legs, and d is the hypotenuse.

What if the two points are on the same horizontal or vertical line?

Then one leg is zero and there is no triangle. Just subtract the coordinates that differ and take the absolute value, as in $|4 - (-3)| = 7$.

How do you find the perimeter of a polygon on a coordinate grid?

List the vertices in order and find the distance between each pair of neighboring vertices. Use counting for horizontal and vertical sides and the distance formula for slanted sides, then add all the lengths.