

Grade 8 - Distance on the Coordinate Plane - Lesson

Common Core 8.G.B.8 · maths-pdf.fr/en/

To find the distance between two points on the coordinate plane, make a right triangle whose legs are the horizontal and vertical changes, then apply the Pythagorean theorem. The distance formula is $d = \text{square root of } (x_2 - x_1)^2 + (y_2 - y_1)^2$. Use it to find side lengths, perimeters and real-world distances on a map.

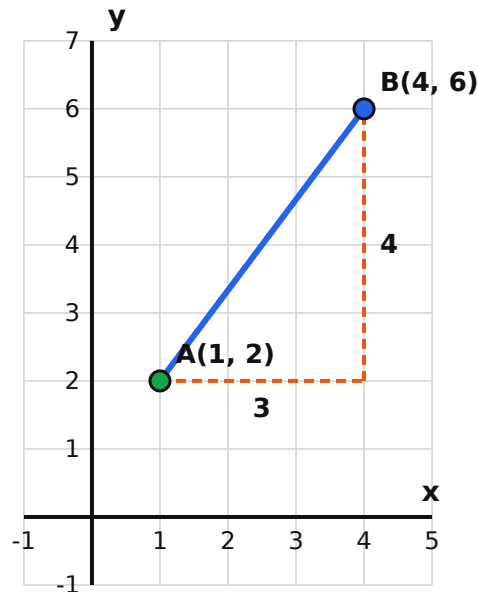
Grade 8 · Common Core State Standards: **8.G.B.8**

Key facts

- Distance: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.
- The horizontal and vertical changes are the legs of a right triangle.
- For horizontal or vertical segments, just subtract coordinates.
- Perimeter: find each side with the distance formula and add.
- Distances can be whole numbers or square roots to estimate.

How do you find the distance between two points?

To find the distance between two points on the coordinate plane, draw a right triangle. The horizontal leg has length $|x_2 - x_1|$ and the vertical leg has length $|y_2 - y_1|$. The segment between the points is the hypotenuse, so the Pythagorean theorem gives its length.

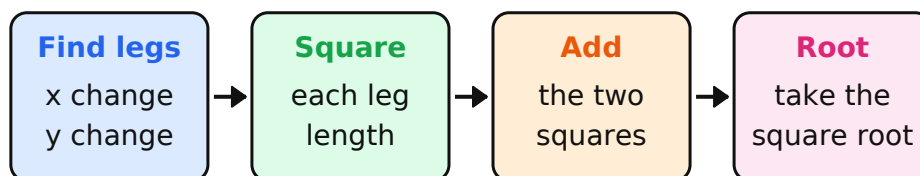


Legs 3 and 4 give a hypotenuse of 5.

Distance formula

The distance between (x_1, y_1) and (x_2, y_2) is $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. It comes directly from $a^2 + b^2 = c^2$.

Worked example. Find the distance from $A(1, 2)$ to $B(4, 6)$. The legs are $4 - 1 = 3$ and $6 - 2 = 4$, so $d^2 = 3^2 + 4^2 = 25$ and $d = 5$.



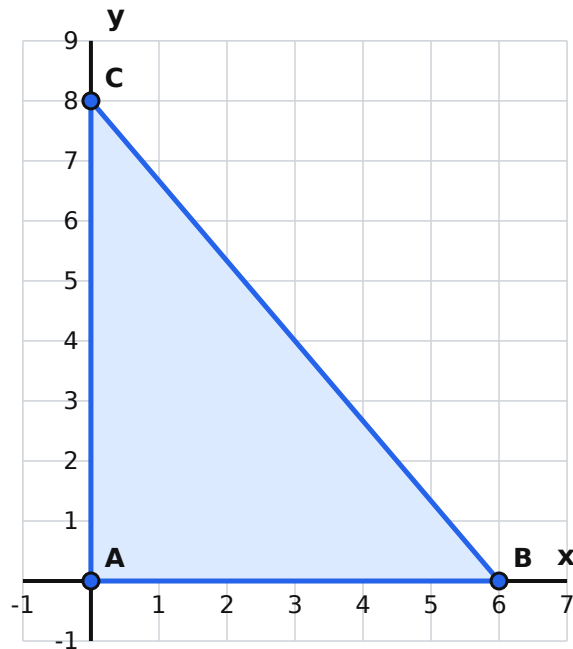
Four steps for the distance.

What about horizontal and vertical segments?

If two points share a y-coordinate, subtract the x-coordinates; no triangle is needed. The distance from $(-4, 3)$ to $(6, 3)$ is $|6 - (-4)| = 10$. Subtract carefully when negative numbers are involved, because $6 - (-4) = 10$, not 2.

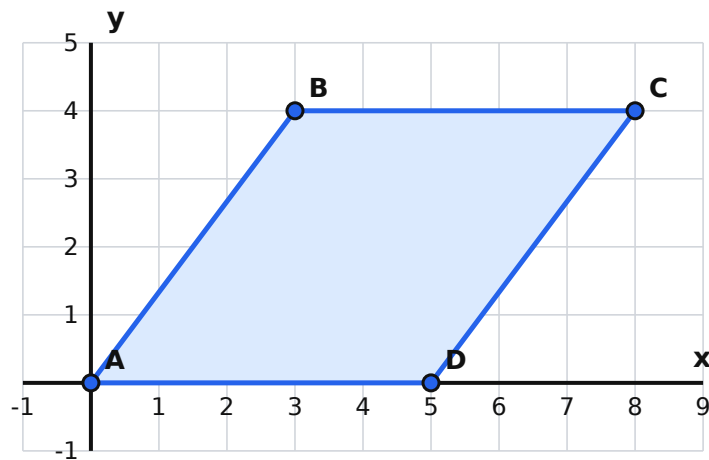
How do you find the perimeter of a figure?

Find the length of each side with the distance formula, then add. The triangle with vertices $A(0, 0)$, $B(6, 0)$ and $C(0, 8)$ has side lengths 6, 8 and $\sqrt{36 + 64} = 10$, so its perimeter is 24.



$$\text{Perimeter} = 6 + 8 + 10 = 24.$$

A quadrilateral with vertices $(0,0)$, $(3,4)$, $(8,4)$ and $(5,0)$ has four sides of length 5, so it is a rhombus with perimeter 20.



All four sides measure 5.

Be careful with signs. For the points $(-3,1)$ and $(5,7)$, the horizontal change is $5 - (-3) = 8$, not 2, and the vertical change is $7 - 1 = 6$. Then $d = \sqrt{64 + 36} = 10$. A common mistake is to forget to square both differences before adding. Another is to take the square root of each square separately. Always add the squares first and then take the root of the sum.

You can also use distances to decide whether a triangle is a right triangle or which of two points is closer to a given location.

Questions about distance on the coordinate plane

Where does the distance formula come from?

It is the Pythagorean theorem. The horizontal and vertical changes are the legs and the distance is the hypotenuse.

Does it matter which point I call the first point?

No. The differences are squared, so the sign does not matter. $(7-2)^2$ and $(2-7)^2$ both equal 25.

What if the distance is not a whole number?

Leave it as a square root or estimate it. For example $\sqrt{40} \approx 6.3$.

How do I find the distance between points on a map?

Set up coordinates in miles or blocks, find the east-west and north-south differences, and apply the formula.

Can I find the perimeter of a polygon on a grid?

Yes. Find the length of every side with the distance formula (or by counting for horizontal and vertical sides) and add them.