Class 8-12 Maths

Distance Formula

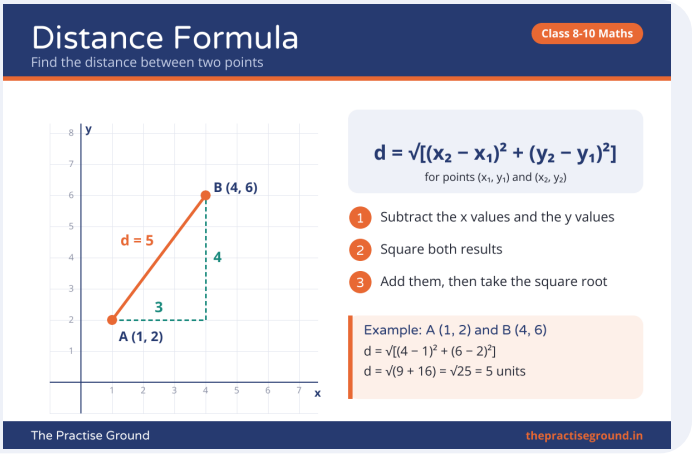
Practice pack: 3 levels, with full answers

$$d = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$$

between $P(x_1, y_1)$ and $Q(x_2, y_2)$

Shortcuts

From the origin: $d = \sqrt{(x^2 + y^2)}$
Same y (horizontal line): $d = |x_2 - x_1|$
Same x (vertical line): $d = |y_2 - y_1|$
In 3D, add $(z_2 - z_1)^2$ under the root



Level 1: Basics

Class 8-9. Find each distance. Leave surds in simplest form.

1. Find the distance between (0, 0) and (3, 4).
2. Find the distance between (1, 2) and (4, 6).
3. Find the distance between (2, 5) and (9, 5).
4. Find the distance between (−1, 3) and (−1, −6).
5. Find the distance between (1, 2) and (3, 6).
6. Find the distance between (−3, 2) and (2, −1).
7. Find the distance between (−2, −3) and (4, 5).
8. Find the distance of the point (−6, 8) from the origin.

Level 2: Applications

Use distances to prove and solve

1. Show that A(0, 0), B(3, 0) and C(0, 4) are the vertices of a right-angled triangle.

2. Show that the triangle with A(1, 1), B(5, 1) and C(3, 4) is isosceles.

3. Show that the points (1, 1), (2, 2) and (3, 3) are collinear.

4. On a map, a school is at (2, 3) and a park is at (8, 11). One unit on the map is 100 m. How far is the park from the school in metres?

5. Find the values of x for which the distance between (x, 2) and (3, −2) is 5.

6. Find the values of y for which the distance between (2, y) and (10, −3) is 10.

7. Find the perimeter of the triangle with vertices P(0, 0), Q(4, 0) and R(4, 3).

8. Show that A(0, 0), B(4, 0), C(4, 4) and D(0, 4) are the vertices of a square.

Level 3: Challenge

Algebra meets geometry

1. Find the point on the x-axis that is equidistant from A(2, −5) and B(−2, 9).

2. Find the point on the y-axis that is equidistant from A(6, 5) and B(−4, 3).

3. Find the distance between (1, 2, 3) and (4, 6, 15) in three dimensions.

4. Find the point equidistant from A(0, 0), B(6, 0) and C(0, 8). What is its distance from each vertex?

5. Show that A(1, 7), B(4, 2), C(−1, −1) and D(−4, 4) are the vertices of a square.

6. The distance from the origin to (a, b) is 13, where a and b are positive integers and a < b. Find (a, b).

Stuck? For "equidistant" questions, let the point be (x, 0) or (0, y), then set the two distances equal. Squaring both sides removes the square roots and the x^2 or y^2 terms cancel.

Worked Examples

See the method before you try it

Level 1: distance between (−3, 2) and (2, −1)

Step 1. Subtract: $x_2 - x_1 = 2 - (-3) = 5$ and $y_2 - y_1 = -1 - 2 = -3$

Step 2. Square both: $5^2 = 25$ and $(-3)^2 = 9$

Step 3. Add: $25 + 9 = 34$

Step 4. Root: $d = \sqrt{34}$, about 5.83 units. Leave as $\sqrt{34}$ if asked for exact form.

Level 2: show A(0, 0), B(3, 0), C(0, 4) form a right triangle

AB = 3 and AC = 4 (they lie on the axes)

$BC = \sqrt{[(0 - 3)^2 + (4 - 0)^2]} = \sqrt{25} = 5$

Check: $AB^2 + AC^2 = 9 + 16 = 25 = BC^2$

By the converse of Pythagoras, the right angle is at A.

Level 3: point on the x-axis equidistant from A(2, −5) and B(−2, 9)

Let the point be P(x, 0). Then $PA^2 = PB^2$.

$(x - 2)^2 + (0 + 5)^2 = (x + 2)^2 + (0 - 9)^2$

$x^2 - 4x + 4 + 25 = x^2 + 4x + 4 + 81$

$-8x = 56$, so $x = -7$. The point is (−7, 0).

Check: $PA^2 = (-9)^2 + 5^2 = 106$ and $PB^2 = 5^2 + 9^2 = 106$.

Answer Key

Check your work

Level 1

1. 5
2. 5
3. 7
4. 9
5. $\sqrt{20} = 2\sqrt{5}$, about 4.47
6. $\sqrt{34}$, about 5.83
7. 10 ($\sqrt{100}$)
8. 10

Level 2

1. AB = 3, AC = 4, BC = 5, and $3^2 + 4^2 = 5^2$
2. AB = 4, AC = BC = $\sqrt{13}$, so two sides are equal
3. AB = BC = $\sqrt{2}$ and AC = $2\sqrt{2}$, so AB + BC = AC
4. Distance = 10 units, so 1000 m (1 km)
5. $x = 6$ or $x = 0$
6. $y = 3$ or $y = -9$
7. PQ = 4, QR = 3, PR = 5, so perimeter = 12
8. All sides = 4 and both diagonals = $4\sqrt{2}$, so it is a square

Level 3

1. (−7, 0)
2. (0, 9). Each distance is $\sqrt{52}$
3. 13 units ($\sqrt{169}$)
4. (3, 4), the midpoint of BC. Each distance is 5
5. AB = BC = CD = DA = $\sqrt{34}$ and AC = BD = $\sqrt{68}$
6. (5, 12)

Pin it on the noticeboard

Page 6 is a one-page poster. Print it and pin it up in your classroom or hostel.

Scan to check answers.

Want more?

Use the free calculator to check any answer and see the steps: **thepractiseground.in/** distance-formula-calculator

Class 9-10 Maths quizzes: **thepractiseground.in/quiz/maths/10**

The Practise Ground

Classes 9-12 Maths

Distance Formula

Find the distance between any two points

1

$$d = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$$

Any two points $A(x_1, y_1)$ and $B(x_2, y_2)$
Subtract, square, add, then take the square root

2

$$d = \sqrt{(x^2 + y^2)}$$

Distance from the origin
Use it when one point is (0, 0)

3

$$d = |x_2 - x_1| \quad \text{or} \quad |y_2 - y_1|$$

Points on a horizontal or vertical line
Same y gives a horizontal line. Same x gives a vertical one

4

$$d = \sqrt{[(x_2-x_1)^2+(y_2-y_1)^2+(z_2-z_1)^2]}$$

Points in 3D space
Add the z-difference squared under the root

Three steps

1. Subtract the x-values, then the y-values.
2. Square both answers and add them.
3. Take the square root. Leave it as a surd if it is not exact.

Quick example

Find the distance from A(1, 2) to B(4, 6).

$d = \sqrt{(3^2 + 4^2)} = \sqrt{25} = 5$ units

The midpoint is $((x_1+x_2)/2, (y_1+y_2)/2)$.

Think you've got it? Test yourself.

Scan to check any answer, step by step.

thepractiseground.in

Print it. Pin it on your classroom noticeboard. Free for every class.