MATHEMATICS · GRADES 10-12

Distance and midpoint formulas

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you work out the distance between two places on a map, or the meeting point halfway between two friends' houses. You do not need to measure the road, just the straight distance between the two points. The midpoint tells you the fairest place to meet, the same distance from both of you. It is the same maths a delivery driver or a map app uses to plan a route.



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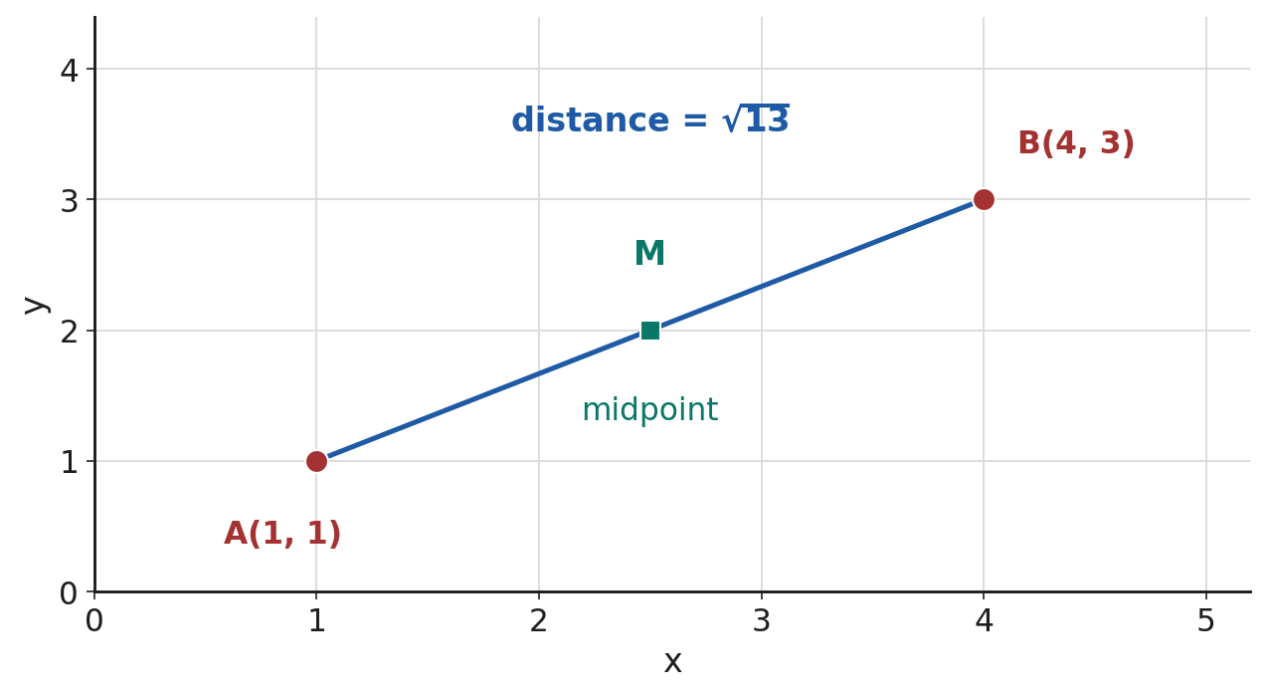
Rule

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

Midpoint: the average of the x values and the average of the y values, $(\frac{(x_1 + x_2)}{2}, \frac{(y_1 + y_2)}{2})$. The distance is the straight line between the points, and the midpoint is the point halfway between them.



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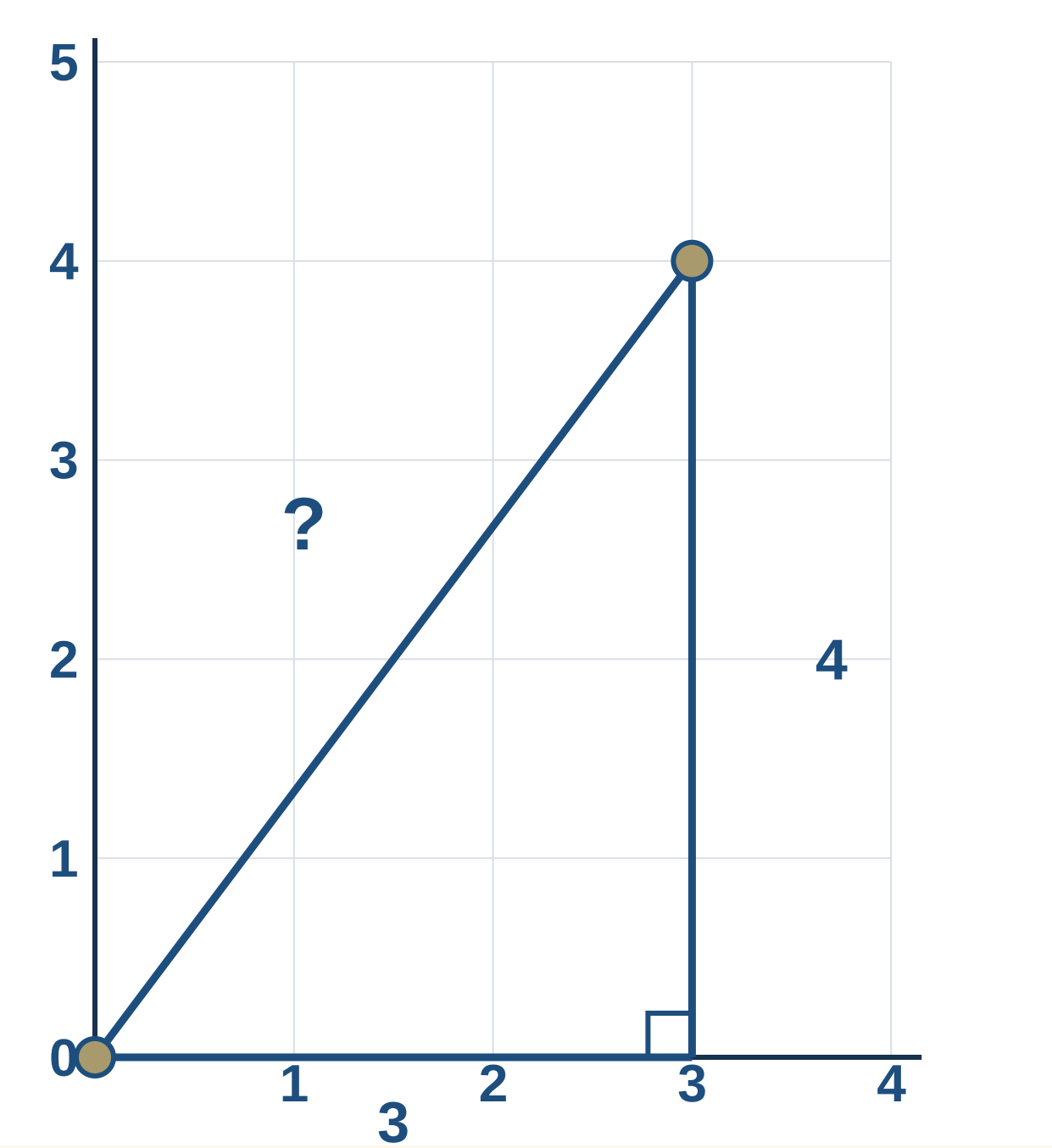
Worked examples

EXAMPLE 1

Q Find the distance between (0, 0) and (3, 4).



SOLUTION

Differences: x difference 3, y difference 4

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Distance = root of $(3^2 + 4^2)$ = root of 25

Distance = 5

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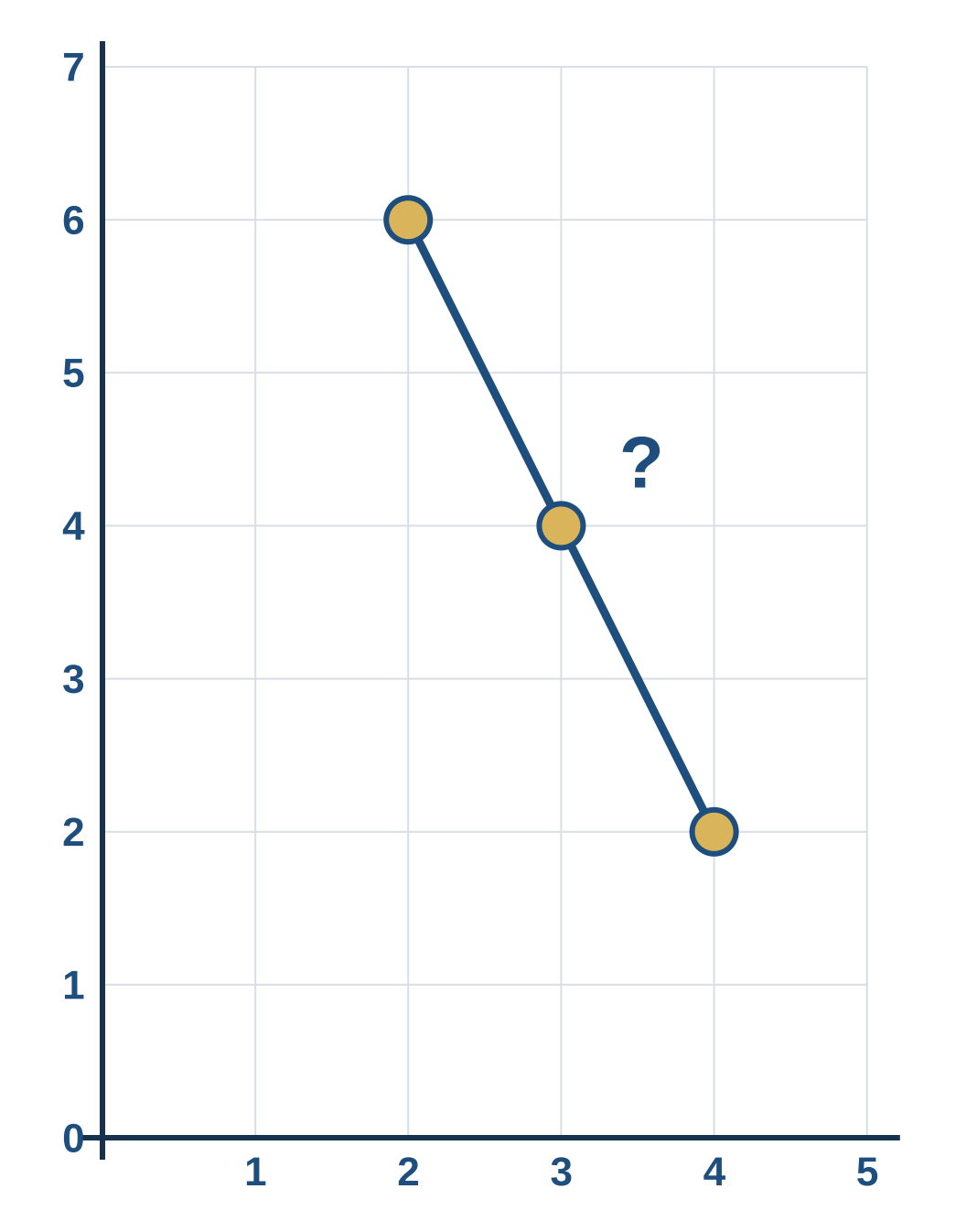
EXAMPLE 2

Q Find the midpoint of (2, 6) and (4, 2).



SOLUTION

Average the x values: $\frac{(2 + 4)}{2} = 3$

Average the y values: $\frac{(6 + 2)}{2} = 4$

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Midpoint: (3, 4)

Practice questions

1 How far apart are (0, 0) and (6, 8)?

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2 What is the midpoint of (0, 0) and (6, 8)?

A (0, 0)

B (6, 8)

C (3, 4)

D (4, 3)

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3 How far apart are (1, 2) and (4, 6)?

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4 What is the midpoint of (1, 2) and (5, 6)?

A (4, 3)

B (3, 4)

C (1, 2)

D (5, 6)

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5 How do you find the distance between two points, in words?

- **A** The sum of the x-coordinates and the y-coordinates
- **B** Half the sum of the x-coordinates and the y-coordinates
- **C** Root of the sum of the squares of the differences in x and y
- **D** The difference of the x-coordinates

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6 How far apart are (3, 3) and (3, 7)?

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7 What is the midpoint of (2, 3) and (8, 3)?

- **A** (2, 3)
- **B** (8, 3)
- **C** (5, 2)
- **D** (5, 3)

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8 How far apart are (0, 5) and (12, 5)?

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9 What is the midpoint of (-2, 6) and (4, 2)?

A (1, 4)

B (3, 4)

C (1, 2)

D (2, 4)

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10 How far apart are (-3, 4) and (3, 4)?

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ANSWER KEY

1. 10

2. (3, 4)

3. 5

4. (3, 4)

5. Root of the sum of the squares of the differences in x and y

6. 4

7. (5, 3)

8. 12

9. (1, 4)

10. 6

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