

# 13 midpoint and distance formulas answer key

**13 midpoint and distance formulas answer key** is an essential topic in geometry that allows students and professionals alike to calculate the midpoint between two points in a coordinate plane and determine the distance between those points. Understanding these formulas is crucial in various fields, including mathematics, engineering, and computer graphics. In this article, we will delve into the midpoint and distance formulas, provide examples, and offer an answer key for 13 practice problems.

## Understanding the Midpoint Formula

The midpoint formula is used to find the midpoint between two points  $A(x_1, y_1)$  and  $B(x_2, y_2)$  in a two-dimensional Cartesian coordinate system. The formula is given by:

$$M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

### How to Use the Midpoint Formula

To find the midpoint:

1. Identify the coordinates of the two points.
2. Plug the coordinates into the formula.
3. Calculate the average of the x-coordinates and the y-coordinates separately.

### Example

Suppose we have two points  $A(2, 3)$  and  $B(4, 7)$ . To find the midpoint  $M$ :

1. Identify coordinates:  $x_1 = 2, y_1 = 3, x_2 = 4, y_2 = 7$ .
2. Plug into the formula:

$$M = \left( \frac{2 + 4}{2}, \frac{3 + 7}{2} \right) = \left( \frac{6}{2}, \frac{10}{2} \right) = (3, 5)$$

Thus, the midpoint  $M$  is  $(3, 5)$ .

# Understanding the Distance Formula

The distance formula calculates the distance between two points  $A(x_1, y_1)$  and  $B(x_2, y_2)$  in the coordinate plane. The formula is expressed as:

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

## How to Use the Distance Formula

To find the distance:

1. Identify the coordinates of the two points.
2. Subtract the coordinates to find the differences.
3. Square the differences.
4. Add the squared differences.
5. Take the square root of the sum.

## Example

Using the previous points  $A(2, 3)$  and  $B(4, 7)$ , we can find the distance  $d$ :

1. Identify coordinates:  $(x_1 = 2, y_1 = 3, x_2 = 4, y_2 = 7)$ .
2. Calculate differences:

$$(x_2 - x_1) = (4 - 2) = 2$$

$$(y_2 - y_1) = (7 - 3) = 4$$

3. Square the differences:

$$(2)^2 = 4$$

$$(4)^2 = 16$$

4. Add the squared differences:

$$\begin{aligned} & \sqrt{4 + 16} = \sqrt{20} \\ & \sqrt{20} \end{aligned}$$

5. Take the square root:

$$\begin{aligned} & \sqrt{d} = \sqrt{20} = 2\sqrt{5} \approx 4.47 \\ & \sqrt{d} \end{aligned}$$

Thus, the distance  $\sqrt{d}$  is approximately  $\sqrt{4.47}$  units.

## Practice Problems

To reinforce the understanding of the midpoint and distance formulas, here are 13 practice problems along with their answers.

### Midpoint Problems

1. Find the midpoint of  $A(1, 2)$  and  $B(3, 4)$ .
2. Find the midpoint of  $A(-1, -5)$  and  $B(3, 1)$ .
3. Find the midpoint of  $A(0, 0)$  and  $B(8, 6)$ .
4. Find the midpoint of  $A(-2, 4)$  and  $B(2, -4)$ .
5. Find the midpoint of  $A(5, -3)$  and  $B(1, 5)$ .
6. Find the midpoint of  $A(7, 2)$  and  $B(3, 6)$ .
7. Find the midpoint of  $A(-3, -7)$  and  $B(1, 5)$ .

### Distance Problems

8. Calculate the distance between  $A(1, 1)$  and  $B(4, 5)$ .
9. Calculate the distance between  $A(2, -3)$  and  $B(-2, 1)$ .
10. Calculate the distance between  $A(-1, 2)$  and  $B(3, 4)$ .
11. Calculate the distance between  $A(0, 0)$  and  $B(-4, -3)$ .
12. Calculate the distance between  $A(1, 2)$  and  $B(1, 5)$ .
13. Calculate the distance between  $A(3, 7)$  and  $B(6, 1)$ .

# Answer Key

## Midpoint Answers

1.  $(M = (2, 3))$
2.  $(M = (1, -2))$
3.  $(M = (4, 3))$
4.  $(M = (0, 0))$
5.  $(M = (3, 1))$
6.  $(M = (5, 4))$
7.  $(M = (-1, -1))$

## Distance Answers

8.  $(d = \sqrt{(4-1)^2 + (5-1)^2} = \sqrt{9 + 16} = \sqrt{25} = 5)$
9.  $(d = \sqrt{(-2-2)^2 + (1+3)^2} = \sqrt{16 + 16} = \sqrt{32} = 4\sqrt{2} \approx 5.66)$
10.  $(d = \sqrt{(3+1)^2 + (4-2)^2} = \sqrt{16 + 4} = \sqrt{20} = 2\sqrt{5} \approx 4.47)$
11.  $(d = \sqrt{(-4-0)^2 + (-3-0)^2} = \sqrt{16 + 9} = \sqrt{25} = 5)$
12.  $(d = \sqrt{(1-1)^2 + (5-2)^2} = \sqrt{0 + 9} = 3)$
13.  $(d = \sqrt{(6-3)^2 + (1-7)^2} = \sqrt{9 + 36} = \sqrt{45} = 3\sqrt{5} \approx 6.71)$

## Conclusion

Understanding the **13 midpoint and distance formulas answer key** is essential for solving problems in geometry related to points in a coordinate plane. The midpoint formula helps determine the center point between two points, while the distance formula provides the length between them. By practicing with various problems, students can gain confidence in applying these formulas effectively.

## Frequently Asked Questions

### What is the midpoint formula?

The midpoint formula is used to find the midpoint (M) between two points (x1, y1) and (x2, y2) in a coordinate plane. It is given by  $M = ((x1 + x2) / 2, (y1 + y2) / 2)$ .

### How do you calculate the distance between two points using the distance

## formula?

The distance formula calculates the distance (d) between two points (x1, y1) and (x2, y2) using the formula  $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ .

## Can you provide an example of using the midpoint formula?

Certainly! For points A(2, 3) and B(4, 7), the midpoint M =  $((2 + 4) / 2, (3 + 7) / 2) = (3, 5)$ .

## What is the importance of the distance formula in geometry?

The distance formula is crucial in geometry as it allows us to find the length of line segments, determine if points are equidistant, and analyze various geometric shapes.

## How do you derive the distance formula from the Pythagorean theorem?

The distance formula is derived from the Pythagorean theorem by considering the difference in x-coordinates as one leg of a right triangle and the difference in y-coordinates as the other leg, leading to  $d = \sqrt{(\Delta x)^2 + (\Delta y)^2}$ .

## What are some common mistakes when using the midpoint and distance formulas?

Common mistakes include forgetting to square the differences in the distance formula, miscalculating the average in the midpoint formula, and mixing up x and y coordinates.

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