

1-7

Midpoint and Distance in the Coordinate Plane

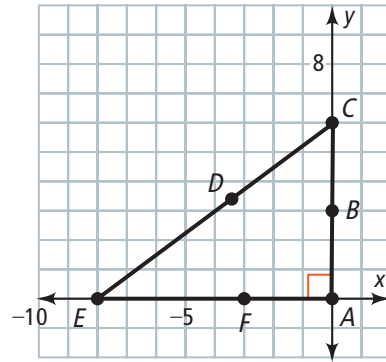


Vocabulary

Review

Use the figure at the right for Exercises 1–6. Write T for *true* or F for *false*.

1. Points A and B are both at the *origin*.
2. If $AB = BC$, then B is the midpoint of \overline{AC} .
3. The *midpoint* of \overline{AE} is F .
4. The *Pythagorean Theorem* can be used for any triangle.
5. Point C is at $(6, 0)$.
6. Point E has a *y-coordinate* of -8 .



Vocabulary Builder

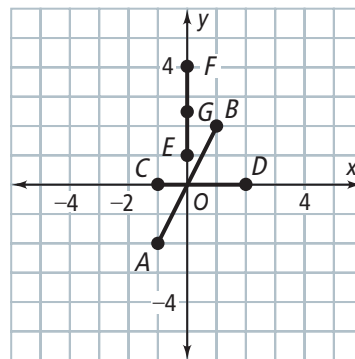
midpoint (noun) MID POYNT

Definition: A *midpoint* of a segment is a point that divides the segment into two congruent segments.

Use Your Vocabulary

Use the figure at the right for Exercises 7–9.

7. The *midpoint* of \overline{EF} is G (,).
8. The *midpoint* of \overline{AB} is (,), or the origin.
9. The *midpoint* of \overline{CD} is (,).



Key Concept Midpoint Formulas

On a Number Line

The coordinate of the midpoint M of \overline{AB} with endpoints at a and b is $\frac{a+b}{2}$.

In the Coordinate Plane

Given $A(x_1, y_1)$ and $B(x_2, y_2)$, the coordinates of the midpoint of \overline{AB} are $M\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

Find the coordinate of the midpoint M of each segment with the given endpoints on a number line.

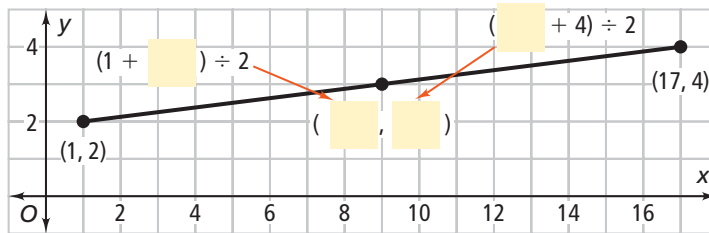
10. endpoints 5 and 9

11. endpoints -3 and 5

12. endpoints -10 and -3

13. endpoints -8 and -1

14. Complete the diagram below.



Problem 2 Finding an Endpoint

Got It? The midpoint of \overline{AB} has coordinates $(4, -9)$. Endpoint A has coordinates $(-3, -5)$. What are the coordinates of B ?

15. Complete the equations below.

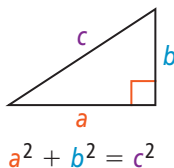
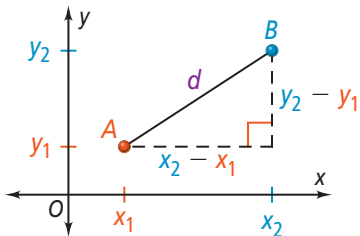
Endpoint A Coordinates (\quad, \quad)	Midpoint Formula $\left(\frac{x_1 + \quad}{2}, \frac{y_1 + \quad}{2}\right)$	Midpoint Coordinates (\quad, \quad)
$\frac{x_1 + \quad}{2} = \quad$ $x_1 + \quad = \quad$ $x_1 = \quad$	<p>← Solve two equations. →</p>	$\frac{y_1 + \quad}{2} = \quad$ $y_1 + \quad = \quad$ $y_1 = \quad$

16. The coordinates of endpoint B are (\quad, \quad) .

Formula The Distance Formula

The distance between two points $A(x_1, y_1)$ and $B(x_2, y_2)$ is $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

The Distance Formula is based on the Pythagorean Theorem.



Use the diagrams above. Draw a line from each triangle side in Column A to the corresponding triangle side in Column B.

Column A

Column B

17. $y_2 - y_1$

a

18. $x_2 - x_1$

b

19. distance, d

c

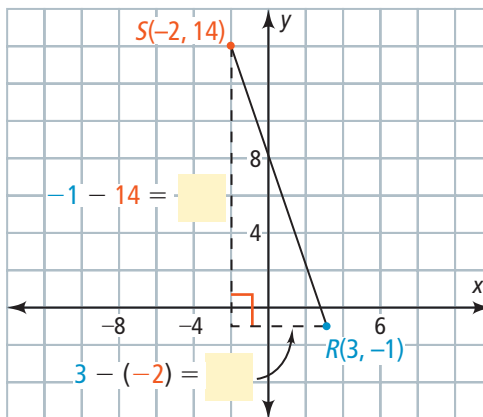


Problem 3 Finding Distance

Got It? \overline{SR} has endpoints $S(-2, 14)$ and $R(3, -1)$. What is SR to the nearest tenth?

20. Complete the diagram at the right.

21. Let $S(-2, 14)$ be (x_1, y_1) and let $R(3, -1)$ be (x_2, y_2) . Use the justifications and complete the steps below to find SR .



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

$$SR = \sqrt{(\square - (-2))^2 + (\square - 14)^2}$$

$$= \sqrt{(\square)^2 + (\square)^2}$$

$$= \sqrt{\square + \square}$$

$$= \sqrt{\square}$$

$$\approx \square$$

Use the Distance Formula.

Substitute.

Subtract.

Simplify powers.

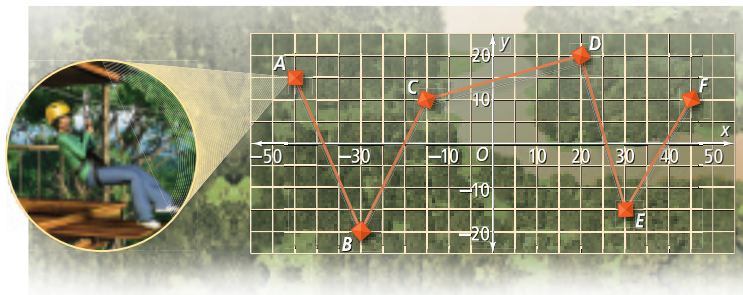
Add.

Use a calculator.



Problem 4 Finding Distance

Got It? On a zip-line course, you are harnessed to a cable that travels through the treetops. You start at Platform A and zip to each of the other platforms. How far do you travel from Platform D to Platform E? Each grid unit represents 5 m.



22. The equation is solved below. Write a justification for each step.

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

$$DE = \sqrt{(30 - 20)^2 + (-15 - 20)^2}$$

$$= \sqrt{10^2 + (-35)^2} = \sqrt{100 + 1225} = \sqrt{1325}$$

23. To the nearest tenth, you travel about m.



Lesson Check • Do you UNDERSTAND?

Reasoning How does the Distance Formula ensure that the distance between two different points is positive?

24. A radical symbol with no sign in front of it indicates a positive / negative square root.

25. Now answer the question.



Math Success

Check off the vocabulary words that you understand.

midpoint distance coordinate plane

Rate how well you can use the *Midpoint and Distance Formulas*.

Need to review

0 2 4 6 8 10



Now I get it!