

# Midpoint Formula

Midpoint is the average of the 'x' values and the average of the 'y' values.

Midpoint is written as a coordinate.

Unit 5-Day 2 (p.591...)

## Applications of the Midpoint and Distance Formula

You can apply the midpoint formula and the distance formula in real life situations.

On a map's coordinate grid, Merryville is located at  $(2, 4)$  and Sillytown is located at  $(2, -2)$ . Bluxberg is the midpoint between Merryville and Sillytown. What is the distance from Merryville to Bluxberg? (One map unit equals one mile.)

**Step 1:** First, we would need to find the midpoint from the points of the cities Merryville,  $(2, 4)$  and Sillytown,  $(2, -2)$ . Let  $(2, 4) = (x_1, y_1)$  and  $(2, -2) = (x_2, y_2)$ .

Use the formula for the midpoint:  $M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

$$M = \left( \frac{2 + 2}{2}, \frac{4 + (-2)}{2} \right) = \left( \frac{4}{2}, \frac{2}{2} \right) = (2, 1)$$

We find the midpoint, Bluxberg is  $(2, 1)$ .

**Step 2:** Next, we need to find the distance between Merryville,  $(2, 4)$ , and Bluxberg,  $(2, 1)$ . Let  $(2, 1) = (x_1, y_1)$  and  $(2, 4) = (x_2, y_2)$ .

Use the distance formula:  $d = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$

$$d = \sqrt{(4 - 1)^2 + (2 - 2)^2} = \sqrt{(3)^2 + (0)^2} = \sqrt{9 + 0} = \sqrt{9} = 3$$

The distance between Merryville and Bluxberg is 3 miles.

**Solve the following word problems using the midpoint formula, the distance formula, or both.**

1. On a map's coordinate grid, Walt City is located at  $(-1, -3)$  and Koshville is located at  $(4, 9)$ . How long is a train's route as the train travels along a straight line from Walt City to Koshville? (One map unit equals one mile.)
2. Find the midpoint of the two cities in problem number one.
3. Caliyaah is traveling to Peru for her summer vacation. She looks at a map of the path of her flight. Her plane leaves from Georgia, located at  $(5, 16)$  on the map's coordinate grid, makes a stop at the halfway point, Panama, and then heads to its destination, Peru, located at  $(7, 8)$  on the map's coordinate grid. Find the location of Panama on Caliyaah's map.
4. Coach Alvarado drew his football team's next play on a coordinate grid. He placed Kaleem at  $(1, 3)$ . He will be passing the ball to Jeremy at  $(-6, 3)$ . What is the distance, in yards, of the pass from Kaleem to Jeremy?
5. In case the ball doesn't reach Jeremy, in the previous problem, Coach Alvarado placed Micah at midpoint. Where is Micah on Coach Alvarado's grid?

1. On a map, Luis's house is located at  $(-7, 6)$  and Melvin's house is at  $(4, -5)$ . What are the coordinates for Raquel's home if she lives exactly halfway between Luis and Melvin?
2. The endpoints of  $\overline{GH}$  are  $G(-3, 7)$  and  $H(2, 9)$ . What are the coordinates of the midpoint of  $\overline{GH}$ ?
3. The midpoint of  $\overline{XY}$  is point  $M(-12, 5)$ . If the coordinates of  $X$  are  $(3, -3)$ , what are the coordinates of  $Y$ ?
4.  $M$  is the midpoint of line segment  $AB$ . The coordinates of  $A$  are  $(-2, 3)$  and the coordinates of  $M$  are  $(1, 0)$ . Find the coordinates of  $B$ .

**Given the midpoint and one endpoint of a line segment, find the other endpoint.**

21) Endpoint:  $(-9, -1)$ , midpoint:  $(8, 14)$

22) Endpoint:  $(10, 12)$ , midpoint:  $(6, 9)$

23) Endpoint:  $(-8, -10)$ , midpoint:  $(10, -7)$

24) Endpoint:  $(-11, 9)$ , midpoint:  $(3, -11)$

25) Endpoint:  $(-2, 7)$ , midpoint:  $(12, -10)$

26) Endpoint:  $(11, 14)$ , midpoint:  $(10, 14)$

27) Endpoint:  $(14, -8)$ , midpoint:  $(5, 8)$

28) Endpoint:  $(-9, 0)$ , midpoint:  $(10, -7)$

29) Endpoint:  $\left(-\frac{5}{6}, -\frac{1}{3}\right)$ , midpoint:  $\left(\frac{1}{2}, -1\right)$

30) Endpoint:  $\left(2, \frac{12}{7}\right)$ , midpoint:  $\left(\frac{1}{3}, -\frac{8}{5}\right)$

1) The line LN has endpoints L(-8,-2) and N(4,2) and midpoint M. What is the equation of the line perpendicular to LN and passing through M?

21) Endpoint:  $(-9, -1)$ , midpoint:  $(8, 14)$   
 $(25, 29)$

22) Endpoint:  $(10, 12)$ , midpoint:  $(6, 9)$   
 $(2, 6)$

23) Endpoint:  $(-8, -10)$ , midpoint:  $(10, -7)$   
 $(28, -4)$

24) Endpoint:  $(-11, 9)$ , midpoint:  $(3, -11)$   
 $(17, -31)$

25) Endpoint:  $(-2, 7)$ , midpoint:  $(12, -10)$   
 $(26, -27)$

26) Endpoint:  $(11, 14)$ , midpoint:  $(10, 14)$   
 $(9, 14)$

27) Endpoint:  $(14, -8)$ , midpoint:  $(5, 8)$   
 $(-4, 24)$

28) Endpoint:  $(-9, 0)$ , midpoint:  $(10, -7)$   
 $(29, -14)$

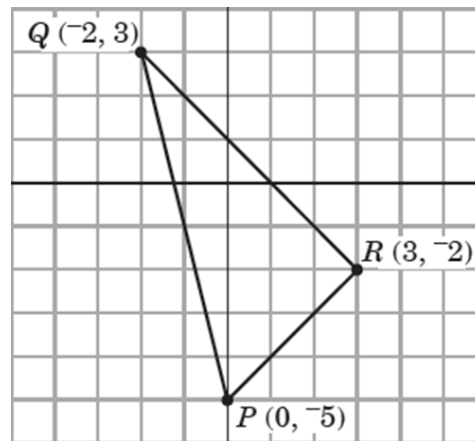
29) Endpoint:  $(-\frac{5}{6}, -\frac{1}{3})$ , midpoint:  $(\frac{1}{2}, -1)$   
 $(\frac{11}{6}, -\frac{5}{3})$

30) Endpoint:  $(2, \frac{12}{7})$ , midpoint:  $(\frac{1}{3}, -\frac{8}{5})$   
 $(-\frac{4}{3}, -\frac{172}{35})$



1. What is the area of a square with vertices  $(3, 3)$ ,  $(6, 6)$ ,  $(9, 3)$ , and  $(6, 0)$ ?
2. On a map's coordinate grid, Panthersville is located at  $(-3, 2)$ , and Heel City is located at  $(4, 8)$ . Falconton is the midpoint between Panthersville and Heel City. What is the *approximate* distance from Panthersville to Falconton?  
(One map unit equals one mile.)

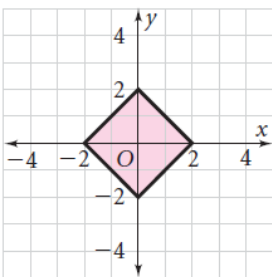
3. What is the perimeter of  $\triangle PQR$ ?



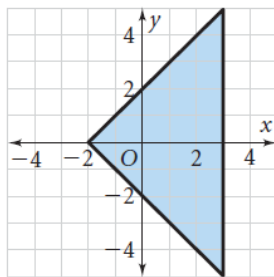
4. Find the perimeter of the triangle with vertices  $T(1, -6)$ ,  $U(1, 3)$ ,  $V(-1, 5)$ .
5. Find the radius of a circle given that the center is at  $(2, -3)$  and the point  $(-1, -2)$  lies on the circle.

Find the perimeter of each figure.

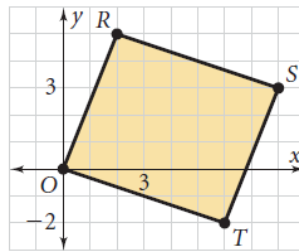
1.



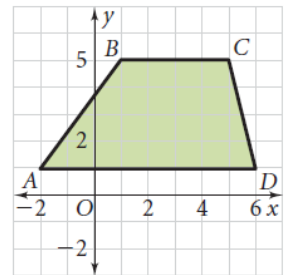
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3.



4.



## From Practice worksheet of 11-3

39.  $\overline{AB}$  is a diameter of a circle. The coordinates of  $A$  are  $(-1, 3)$ , and the coordinates of  $B$  are  $(-5, 9)$ . Find the center of the circle.
40.  $\overline{CD}$  is a diameter of a circle. The coordinates of  $C$  are  $(-2, -3)$ , and the coordinates of  $D$  are  $(-12, -5)$ . Find the center of the circle.
41. A quadrilateral is a parallelogram if the diagonals bisect each other. Quadrilateral  $EFGH$  has vertices  $E(-4, 3)$ ,  $F(2, 1)$ ,  $G(4, 7)$ , and  $H(-2, 9)$ . Find the midpoint of each diagonal. Is  $EFGH$  a parallelogram? Explain.
42. A large building is on fire. Fire trucks from two different stations respond to the fire. One station is 1 mi east and 2 mi north of the fire. The other station is 2 mi west and 1 mi south of the fire. How far apart are the two fire stations?
43. The Anderson and McCready families decide to go to a concert together. The Andersons live 4 km west and 6 km north of the concert hall. The McCreadys live 5 km east and 2 km south of the concert hall. How far apart do the two families live?
44. According to the map, a ball field is 4 km west and 2 km north of where you live. A theater is 1 km east and 4 km south of where you live. How far apart are the ball field and the theater?

A line segment has endpoints A(3, 2) and B(5, 4). The point K is the midpoint of segment AB. What is the equation of the line that is perpendicular to segment AB through point K? **(G.GPE.5 & G.GPE.6)**

- a.  $y = -x + 7$
- b.  $y = x + 7$
- c.  $y = -x - 7$
- d.  $y = x + (-7)$

