

Chapter 1 Points, Lines, Planes, and Angles Lesson 1-3

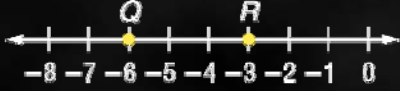
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- Example 1 Find Distance on a Number Line
- Example 2 Find Distance on a Coordinate Plane
- Example 3 Find Coordinates of Midpoint
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Help Extra Examples 5-Minute Check

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Example 1
Use the number line to find QR .



The coordinates of Q and R are -6 and -3 .

$$QR = |-6 - (-3)| \quad \text{Distance Formula}$$

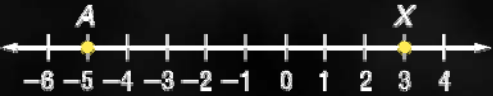
$$= |-3| \text{ or } 3 \quad \text{Simplify.}$$

Answer: 3

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Your Turn
Use the number line to find AX .



Answer: 8

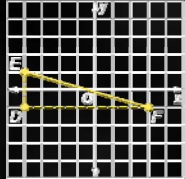
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Example 2
Find the distance between $E(-4, 1)$ and $F(3, -1)$.

Method 1 Pythagorean Theorem

Use the gridlines to form a triangle so you can use the Pythagorean Theorem.



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Example 2

$$(EF)^2 = (ED)^2 + (DF)^2 \quad \text{Pythagorean Theorem}$$

$$(EF)^2 = 2^2 + 7^2 \quad ED = 2 \text{ units}, DF = 7 \text{ units}$$

$$(EF)^2 = 53 \quad \text{Simplify.}$$

$$EF = \sqrt{53} \quad \text{Take the square root of each side.}$$

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Example 2

Method 2 Distance Formula

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

$$EF = \sqrt{[3 - (-4)]^2 + (-1 - 1)^2} \quad (x_1, y_1) = (-4, 1) \text{ and } (x_2, y_2) = (3, -1)$$

$$EF = \sqrt{(7)^2 + (-2)^2} \quad \text{Simplify.}$$

$$EF = \sqrt{53} \quad \text{Simplify.}$$

Answer: The distance from E to F is $\sqrt{53}$ units. You can use a calculator to find that $\sqrt{53}$ is approximately 7.28.

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Your Turn

Find the distance between $A(-3, 4)$ and $M(1, 2)$.

Answer: $\sqrt{20} \approx 4.47$

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Example 3a

The coordinates on a number line of J and K are -12 and 16 , respectively. Find the coordinate of the midpoint of \overline{JK} .

The coordinates of J and K are -12 and 16 .
Let M be the midpoint of \overline{JK} .

$$M = \frac{-12 + 16}{2} \quad a = -12, b = 16$$

$$= \frac{4}{2} \text{ or } 2 \quad \text{Simplify.}$$

Answer: 2

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Example 3b

Find the coordinates of M , the midpoint of \overline{GH} , for $G(8, -6)$ and $H(-14, 12)$.

Let G be (x_1, y_1) and H be (x_2, y_2) .

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = M\left(\frac{8 + (-14)}{2}, \frac{-6 + 12}{2}\right)$$

$$= M\left(\frac{-6}{2}, \frac{6}{2}\right) \text{ or } M(-3, 3)$$

Answer: $(-3, 3)$

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Your Turn

a. The coordinates on a number line of Y and O are 7 and -15 , respectively. Find the coordinate of the midpoint of \overline{YO} .

Answer: -4

b. Find the coordinates of the midpoint of \overline{XY} for $X(-2, 3)$ and $Y(-8, -9)$.

Answer: $(-5, -3)$

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Example 4

Find the coordinates of D if $E(-6, 4)$ is the midpoint of \overline{DF} and F has coordinates $(-5, -3)$.

Let F be (x_2, y_2) in the Midpoint Formula.

$$E(-6, 4) = E\left(\frac{x_1 + (-5)}{2}, \frac{y_1 + (-3)}{2}\right) \quad (x_2, y_2) = (-5, -3)$$

Write two equations to find the coordinates of D .

$$-6 = \frac{x_1 + (-5)}{2} \quad 4 = \frac{y_1 + (-3)}{2}$$

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Example 4

Solve each equation.

$$-6 = \frac{x_1 + (-5)}{2}$$

$$-12 = x_1 - 5 \quad \text{Multiply each side by 2.}$$

$$-7 = x_1 \quad \text{Add 5 to each side.}$$

$$4 = \frac{y_1 + (-3)}{2}$$

$$8 = y_1 - 3 \quad \text{Multiply each side by 2.}$$

$$11 = y_1 \quad \text{Add 3 to each side.}$$

Answer: The coordinates of D are $(-7, 11)$.

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Your Turn

Find the coordinates of R if $N(8, -3)$ is the midpoint of \overline{RS} and S has coordinates $(-1, 5)$.

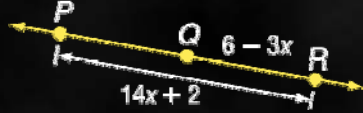
Answer: $(17, -11)$

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Example 5

Multiple-Choice Test Item
What is the measure of \overline{PR} if Q is the midpoint of \overline{PR} ?



A $\frac{1}{2}$ B 4 C $4\frac{1}{2}$ D 9

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Example 5

Read the Test Item

You know that Q is the midpoint of \overline{PR} and the figure gives algebraic measures for \overline{QR} and \overline{PR} . You are asked to find the measure of \overline{PR} .

Solve the Test Item

Because Q is the midpoint, you know that $QR = \frac{1}{2}PR$. Use this equation and the algebraic measures to find a value for x .

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Example 5

$QR = \frac{1}{2}PR$	Definition of midpoint
$6 - 3x = \frac{1}{2}(14x + 2)$	$QR = 6 - 3x, PR = 14x + 2$
$6 - 3x = 7x + 1$	Distributive Property
$5 - 3x = 7x$	Subtract 1 from each side.
$5 = 10x$	Add 3x to each side.
$\frac{1}{2} = x$	Divide each side by 10.

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Example 5

Now substitute $\frac{1}{2}$ for x in the expression for PR .

$PR = 14x + 2$	Original measure
$PR = 14\left(\frac{1}{2}\right) + 2$	$x = \frac{1}{2}$
$PR = 7 + 2$ or 9	Simplify.

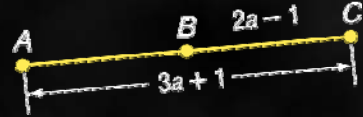
Answer: D

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Your Turn

Multiple-Choice Test Item
What is the measure of \overline{AC} if B is the midpoint of \overline{AC} ?



A 1 B 3 C 5 D 10

Answer: B

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