

## 1.3 Notes.notebook

### 1-3 Distance and Midpoints

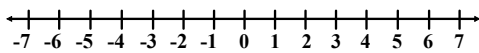
Aug 27-3:23 PM

When we ask for the distance between two things, we are wanting to know *how far apart* they are.

How we calculate the distance depends on the figure we are looking at or the question we are asking.

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We can ask the distance between any two points on a number line:



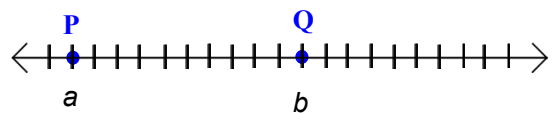
What is the distance between 2 and -4?

Between -3 and 0? Between 3 and 0?

Jun 5-9:40 AM

### Measuring a line segment

The measure of a line segment is the absolute value of the **DIFFERENCE** of the coordinates of the endpoints.

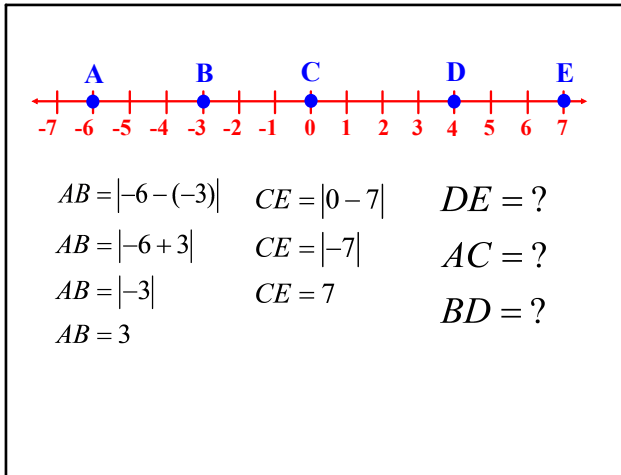


$$PQ = |a - b|$$

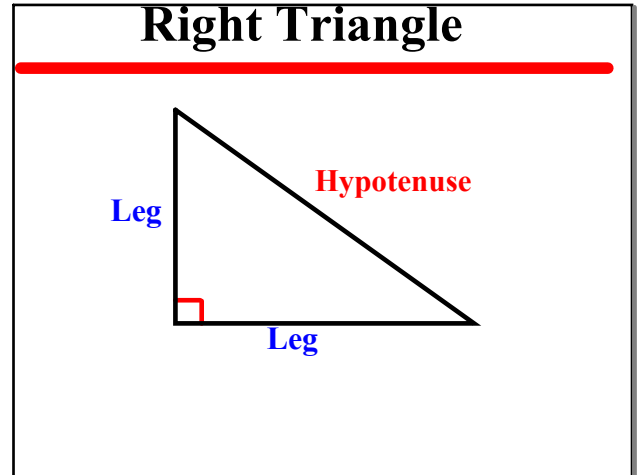
$$PQ = |b - a|$$

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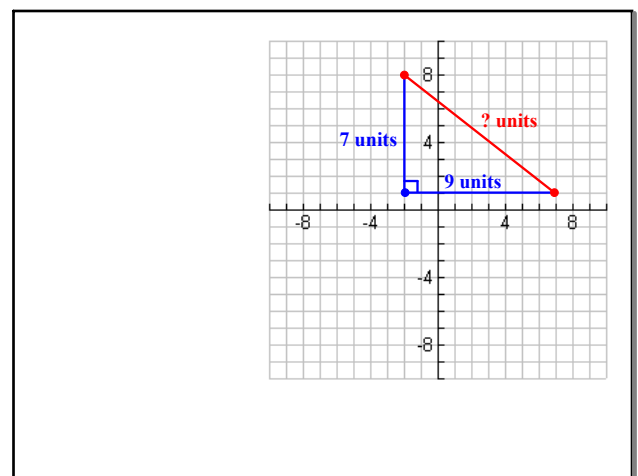
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### The Pythagorean Theorem

In A right triangle, if  $a$  and  $b$  are the lengths of the legs and  $c$  is the length of the hypotenuse, then the following equation is always true:

$$a^2 + b^2 = c^2$$

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### The Distance Formula

On the coordinate plane, the distance between any 2 pts. with coordinates  $(x_1, y_1)$  and  $(x_2, y_2)$  can be found by the following formula:

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

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### Definition: Midpoint

The midpoint of a segment is the point on the segment that divides the segment into two congruent segments.

The midpt. of  $\overline{AB}$  is the pt. X  
between A and B such that  $AX = XB$



Draw  $\overline{PQ}$  with midpoint M.

Jun 4-9:05 AM

### Midpoint Formulas

1. On a number line, the coordinate of the midpt. of a segment whose endpts. have coordinates  $a$  and  $b$  can be found by:

$$\frac{a + b}{2}$$

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

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2. On the coordinate plane, the coordinates of the midpt. of a segment whose endpts. are  $(x_1, y_1)$  and  $(x_2, y_2)$  are:

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

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

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You can also find the coordinates of an endpoint of a segment if you know the coordinates of its other endpoint and its midpoint.

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

Write separate equations for the x and the y coordinates:

$$x_m = \frac{x_1 + x_2}{2} \qquad y_m = \frac{y_1 + y_2}{2}$$

$$-6 = \frac{-5 + x_2}{2} \qquad 4 = \frac{-3 + y_2}{2}$$

$$-12 = -5 + x_2 \qquad 8 = -3 + y_2$$

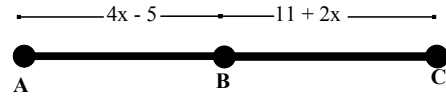
$$-7 = x_2 \qquad 11 = y_2$$

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

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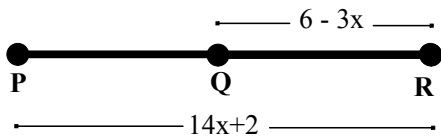
We can also use the fact that the midpoint creates two congruent segments to help us answer other questions:

Find AC, AB, and BC if B is the midpoint of  $\overline{AC}$ .



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What is PR if Q is the midpoint of  $\overline{PR}$ ?



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## Definition: Segment Bisector

**Any segment, line, or plane that intersects a segment at its midpoint.**

(Also see diagram at top of page 25 in the text.)



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