

Pythagorean Theorem and Midpoints

Name: _____

Pythagorean Theorem

Date:

Warm Up: Estimate the square roots below to 1 decimal place.

1. $\sqrt{21}$

2. $\sqrt{10}$

3. $\sqrt{111}$

4. $\sqrt{91}$

5. $\sqrt{68}$

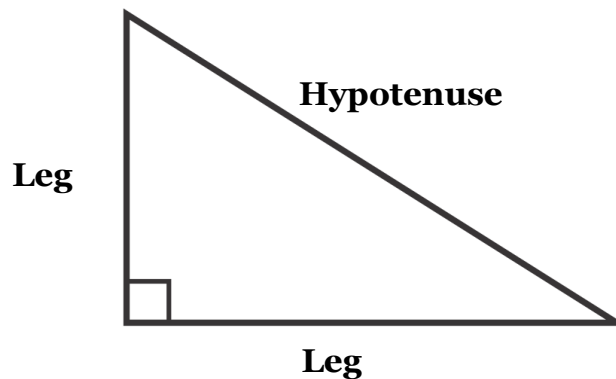
6. $\sqrt{140}$

In a **right triangle**:

The *hypotenuse* is THE LONGEST SIDE OF A TRIANGLE and

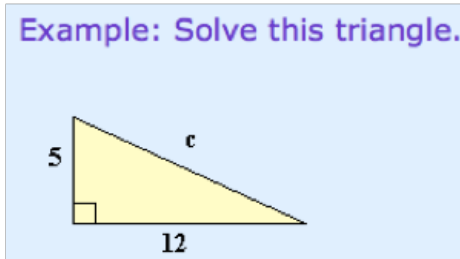
The *legs* are the remaining TWO sides of the Triangle.

Right Triangle

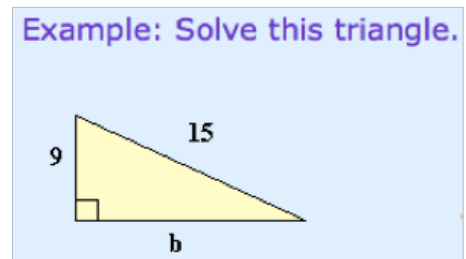


Word	Definition	Picture/Symbol/Example
Pythagorean Theorem	$a^2 + b^2 = c^2$ a = side of right triangle b = side of right triangle c = hypotenuse	

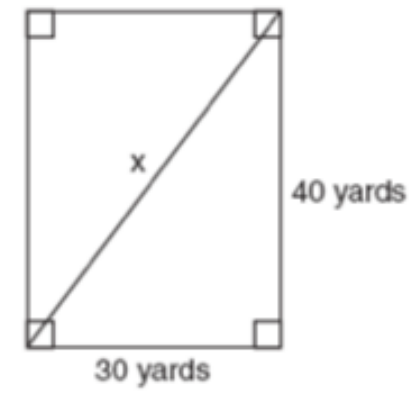
Example: Solve this triangle.



Example: Solve this triangle.

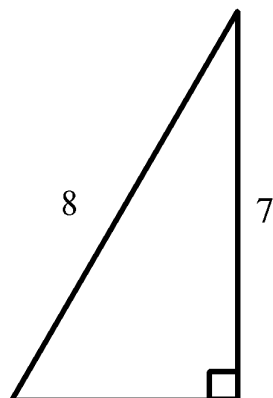


Example: Find the length of the diagonal of the rectangle.



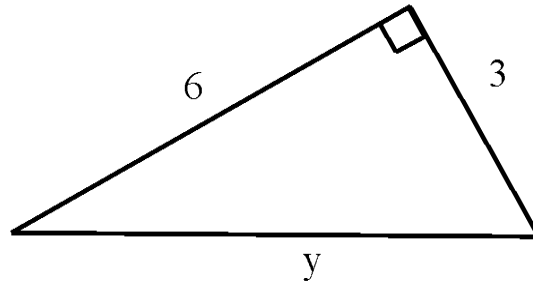
Which of the following is the closest to the length of the missing side of the triangle?

- A) 3.4
- B) 3.9
- C) 4.5
- D) 4.8



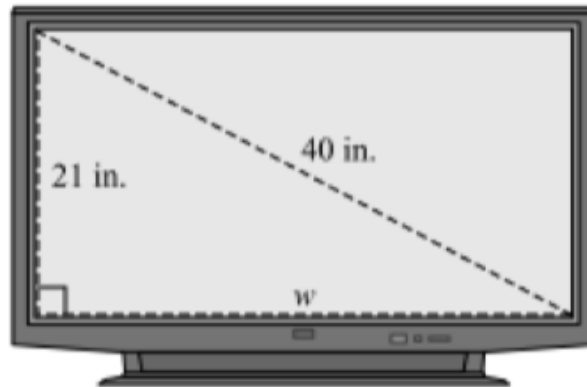
The length of side y falls between which two whole numbers?

- A) 6 and 7
- B) 7 and 8
- C) 8 and 9
- D) 9 and 10



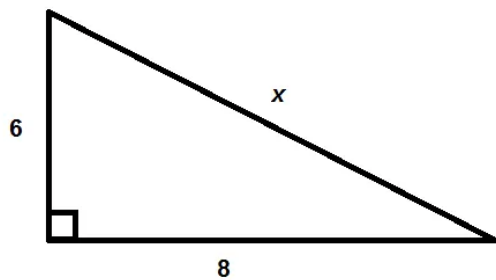
A rectangular television screen and some of its measurements are shown.
What is w , the width of the television screen, to the nearest inch?

- A) 19
- B) 34
- C) 45
- D) 61



On Your Own: Find the missing side length using the Pythagorean Theorem. Estimate your answer to one decimal point when needed.

1.



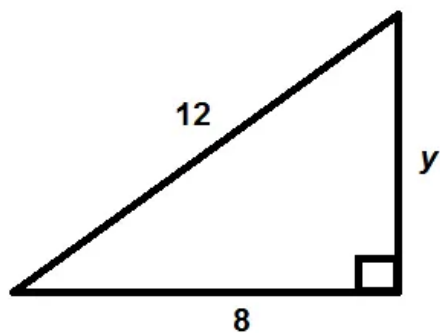
$$a^2 + b^2 = c^2$$

a = side of right triangle

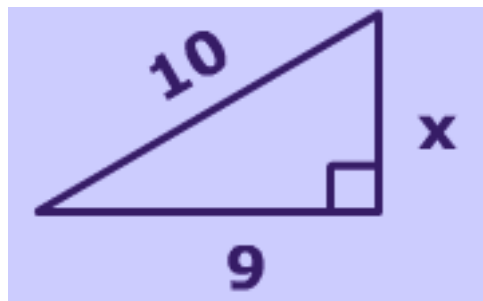
b = side of right triangle

c = hypotenuse

2.



3.

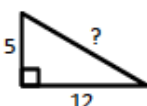


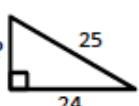
Homework Directions:

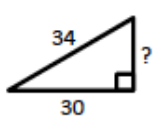
1. Solve for the missing side of each right triangle below.
2. Find that square with the answer in it (there may be more than one).
3. Color the square to match the picture shown to the right of the triangle.

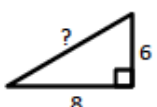
MATHS MOSAIC

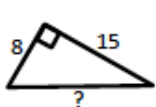
PYTHAGORAS' THEOREM

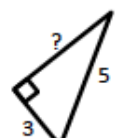
1.  

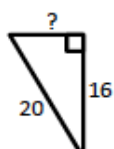
2.  

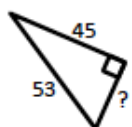
3.  

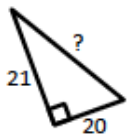
4.  

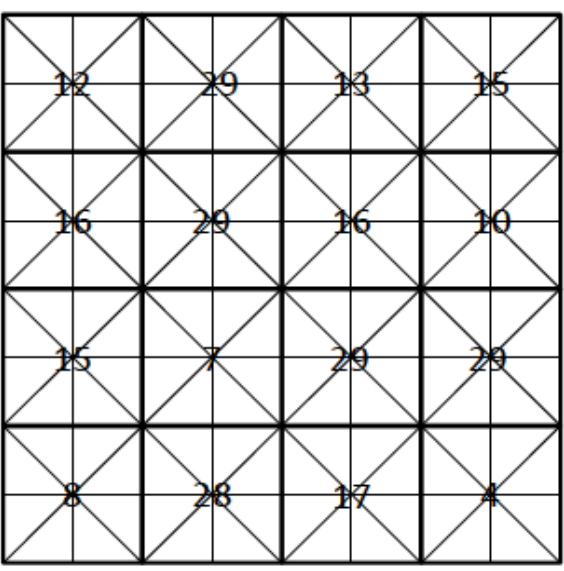
5.  

6.  

7.  

8.  

9.  



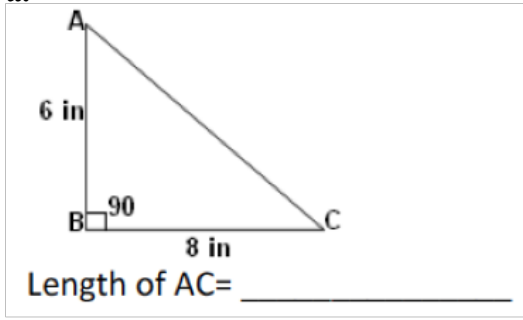
Distance & Pythagorean Theorem

Date:

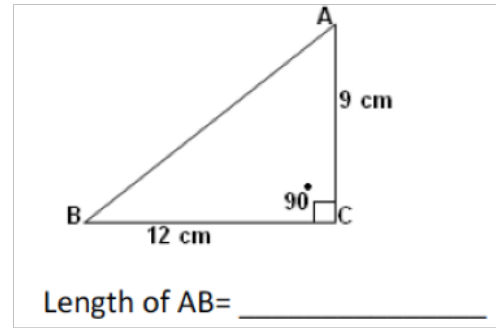
Warm-Up:

Find the length of the missing side of each right triangle. (No Calculator) Estimate your answer to one decimal.

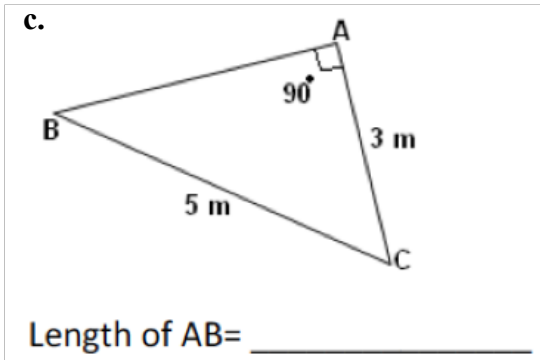
a.



b.



c.



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

a = side of right triangle

b = side of right triangle

c = hypotenuse

Using Pythagorean Theorem to Find Length

Example 1:

Plot the following points:

$A(2, 7)$ This one has been done for you!

$B(-4, 7)$

$C(-4, -1)$

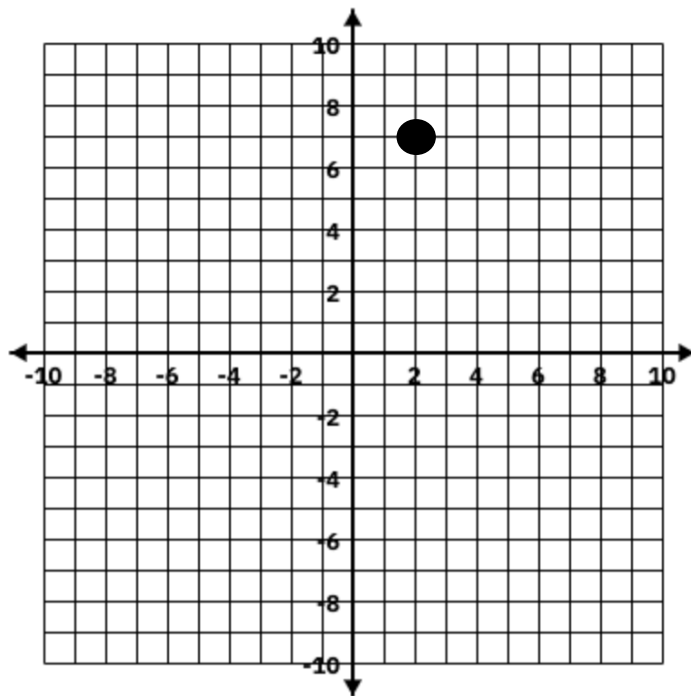
Try to find the lengths of the following line segments

$\overline{AB} =$

$\overline{BC} =$

$\overline{AC} =$

Plotting Points (X, Y)
1. Move (left or right) along the x-axis to plot the X-Value
2. Move (up or Down) along the y-axis to plot the Y-Value



Were you able to find the length of all of the different line segments?

What was the issue with the more difficult ones?

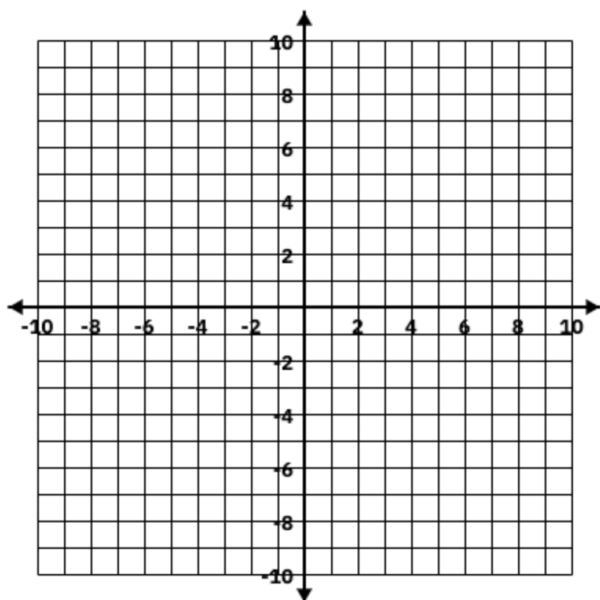
What do you think you could do to find the length of $\overline{AC}$?

Finding the Distance Between Two Points

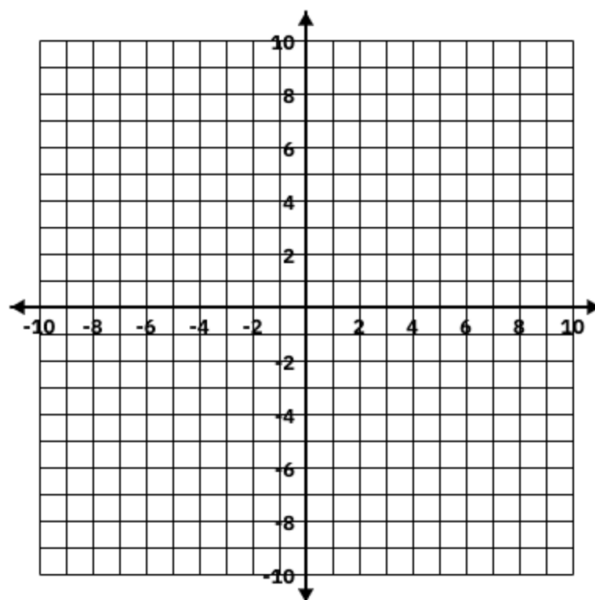
- Plot the 2 points and label them with the appropriate capital letter
- Draw the segment to connect the two points
- Create the right triangle (using your segment as the hypotenuse)
- Calculate the vertical and horizontal lengths for the legs of the right triangle by counting boxes
- Use the Pythagorean Theorem to find the length of the segment.
- Estimate your answer to one decimal place

Examples:

1. $A(-5, 7)$ and $B(1, -3)$



2. $C(-2, -8)$ and $D(3, 4)$



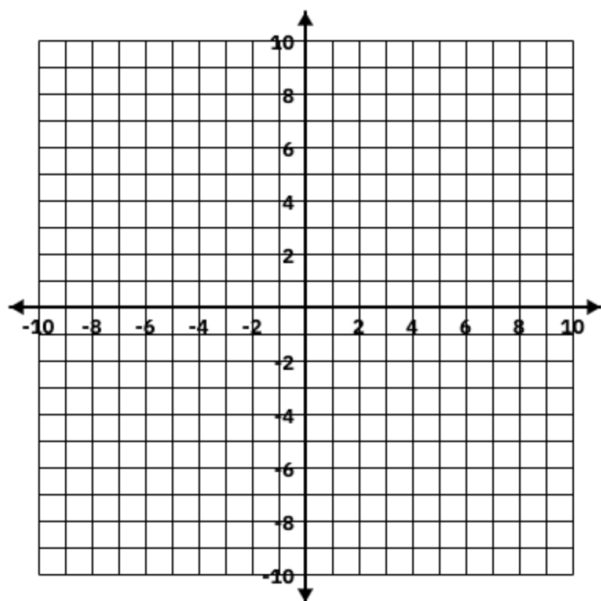
$$a^2 + b^2 = c^2$$

a = side of right triangle

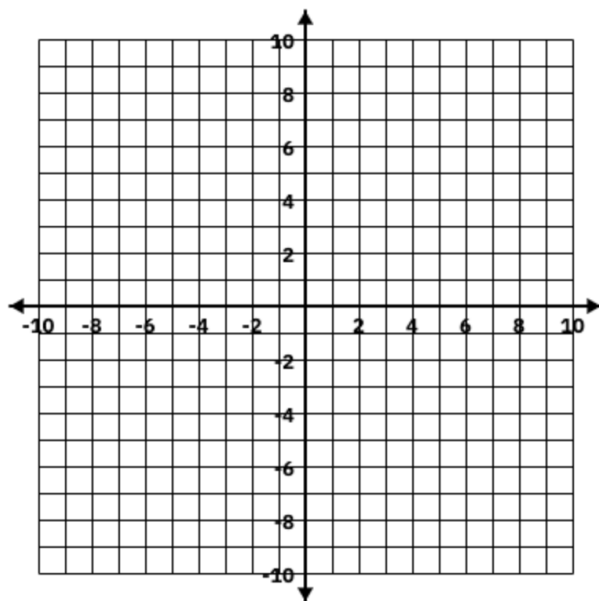
b = side of right triangle

c = hypotenuse

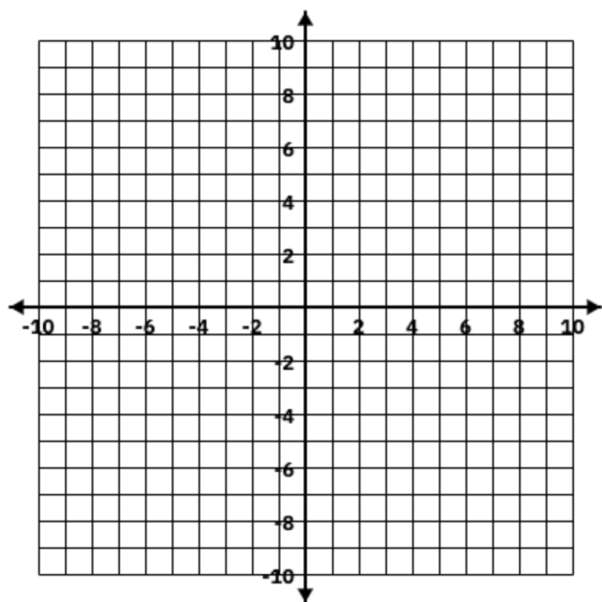
3. $E(2,6)$ and $F(1,3)$



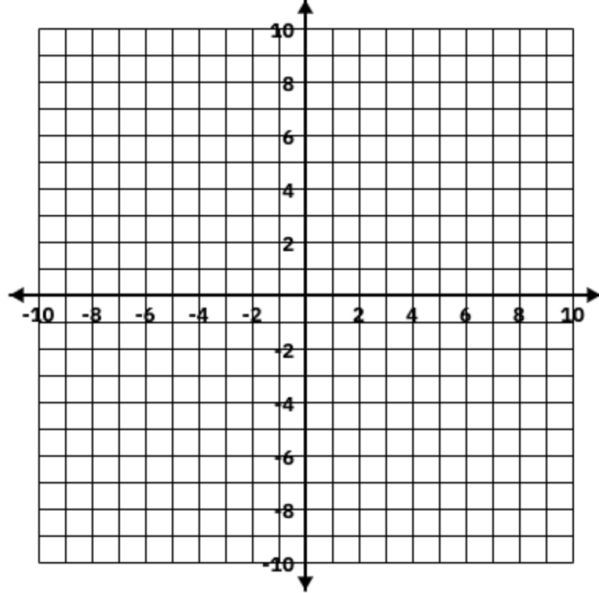
4. $X(5,3)$ and $Y(-3,-3)$



5. $A(-2,2)$ and $B(2,-2)$

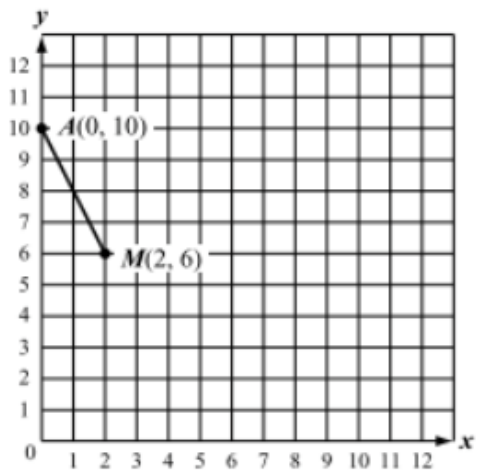


6. $C(2,4)$ and $D(3,1)$

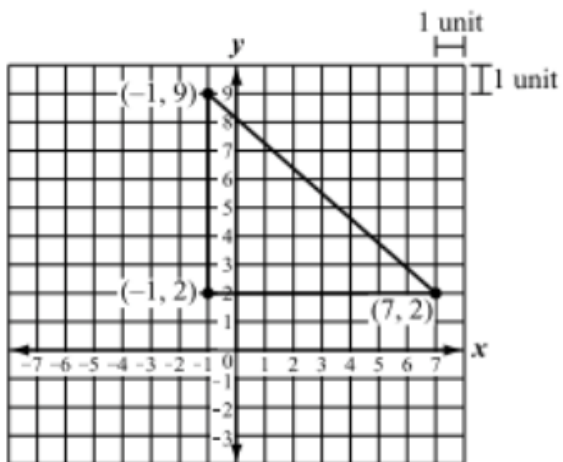


ON YOUR OWN – MCAS Practice (No Calculator)

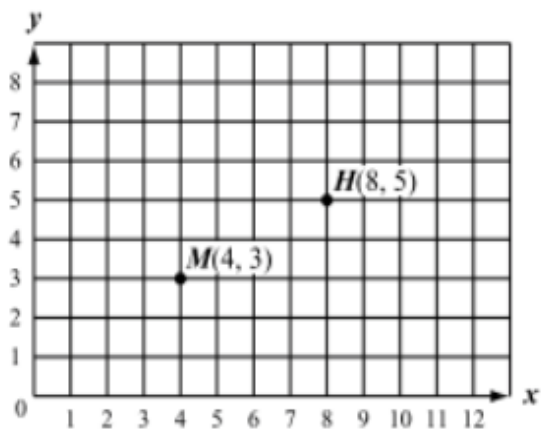
1. Find the distance between points A and M.



2. Find the length of the three sides of the triangle.



3. Find the distance between points M and H.

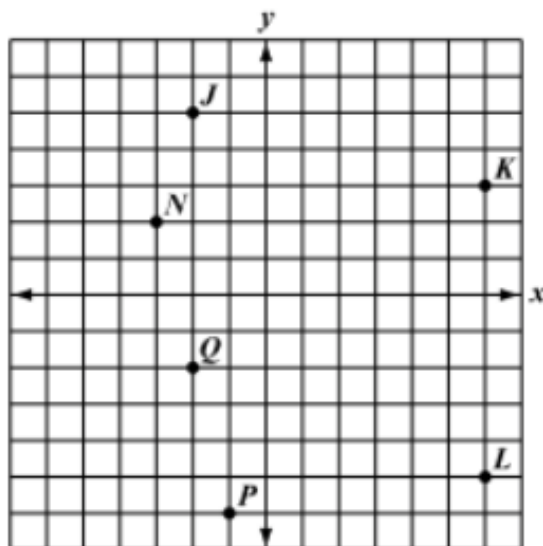


4. The grid to the right is a unit grid (each square is 1 x 1). Find the following lengths.

a. JK

b. QP

c. KL



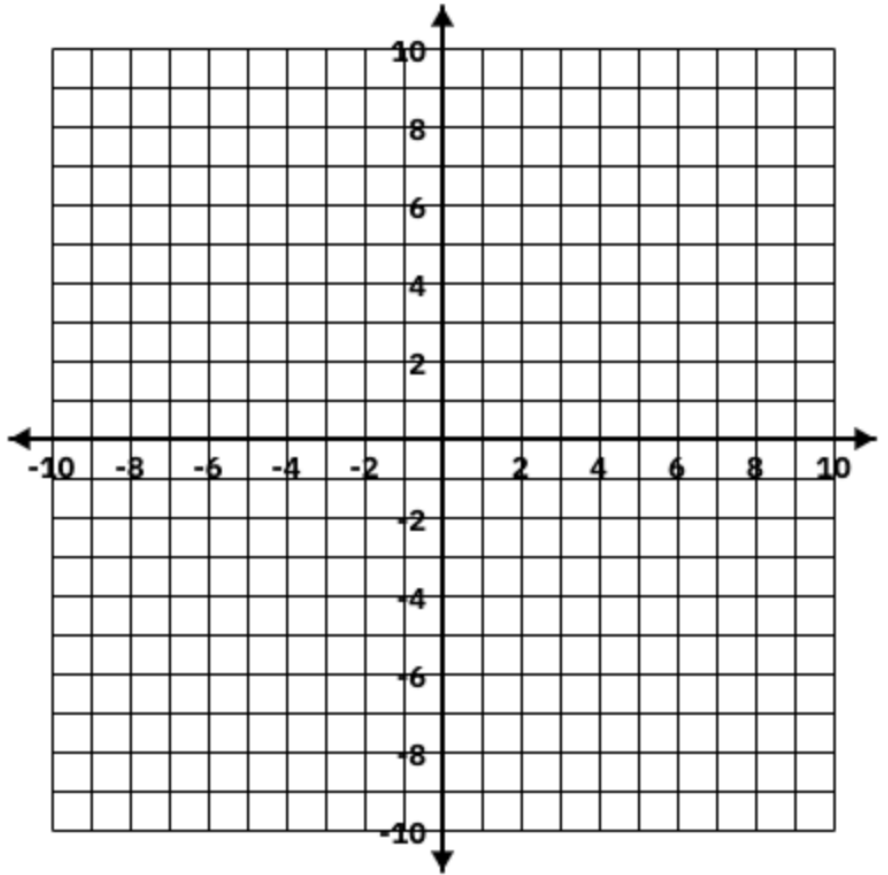
Pythagorean Theorem Word Problems

Date:

Warm Up: Use the Pythagorean Theorem to determine the distance between the two points

$A(3,9)$ and $B(8,6)$

$E(-5,-3)$ and $F(1,-8)$



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

a = side of right triangle

b = side of right triangle

c = hypotenuse

Pythagorean Theorem Word Problems

- Each group has 2 word problems
- **Work together** to draw a picture of what the situation looks like
- Determine what sides are the hypotenuse and legs
- Determine what you are looking for
- Use the Pythagorean Theorem to solve for the missing side in your word problems
 - o Estimate your answers to 1 decimal place when necessary
- Create a poster for your word problems. Your poster should include:
 - o The names of everyone in your group
 - o A diagram of your word problems (make it look nice!)
 - o Labels or a key with what are the legs and hypotenuse
 - o Your math you did to find your answer
 - o Your final answer circled or emphasized in some other way
- Present your poster to the class. Your presentation should include:
 - o Your word problems read out loud
 - o Your picture explained
 - o Your math explained
 - o Your final answer
 - o (It is okay if one person does most of the talking as long as everyone in the group is okay with that)
- During other group presentations you are:
 - o Not on your phone
 - o Not talking
 - o Taking notes

Rubric:

Hypotenuse and Legs accurately determined	2 points	
Missing side determined accurately (what are you looking for)	2 points	
Missing sides found accurately (what is your final answer)	5 points	
Poster: - Names - Diagrams - Labels/Key - Math included - Final Answer Circled	.5 points 2 points 1 point 2 points .5 points	
Presentation: - Problems read aloud - Picture Explained - Math Explained - Final Answer	1 point 1 point 2 points 1 point	
Total	15 Points	

Group 1:

Emir is about to ride a straight water slide. The launching platform is at the top of a tower that is 12 meters tall. The splash pool at the end of the slide is 16 meters from the base of the tower. How long is the water slide itself?

A wire extends from the top of a 14-foot telephone pole to a stake in the ground 6 feet away. How long is the wire?

Group 2:

Hanson's bedroom is rectangular. The length of one wall of Hanson's bedroom is 3 meters. The length from one corner of the bedroom to the diagonally opposite corner is 5 meters. What is the length of the other wall?

Two cars leave the same parking lot, with one heading north and the other heading east. After several minutes, the eastbound car has traveled 13 kilometers. If the two cars are now a straight-line distance of 16 kilometers apart, how far has the northbound car traveled?

Group 3:

Leah is building a wheelchair ramp onto her porch. If the ramp begins 63 centimeters from the porch and is 87 centimeters long, how tall is the porch?

From her house, Lara could drive due north to get to her parents' house or she could drive due east to get to her grandparents' house. It is 7 miles from Lara's house to her parents' house and a straight-line distance of 9 miles from her parents' house to her grandparents' house. How far is Lara from her grandparents' house?

Group 4:

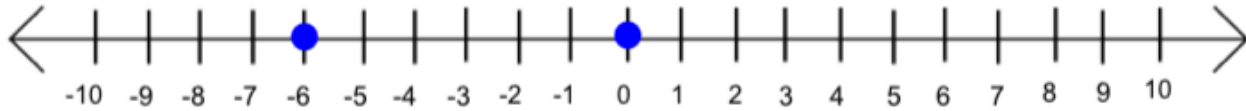
A bird was sitting 33 feet from the base of an oak tree and flew 55 feet to reach the top of the tree. How tall is the tree?

Three ballet dancers are positioned on stage. Leroy is straight behind Kaylee and directly left of Julia. If Kaylee and Leroy are 5 feet apart, and Julia and Kaylee are 9 feet apart, what is the distance between Leroy and Julia?

Midpoint Formula

Date:

Example 1: Find the midpoint between each set of points.



The Midpoint

Definition: **middle point of a line segment. It is equidistant from both endpoints**

Equation to find Midpoint:
$$(x_m, y_m) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

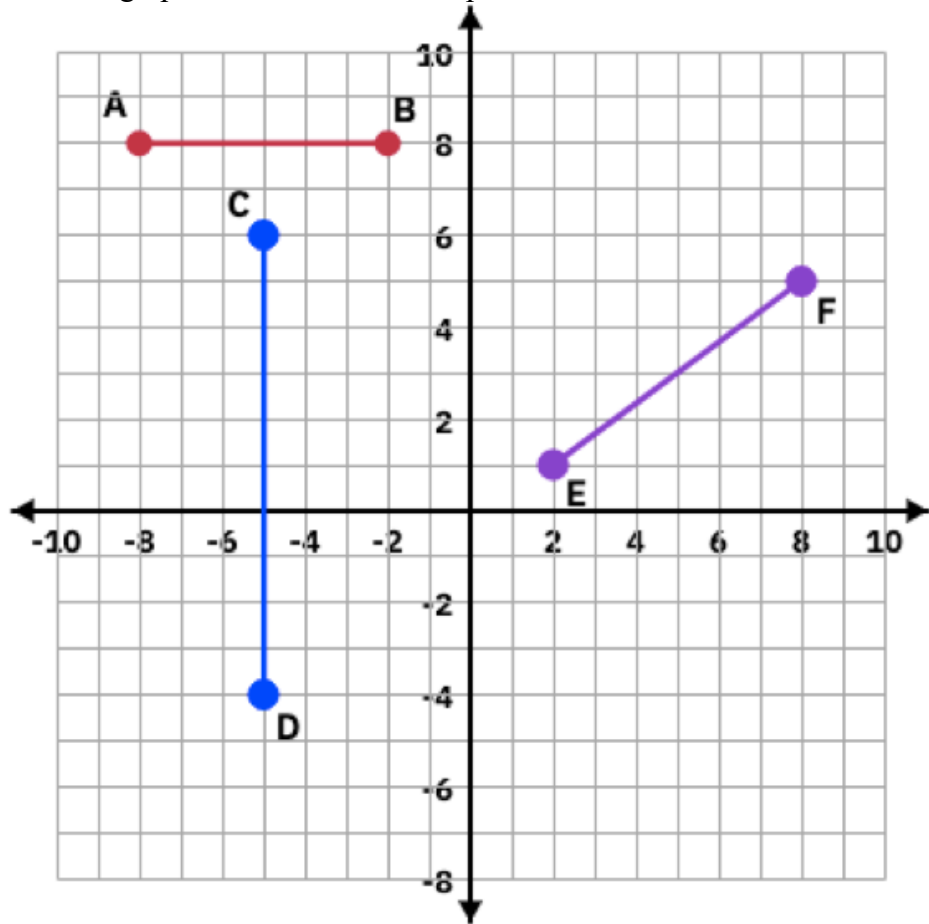
(x_m, y_m) = coordinates of the midpoint

(x_1, y_1) = coordinates of the first point

(x_2, y_2) = coordinates of the second point

Example 1:

Use the graph to determine the midpoints of $\overline{AB}$, $\overline{CD}$, and $\overline{EF}$.



A: (-8, 8)

B: (-2, 8)

C: (-5, 6)

D: (-5, -4)

E: (2, 1)

F: (8, 5)

How to find the midpoint when you don't have a graph

Midpoint Formula	“Jumping Method”
$A(4, 10)$ and $B(-2, 5)$	$C(1, 12)$ and $D(-4, 6)$

On Your Own:

Find the midpoint of the following line segments with the given end points. Do not graph the points.

1. $(2,5)$ and $(8,7)$

2. $(4,-6)$ and $(6,8)$

3. $(9,-4)$ and $(-5,-4)$

4. $(-3,0)$ and $(7,0)$

5. $(-1,3)$ and $(-1,-11)$

6. $(0,0)$ and $(11,9)$

7. $(10,14)$ and $(6,-6)$

8. $(-3,-5)$ and $(3,5)$

Pythagorean Theorem Mixed Practice

Date:

Warm Up: Determine the midpoint of the sets of points below.

a. $(-3, 5)$ and $(-7, 11)$

c. $(3, 4)$ and $(6, 5)$

b. $(4, 6)$ and $(-8, 2)$

d. $(4, 7)$ and $(-4, -7)$

Mixed Practice: Midpoint & Distance

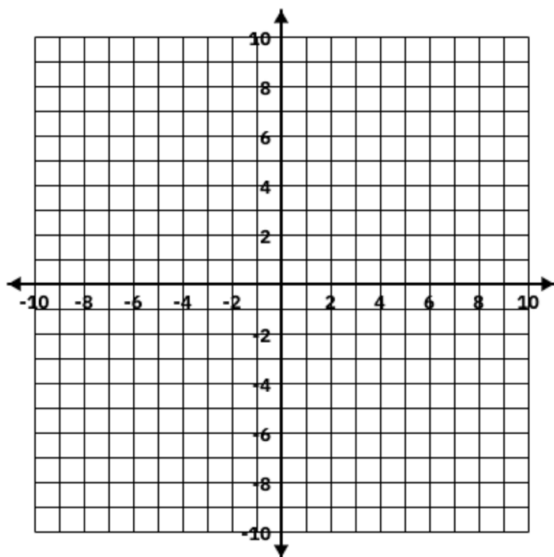
For each of the following:

- Plot each pair of points
- Draw a right triangle and use the Pythagorean theorem to determine the distance between the two points. You may leave your answer as a square root if necessary.
- Determine the midpoint of the segment.

9. $A(1, 3)$ and $B(4, 7)$

Length of $\overline{AB}$ = _____

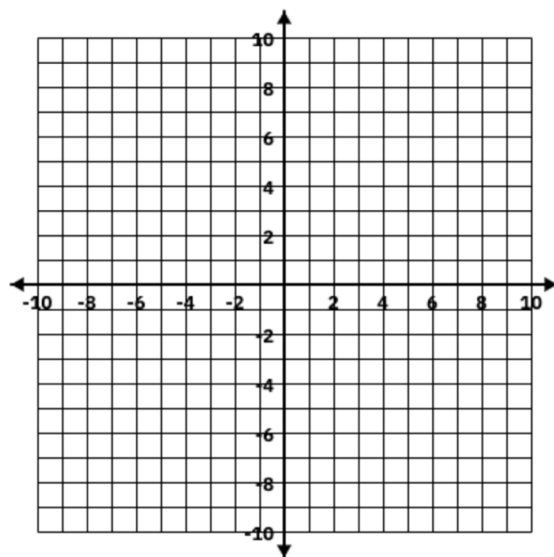
Midpoint of $\overline{AB}$ = _____



10. $A(2, 8)$ and $B(7, 7)$

Length of $\overline{AB}$ = _____

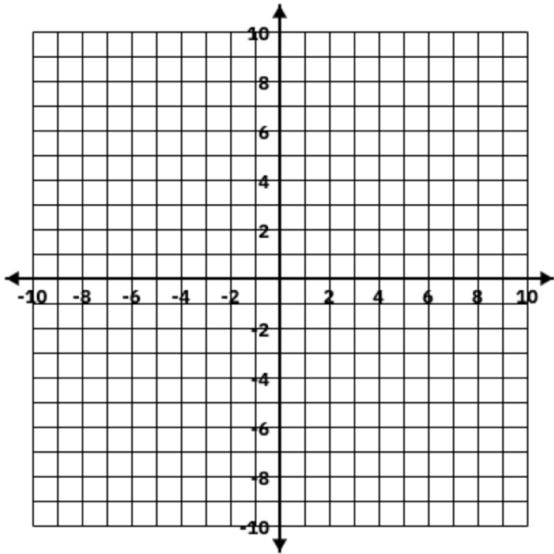
Midpoint of $\overline{AB}$ = _____



11. $A(-1,6)$ and $B(-3,0)$

Length of $\overline{AB}$ = _____

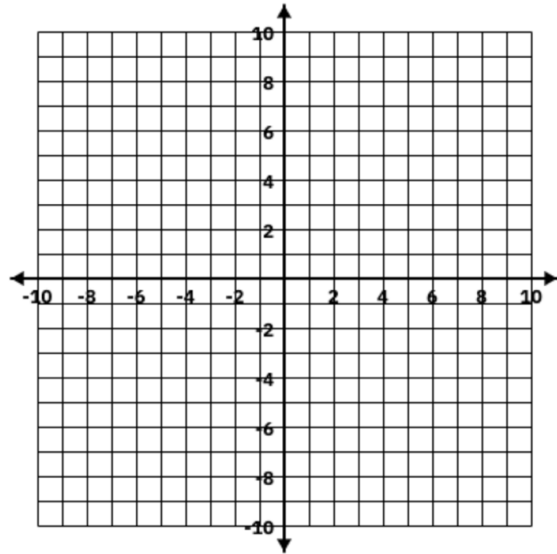
Midpoint of $\overline{AB}$ = _____



12. $A(-3,7)$ and $B(2,-5)$

Length of $\overline{AB}$ = _____

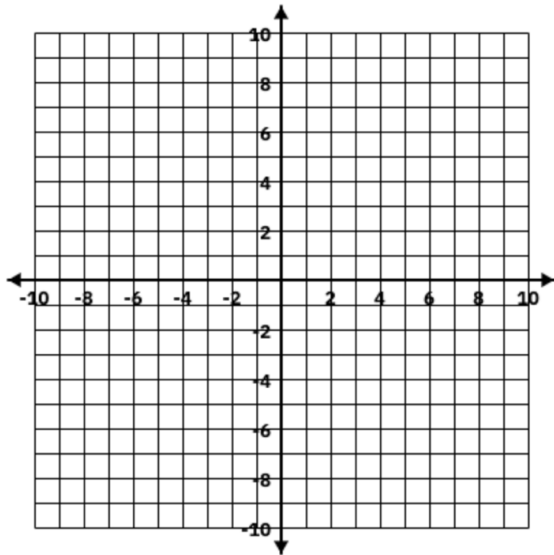
Midpoint of $\overline{AB}$ = _____



13. $A(0,4)$ and $B(8,-2)$

Length of $\overline{AB}$ = _____

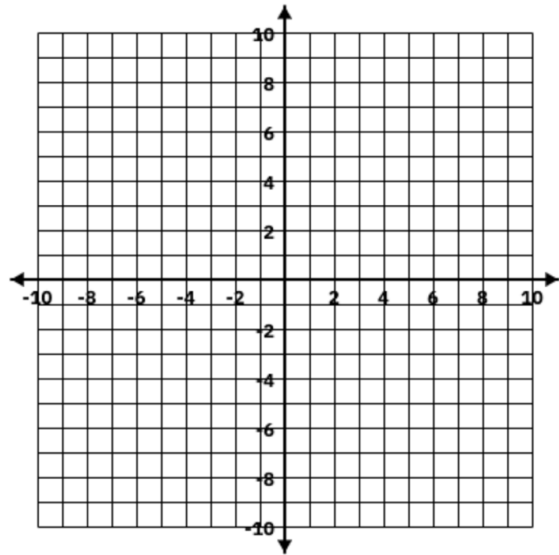
Midpoint of $\overline{AB}$ = _____



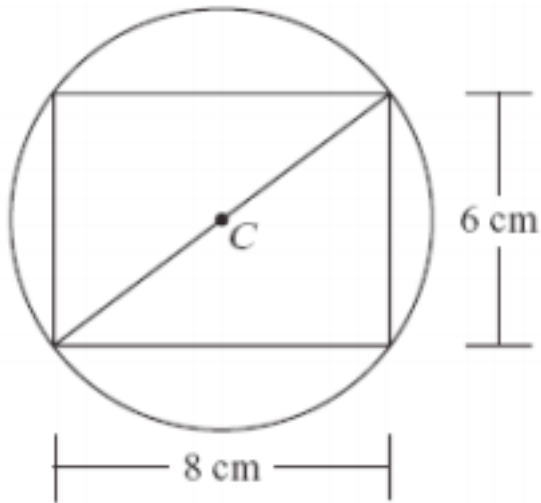
14. $A(0,-6)$ and $B(5,6)$

Length of $\overline{AB}$ = _____

Midpoint of $\overline{AB}$ = _____

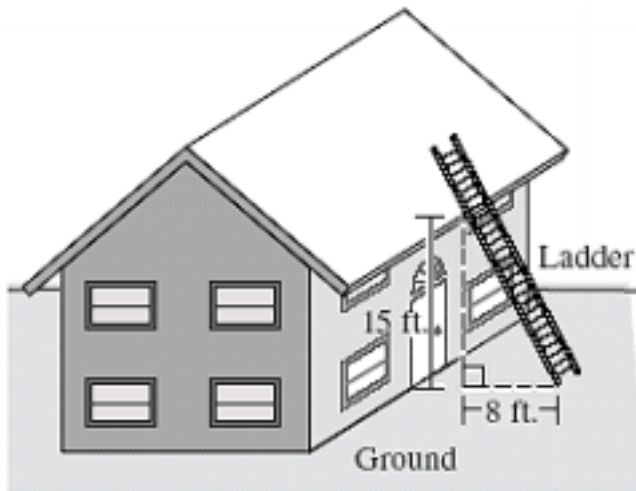


15. For an art project, Calvin drew a rectangle inscribed in circle C , as shown below. The rectangle is 8 centimeters long and 6 centimeters wide.

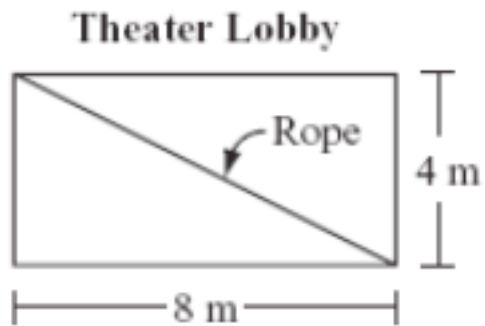


What is the diameter, in centimeters, of circle C ?

16. Using the measures shown in the sketch, what is the length of the section of the ladder from the point where it rests on the ground to the point where it touches the house?



17. The floor of the lobby of a theater is shaped like a rectangle, as shown below.



Before a performance starts, the velvet rope is stretched diagonally across the lobby. Which of the following best describes the diagonal length of the lobby?

- A) Between 8 and 9 meters
- B) Between 9 and 10 meters
- C) Between 10 and 11 meters
- D) Between 11 and 12 meters

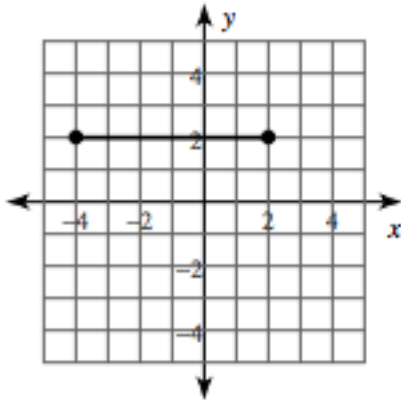
Finding Endpoints

Date: _____

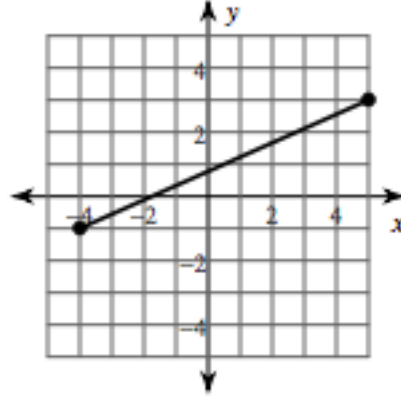
Warm-Up:

1. Find the midpoint between each of the given points

a. Midpoint = _____



b. Midpoint = _____



c. Midpoint = _____

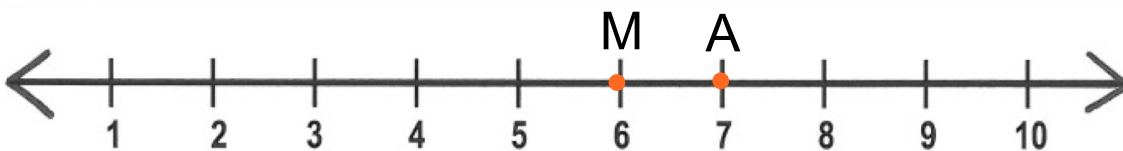
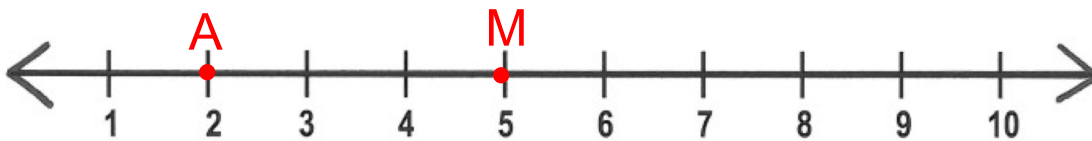
$(-1, -6), (-6, 5)$

d. Midpoint = _____

$(-4, 4), (5, -1)$

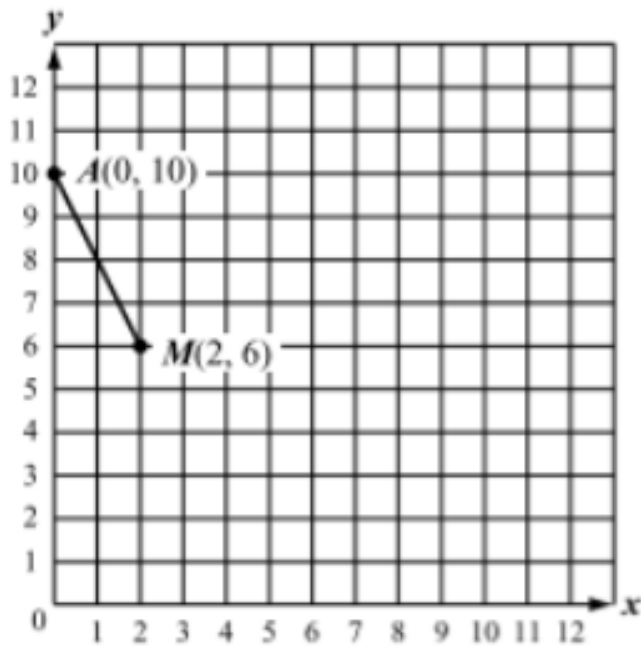
Finding an Endpoint on a Number Line

Example 1: On each of the following number lines, A is an endpoint of a segment and M is the midpoint of the segment. Find B , the other endpoint of segment AB .

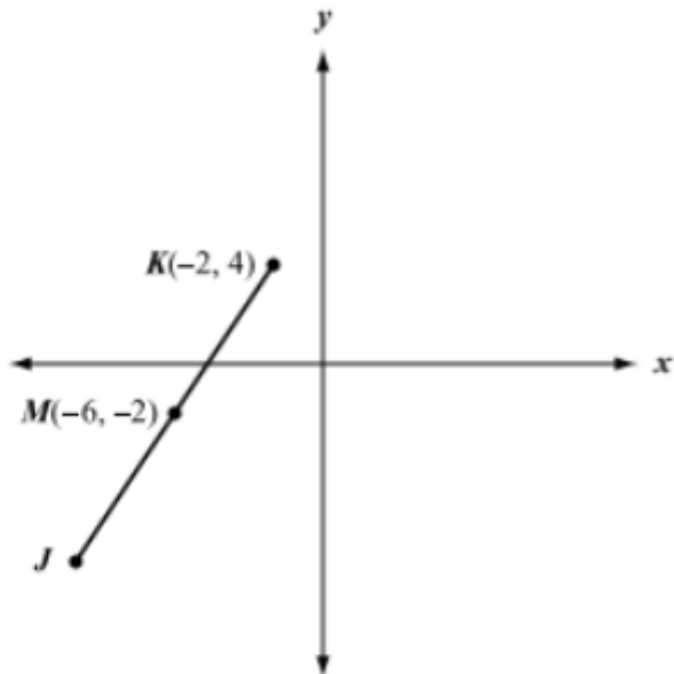


Finding an Endpoint on a Coordinate Grid

Example 2: Points A and M are shown on the coordinate grid below. Point M is the midpoint of segment AB . Find point B .



Example 3: In the diagram below, point M is the midpoint of $\overline{JK}$. What are the coordinates of point J ?



Finding an Endpoint without Graphing

Midpoint Formula	“Jumping Method”
Example 5: A segment has endpoint $A(-5, 3)$ and midpoint $M(-4, 8)$ end point B ; the other endpoint of the segment.	Example 6: A segment has endpoint $S(0, -6)$ and midpoint $M(-5, -4)$ end point T ; the other endpoint of the segment.

On Your Own:

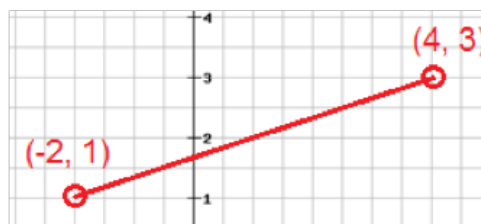
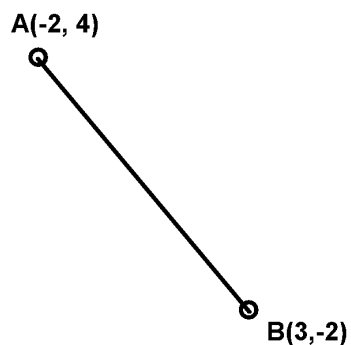
Find the length and midpoint of each of the following segments.

Length of Segment: _____

Length of Segment: _____

Midpoint of Segment: _____

Midpoint of Segment: _____



Find the missing endpoint of the following line segments.

2. Endpoint: $(2,5)$ Midpoint: $(3,4)$

3. Endpoint: $(2,5)$ Midpoint: $(-3,-4)$

Missing Endpoint: _____

Missing Endpoint: _____

4. Endpoint: $(-4,8)$ Midpoint: $(0,8)$

5. Endpoint: $(-1,-1)$ Midpoint: $(-1,4)$

Missing Endpoint: _____

Missing Endpoint: _____

6. Endpoint: $(3,10)$ Midpoint: $(-2,-3)$

7. Endpoint: $(0,4)$ Midpoint: $(5,3.5)$

Missing Endpoint: _____

Missing Endpoint: _____

8. Endpoint: $(6,-2)$ Midpoint: $(4.5,-2.5)$

9. Endpoint: $(4,4)$ Midpoint: $(0,0)$

Missing Endpoint: _____

Missing Endpoint: _____

