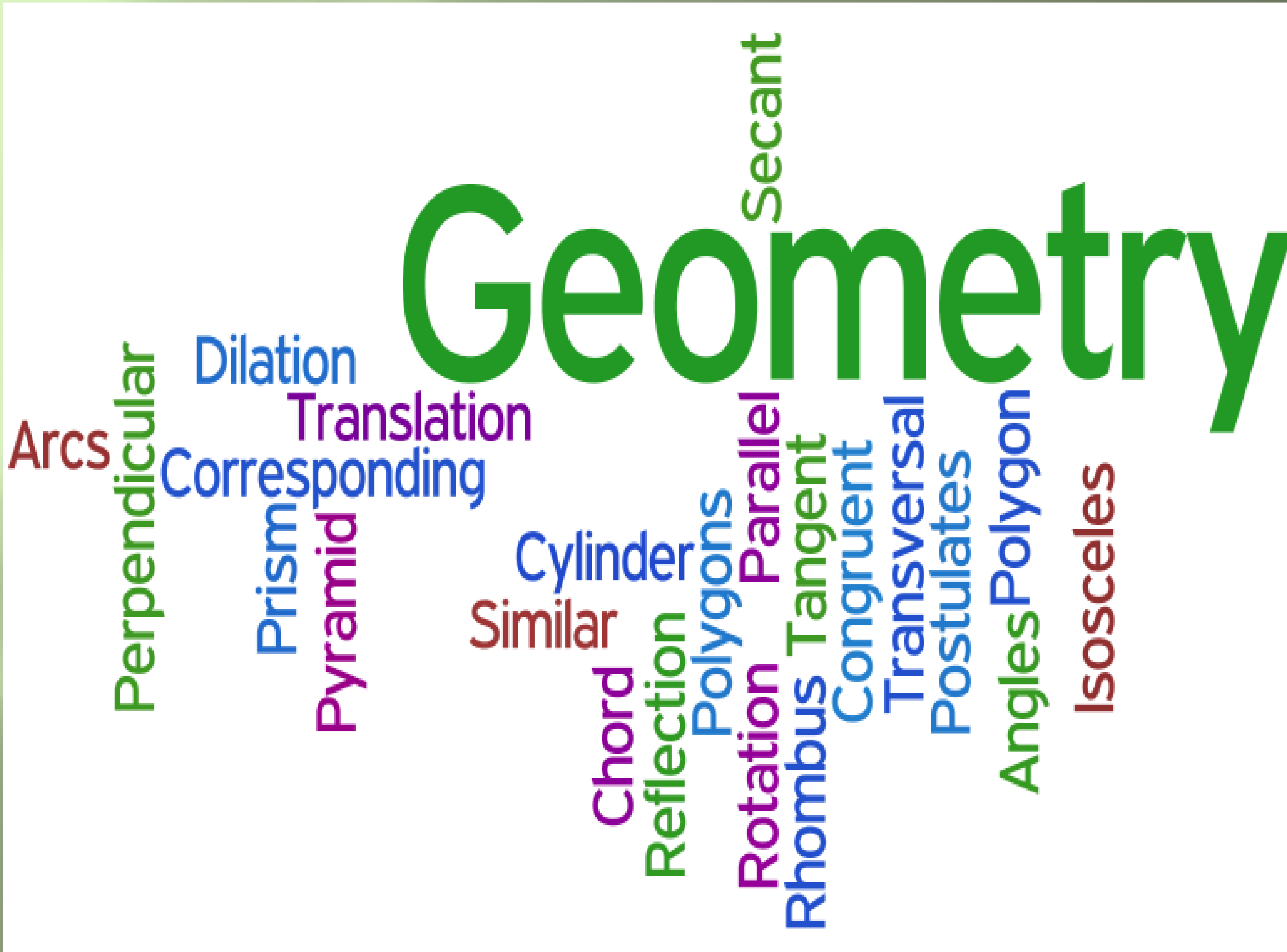
Geometry
Secant
Dilation
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Rotation
Tangent
Rhombus
Congruent
Transversal
Postulates
Polygon
Angles
Isosceles

Math Skills Review

www.unioncatholic.org/downloads/pdf/2014-2015/algebraprep.pdf

Evaluate each expression.

1) $2 - 6 \div 6$

2) $6 - (4 - 2)$

3) $1 - (-8) - \dfrac{12}{-3}$

4) $9 - \dfrac{24}{-8} - (-5)$

Evaluate each using the values given.

5) $-5x^2 - (x + y)$; use $x = -2$, and $y = 5$

6) $|-5|\left(\dfrac{n}{3} - p\right)$; use $n = -9$, and $p = 2$

Solve each proportion.

7) $\dfrac{v - 3}{v + 5} = -\dfrac{12}{7}$

8) $\dfrac{11}{b - 1} = \dfrac{6}{b + 1}$

Order of Operations

www.mathsisfun.com/operation-order-pemdas.html

Algebra Index

Order of Operations

Order of Operations Calculator

- Do things in Parentheses First. Example:

✓ $6 \times (5 + 3) = 6 \times 8 = 48$

✗ $6 \times (5 + 3) = 30 + 3 = 33$ (wrong)

- Exponents (Powers, Roots) before Multiply, Divide, Add or Subtract. Example:

✓ $5 \times 2^2 = 5 \times 4 = 20$

✗ $5 \times 2^2 = 10^2 = 100$ (wrong)

- Multiply or Divide before you Add or Subtract. Example:

✓ $2 + 5 \times 3 = 2 + 15 = 17$

✗ $2 + 5 \times 3 = 7 \times 3 = 21$ (wrong)

- Otherwise just go left to right. Example:

✓ $30 \div 5 \times 3 = 6 \times 3 = 18$

✗ $30 \div 5 \times 3 = 30 \div 15 = 2$ (wrong)

How Do I Remember It All ... ? PEMDAS !

P	**P**arentheses first
E	**E**xponents (ie Powers and Square Roots, etc.)
MD	**M**ultiplication and **D**ivision (left-to-right)
AS	**A**ddition and **S**ubtraction (left-to-right)

Divide and Multiply rank equally (and go left to right).

Add and Subtract rank equally (and go left to right).

Math Skills Review

Find each percent change. State if it is an increase or a decrease.

9) From 12 to 15

10) From 16.6 to 13

11) From 99 to 35

12) From 17 to 74

13) From 305 to 395

14) From 309 to 292

Math Skills Review

Solve each problem.

15) What is 42% of 66?

16) What is 98% of 1.8?

17) 98% of 74 is what?

18) 41% of what is 35?

19) 330 is 300% of what?

20) 13% of what is 260?

Solve each equation.

21) $6x - 5x = 0$

22) $17 = n + 2 + 4n$

23) $-2(2m + 7) = -28 - 6m$

24) $25 + r = -5(2 + 8r) + 6r$

Math Skills Review

25) $-6n - 12(-11n + 8) = -10(n - 4)$

26) $-28x + 6 = -3(1 + 7x) - 7x$

27) $|-6n| = 6$

28) $|5x| = 30$

29) $|-7 - 8k| = 73$

30) $|10a - 8| = 78$

31) $-6|3 - 9x| = -18$

32) $|9x - 9| + 4 = 76$

Math Skills Review

Simplify each expression.

53) $(7n^4 - 14 - 5n^3) - (7 - 8n^3 + 11n^4)$

54) $(12x + 10x^3 - 7) + (6x^3 + 14 + 4x)$

55) $(13xy - 6y^2) + (14x^4 - 3y^2 + x^2y^2) - (-9y^2 - 4xy)$

56) $(9 - 4a^3b^3) - (-6a^3b^3 - 14 - a) - (-6a^3b^3 + 2a)$

Find each product.

57) $(2x + 4)(2x - 2)$

58) $(4n + 5)(n + 4)$

59) $(-5p + 8)(7p - 5)$

60) $(-k + 3)(8k - 8)$

Math Skills Review

Solve each equation with the quadratic formula.

87) $n^2 - 2n - 3 = 0$

88) $x^2 - 3x - 18 = 0$

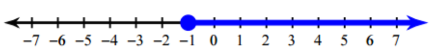
89) $4r^2 = 24 - 10r$

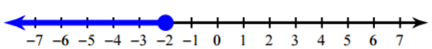
90) $4m^2 = 2 - 4m$

91) $-2n^2 + 2n + 53 = -7$

92) $-10x^2 - 12x + 45 = -9x^2 + 1 - 5x$

Write an inequality for each graph.

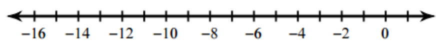
93)


94)


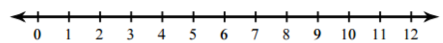
Math Skills Review

Solve each compound inequality and graph its solution.

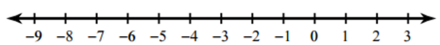
97) $2a - 12 > -20$ or $5 - 2a \geq 29$



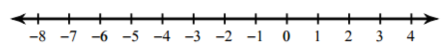
98) $11 \leq 4 + 7n \leq 67$



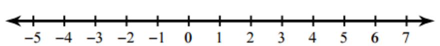
99) $5x \geq -10$ or $3x \leq -18$



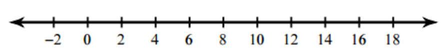
100) $-1 < 3 + r \leq 4$



101) $-14 - 15v \leq 18 - 19v < -19v - 1$



102) $-17x - 3 \leq 13 - x$ and $8 - 2x > -8 - x$



Math Skills Review

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www.unioncatholic.org/downloads/pdf/2014-2015/algebraprep.pdf

Apps | Getting Started | Imported From Firef...

Simplify.

109) $\sqrt{8}$

110) $\sqrt{27}$

111) $3\sqrt{486v^3}$

112) $-5\sqrt{256x}$

113) $-5\sqrt{2}+5\sqrt{2}$

114) $-2\sqrt{5}+5\sqrt{5}$

115) $-2\sqrt{3}-2\sqrt{12}-\sqrt{54}$

116) $-3\sqrt{12}-3\sqrt{45}-2\sqrt{5}$

117) $4\sqrt{112}-2\sqrt{128}-2\sqrt{7}-2\sqrt{32}$

118) $2\sqrt{80}+2\sqrt{8}-\sqrt{20}+4\sqrt{5}$

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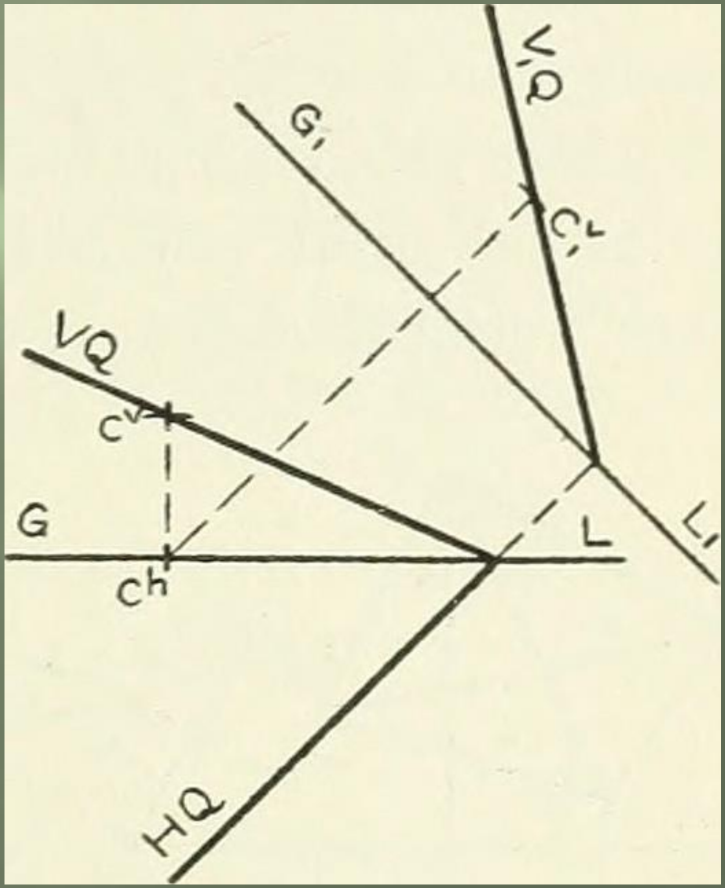
Geometry Unit 1

Tools of Geometry



Warm-Up

1. $X + 9 = 24$

2. $25 - X = 15$

3. $X + 3 = -2X - 10$

4. $3X + 4Y = 2$ Place in slope intercept form.

5. $Y = \frac{1}{2} X - 2$ What is the slope? What is the Y- Intercept?

Patterns and Inductive Reasoning

Inductive Reasoning is reasoning that is based on patterns you observe. You can use inductive reasoning to tell what the next terms in the sequence will be.

Finding and Using a Pattern:

a. 3,6,12,24,…..

3 6 12 24

X2 X2 X2

Each term is twice the preceding Term. The next two terms are: 2 X 24 = 48 and 2 X 48 = 96.

Using Inductive Reasoning

A conclusion you reach using inductive reasoning is call a ***Conjecture***.

For example:
Make a conjecture about the sum of the first 30 odd numbers.

Find the first few sums. Notice that each sum is a perfect square.

$1 = 1 = 1^2$
$1 + 3 = 4 = 2^2$
$1 + 3 + 5 = 9 = 3^2$
$1 + 3 + 5 + 7 = 16 = 4^2$

The perfect squares form a pattern.

Using inductive reasoning , you can conclude that the sum of the first 30 odd number
Is 30^2, or 900.

Now you try:

Make a conjecture about the sum of the first 35 odd numbers. Use your calculator to verify your conjecture.

The sum of the first 35 odd numbers is 35^2, or 1225.

A ***Counterexample*** to a conjecture is an example for which the Conjecture is incorrect.

Testing a Conjecture

Turn to pg. 5 in textbook and lets look
At Example 3.

Practice

Pg. 6-8
#1-41 odd (HONORS ALL)

Warm UP

1. Find a pattern for the sequence. Use the pattern to show the next two terms.

   a. 1,3,7,13,21,…

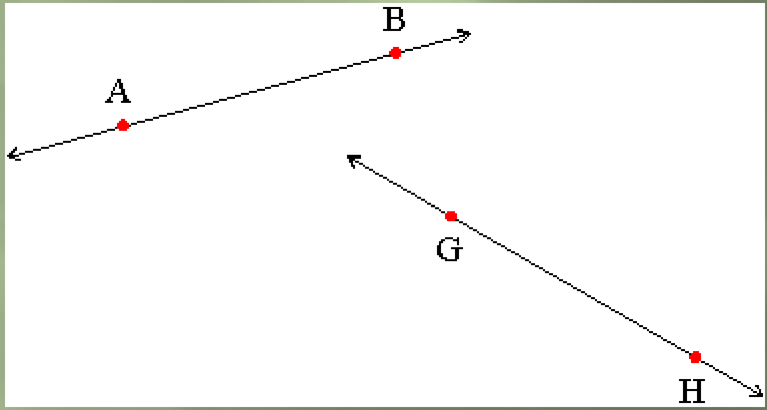
   b. 0, 1/2, ¾, 7/8, 15/16, …

2. Evaluate the expression a = 4 and b = -2

   a. $\frac{a+b}{2}$ b. $\frac{a-7}{3-b}$ c. $\sqrt{(7-a)^2+(2-b)^2}$

Points, Lines, and Planes

A POINT is a location. A point has no size. It is represented by a small dot and is named by a capital letter. A geometric figure is a set of points. SPACE is defined as the set of all points.



You can think of a LINE as a series of points that extends in two opposite directions without end. You can name a line by any two points on the line, such as $\overleftrightarrow{AB}$ *(read "line AB". Points that lie on the same line are COLLINEAR POINTS.*

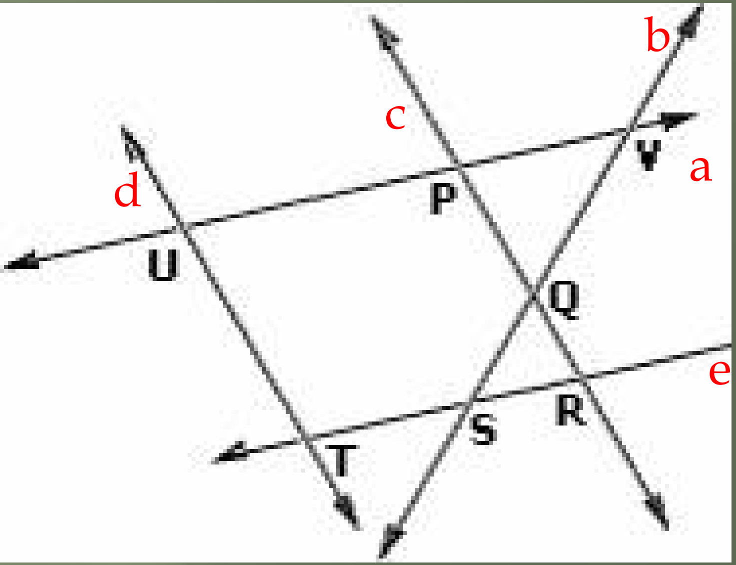
Identifying Collinear Points

a. Are points V, Q, S collinear?
   If so, name the line on which they lie.

Points V, Q, S are collinear. They lie on line *b*.

b. Are points S, R, Q collinear?
   If so, name the line on which they lie.

Points S, R, Q are not collinear.

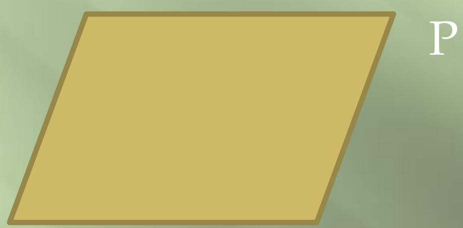


Now you try:

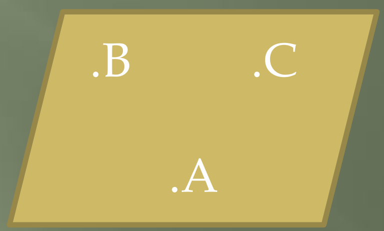
1. Are points U, P, V collinear? If so, name the line on which they lie.

2. Name line *e* in three other ways.

A PLANE is a flat surface that has no thickness. A plane contains many lines and
without end in the directions of all its lines. You can name a plane by either a singl
capital letter or by at least three of its noncollinear points. Points and lines in the sa
plane are COPLANER



Plane P

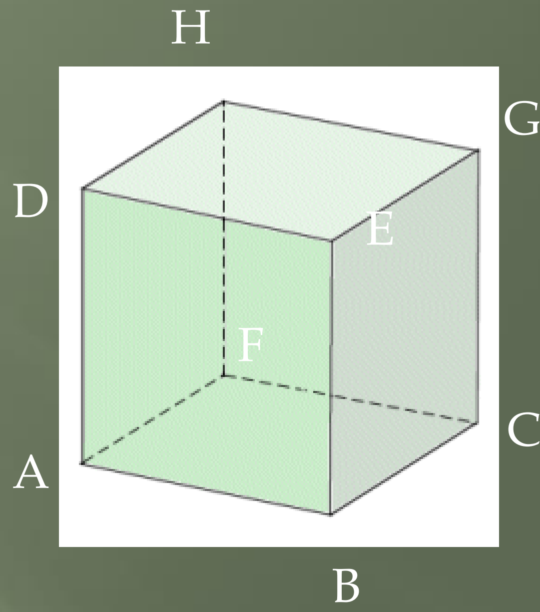


Plane ABC

Naming a Plane

Each surface of the ice cube represents part
Of a plane. Name the plane represented by
The front of the ice cube.

You can name the plane represented by the front of the ice cube using at least three noncollinear points in the plane. Some names are plane AEF, plane AEB, and plane ABFE.



List three different names for the plane represented by the top of the ice cube.

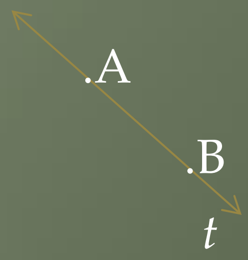
Let's Practice! Pg. 13-14, # 1- 16 all.

A POSTULATE or AXIOM is an accepted statement of fact.

Postulate 1-1

Through any two points, there is exactly one line.

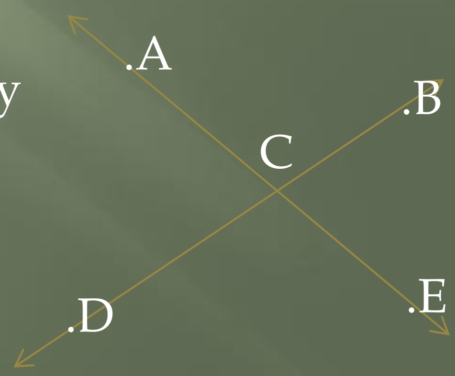
Line *t* is the only line that passes through points A and B



Postulate 1-2

If two lines intersect, then they intersect in exactly one point.

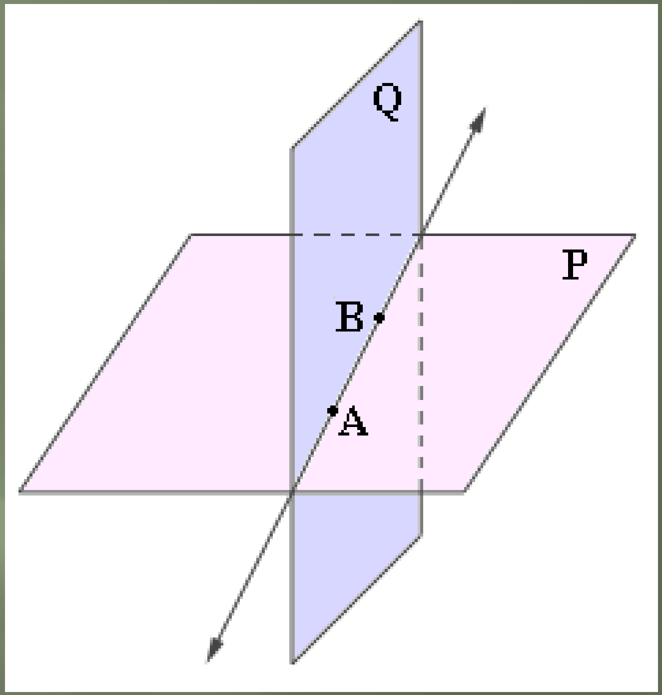
Line $\overleftrightarrow{AE}$ and $\overleftrightarrow{BD}$ intersect at C.



Postulate 1-3

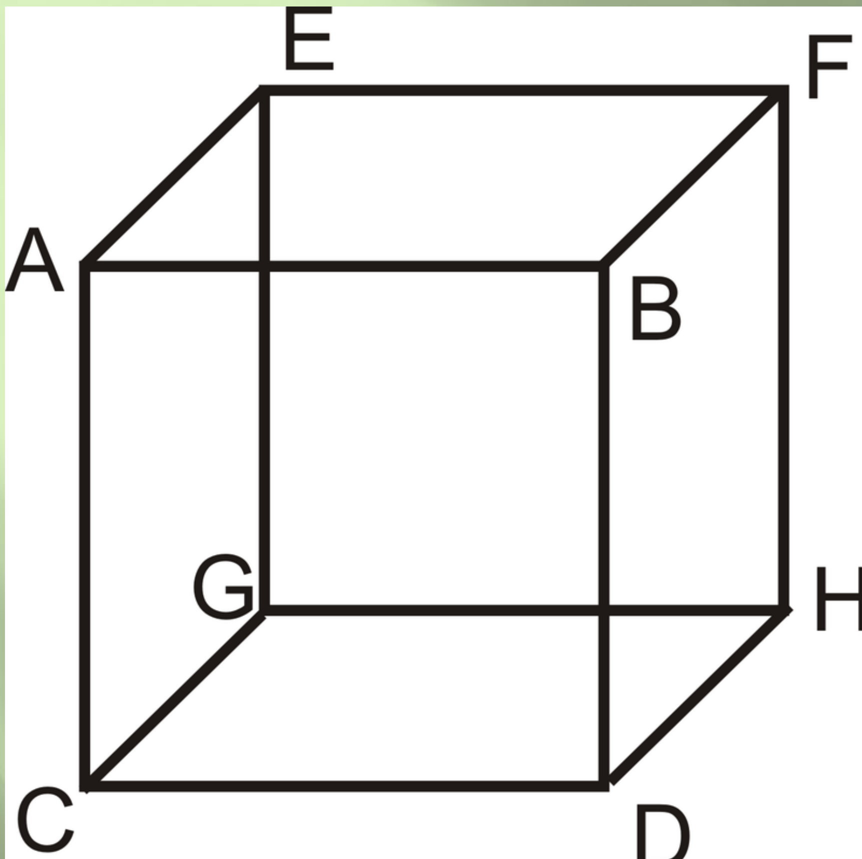
If two plane intersect, then they intersect in exactly one line.

Plane QBA and plane PBA intersect in $\overleftrightarrow{AB}$



When you know two points in the intersection of two planes, Postulates 1-1 and 1-3 tell you that The line through those points is the line of intersection of the planes.

Finding the Intersection of Two Planes



What is the intersection of plane AEFB and plane DHBF?

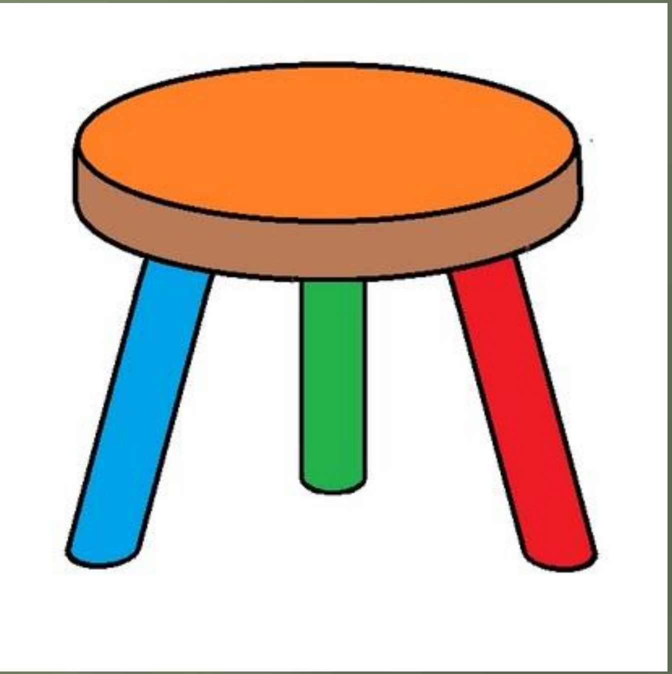
Plane AEFB and plane DHBF, Intersect in $\overleftrightarrow{BF}$.

Name two planes that intersect in $\overleftrightarrow{BD}$

ACD and HDB

Postulate 1-4

Through any three noncollinear points there is exactly one plane.



A three-legged stool will always be stable.
As long as the feet of the stand don't lie in
One line, the feet of the three legs will lie
Exactly in one plane.

This illustrates Postulate 1-4!

Now lets look at Example 4 pg. 13 in the textbook!

Practice! Pg. 14-15 #18-46 even and 52, 54, 66,

Honors add 70-72.

Warm-Up

Simplify each expression

1. -6 (a + 8)

2. 4 (1 + 9x)

3. (-4 – 3n) · -8

4. 5 (b – 1)

Solve each proportion

5. $\frac{10}{8} = \frac{n}{10}$

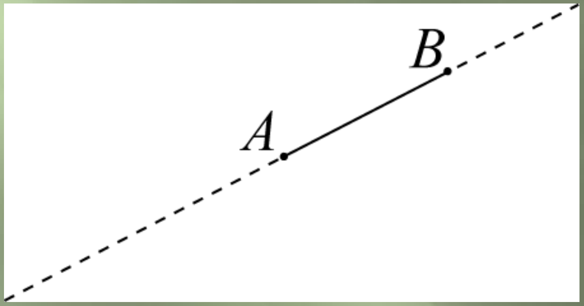
6. $\frac{7}{b+5}$

7. $\frac{7}{5} = \frac{x}{3}$

8. $\frac{5}{6} = \frac{7n+9}{9}$

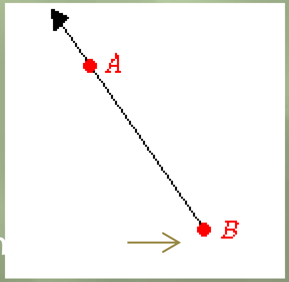
Segments, Rays, Parallel Lines and Planes

A SEGMENT is the part of a line consisting of two endpoints and all points between th

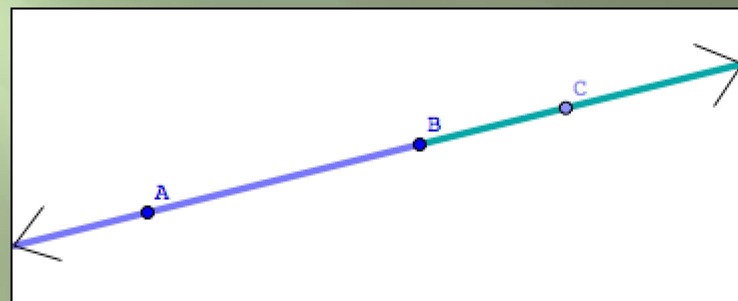


A RAY is the part of a line consisting of one endpoint and all of the points of the line
one side of the endpoint.

en

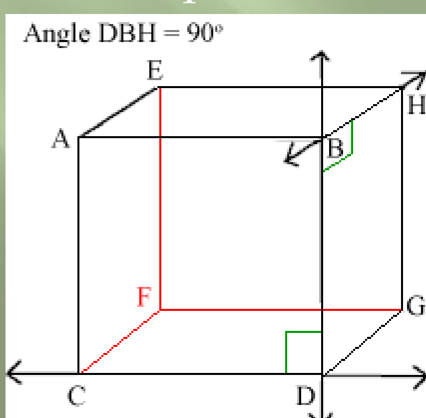


OPPOSITE RAYS are two collinear rays with the same endpoint. Opposite rays always form a line.



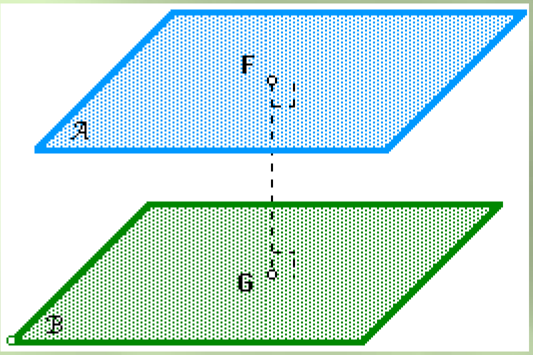
$\overrightarrow{BA}$ and $\overrightarrow{BC}$ are opposite rays

PARALLEL LINES are coplanar lines that do not intersect. SKEW LINES are Non-coplanar; Therefore, they are not parallel and do no intersect.



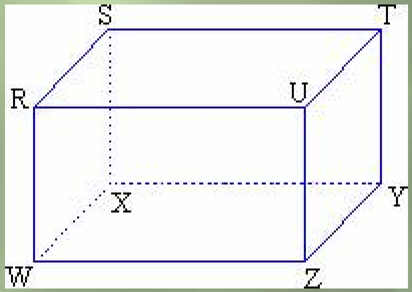
$\overleftrightarrow{BH}$ ll $\overleftrightarrow{DG}$

$\overleftrightarrow{CD}$ and $\overleftrightarrow{HG}$ are skew.



<u>Parallel Planes</u> are planes that do not intersect.

For Example:
The planes on the front and back are parallel. Name two other pairs of parallel planes in the figure.



Plane RSTU | | to WXYZ

Plane RSWX | | to UTZY

Practice Pg. 19-20 #1-25 odd and 37-41 odd.
Pg. 21 #55

Homework: Practice 1-3 (attached to engrade)

Warm-Up

Solve the following equations:

1. $(5x + 8) - (2x - 9) = 38$

2. $4x - 9 = 7x - 15$

Find the next two terms in each sequence:

3. 1, 1.08, 1.16, 1.24, 1.32, …..

4. -1, -2, -4, -7, -11, -16,…..

Section 1-4

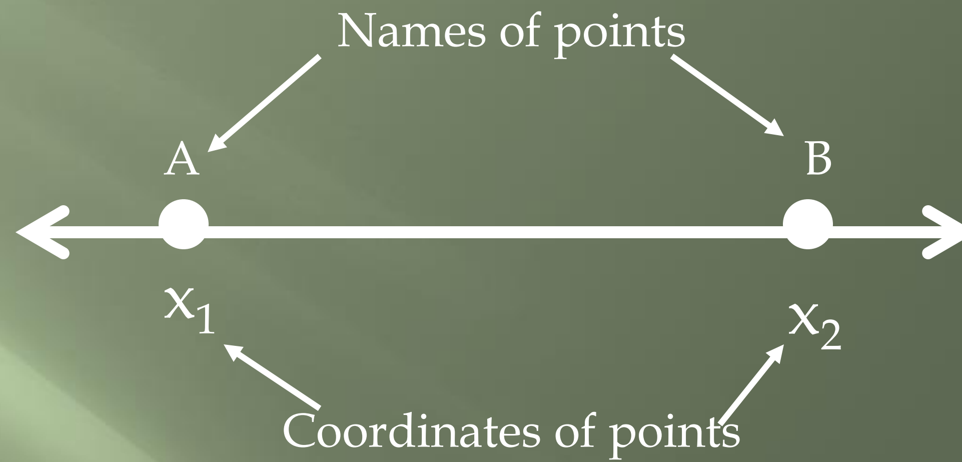
- Measuring Segments and Angles

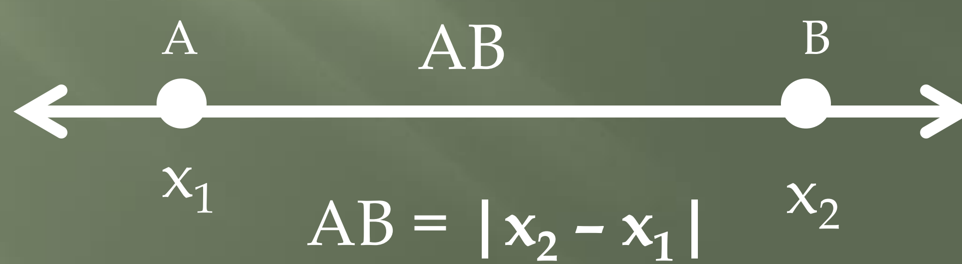
Using Segment Postulates

- In geometry, rules that are accepted without proof are called *postulates*, or *axioms*. Rules that are proved are called *theorems*. In this lesson, you will study two postulates about the lengths of segments.

Postulate 1: Ruler Postulate

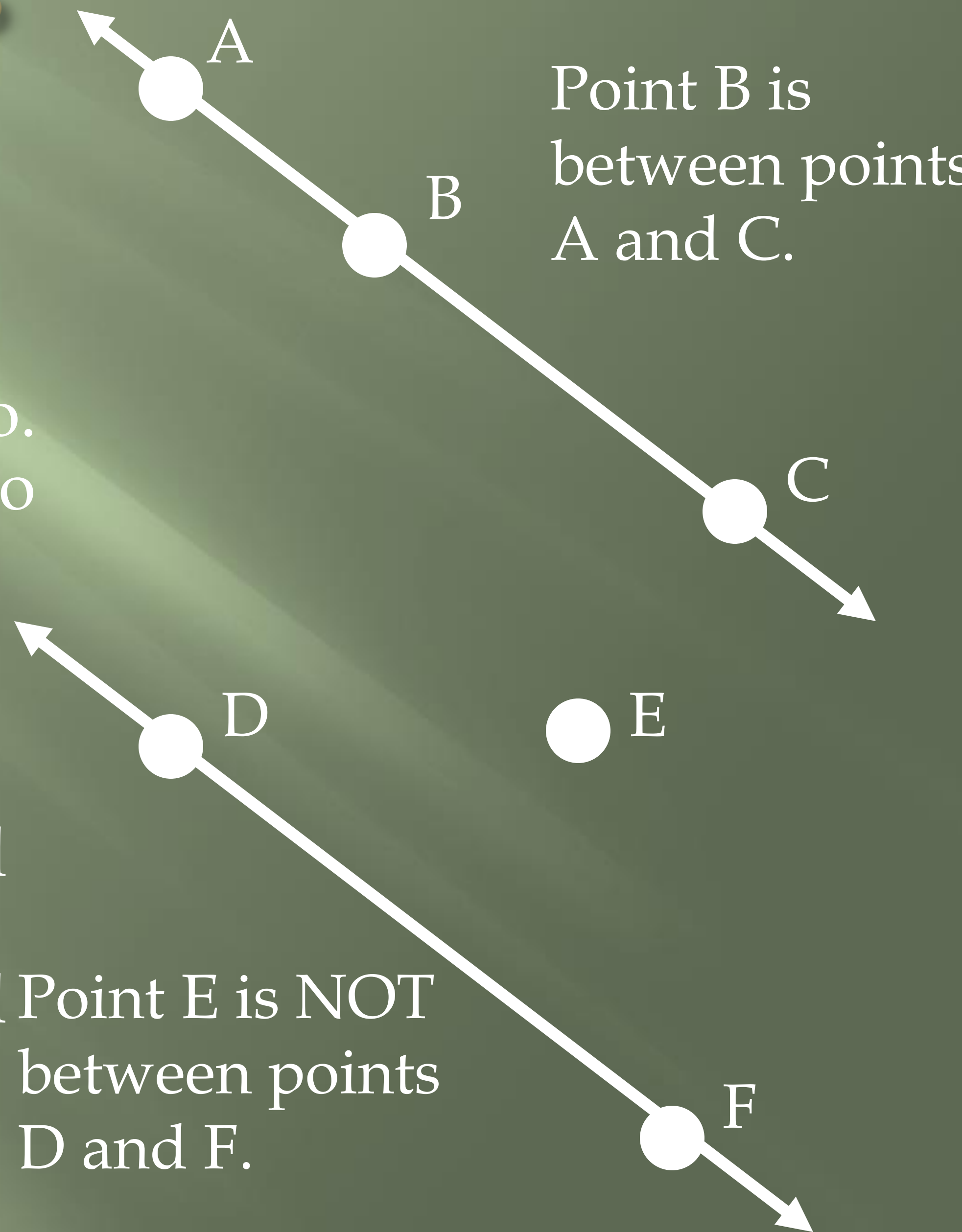
- The points on a line can be matched one to one with the real numbers. The real number that corresponds to a point is the <u>*coordinate*</u> of the point.
- The distance between points A and B written as AB, is the absolute value of the difference between the coordinates of A and B.
- AB is also called the length of AB.





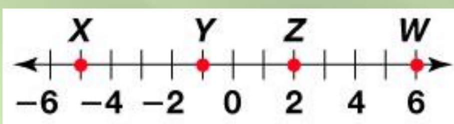
Several Points

- When three points lie on a line, you can say that one of them is between the other two. This concept applies to collinear points only. For instance, in the figures on the next slide, point B is between points A and C, but point E is not between points D and F.



Measuring Segments

1 EXAMPLE Find which two of the segments $\overline{XY}$, $\overline{ZY}$, and $\overline{ZW}$ are congruent.



Use the Ruler Postulate to find the length of each segment.

$XY = |-5 - (-1)| = |-4| = 4$

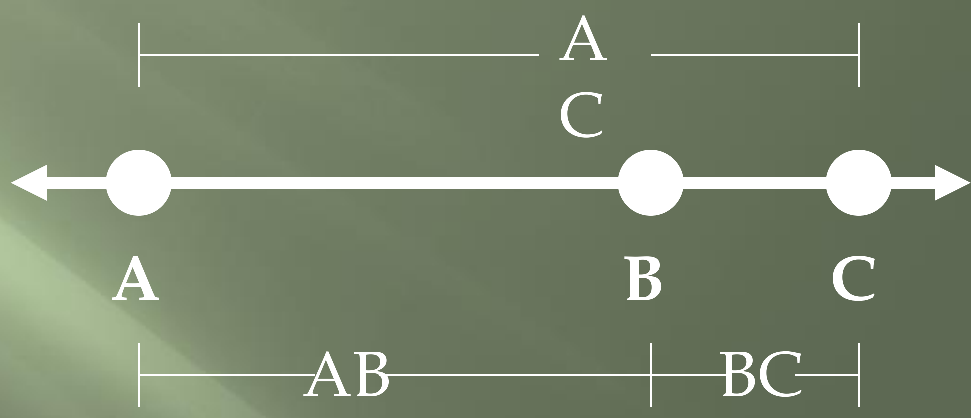
$ZY = |2 - (-1)| = |3| = 3$

$ZW = |2 - 6| = |-4| = 4$

Because $XY = ZW$, $\overline{XY} \cong \overline{ZW}$.

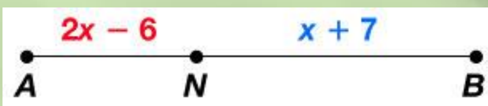
Postulate 2: Segment Addition Postulate

- If B is between A and C, then AB + BC = AC. If AB + BC = AC, then B is between A and C.



Measuring Segments

2 EXAMPLE If $AB = 25$, find the value of x. Then find AN and NB.



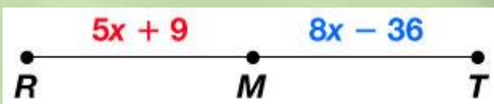
Use the Segment Addition Postulate to write an equation.

$AN + NB = AB$	Segment Addition Postulate
$(2x - 6) + (x + 7) = 25$	Substitute.
$3x + 1 = 25$	Simplify the left side.
$3x = 24$	Subtract 1 from each side.
$x = 8$	Divide each side by 3.
$AN = 2x - 6 = 2(8) - 6 = 10$ $NB = x + 7 = (8) + 7 = 15$	Substitute 8 for x.

$AN = 10$ and $NB = 15$, which checks because the sum of the segment lengths equals 25.

Measuring Segments

3 EXAMPLE M is the midpoint of $\overline{RT}$. Find RM, MT, and RT.



Use the definition of midpoint to write an equation.

$RM = MT$	Definition of midpoint
$5x + 9 = 8x - 36$	Substitute.
$5x + 45 = 8x$	Add 36 to each side.
$45 = 3x$	Subtract $5x$ from each side.
$15 = x$	Divide each side by 3.

$RM = 5x + 9 = 5(15) + 9 = 84$

$MT = 8x - 36 = 8(15) - 36 = 84$

Substitute 15 for x.

$RT = RM + MT = 168$ Segment Addition Postulate

RM and MT are each 84, which is half of 168, the length of $\overline{RT}$.

Warm Up

1. $3n + 4n = -14$
2. $-6 + 5(-1 - b) = 19$
3. $73 = -6(k - 7) + 6(k + 5)$
4. $-9 + 4r = 4r - 3 - 6$
5. $7(1 + 5n) + 6(1 + 4n)$

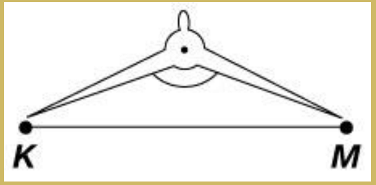
In a ***Construction*** you use a straightedge and a compass to draw a geometric figure. A ***compass*** is a geometric tool Used to draw circles and parts of circles called arcs.

Basic Constructions

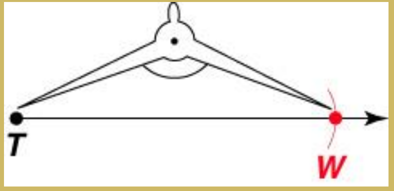
1 EXAMPLE Construct $\overline{TW}$ congruent to $\overline{KM}$.

Step 1: Draw a ray with endpoint T.

Step 2: Open the compass to the length of $\overline{KM}$.

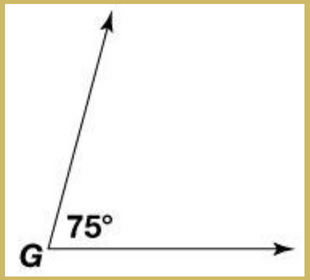


Step 3: With the same compass setting, put the compass point on point T. Draw an arc that intersects the ray. Label the point of intersection W.



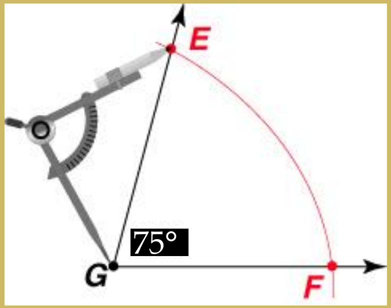
$\overline{TW} \cong \overline{KM}$

2 EXAMPLE Construct $\angle Y$ so that $\angle Y \cong \angle G$.

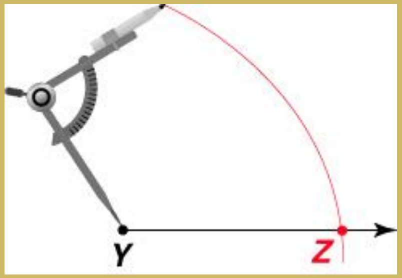


Step 1: Draw a ray with endpoint Y.

Step 2: With the compass point on point G, draw an arc that intersects both sides of $\angle G$. Label the points of intersection E and F.

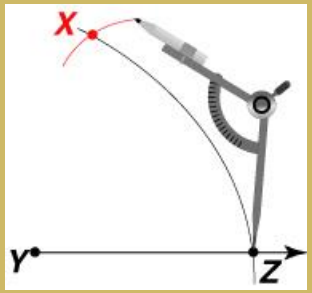


Step 3: With the same compass setting, put the compass point on point Y. Draw an arc that intersects the ray. Label the point of intersection Z.



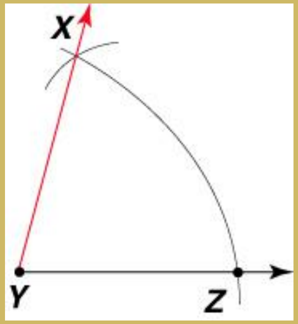
2 EXAMPLE (continued)

Step 4: Open the compass to the length EF. Keeping the same compass setting, put the compass point on Z. Draw an arc that intersects the arc you drew in Step 3. Label the point of intersection X.



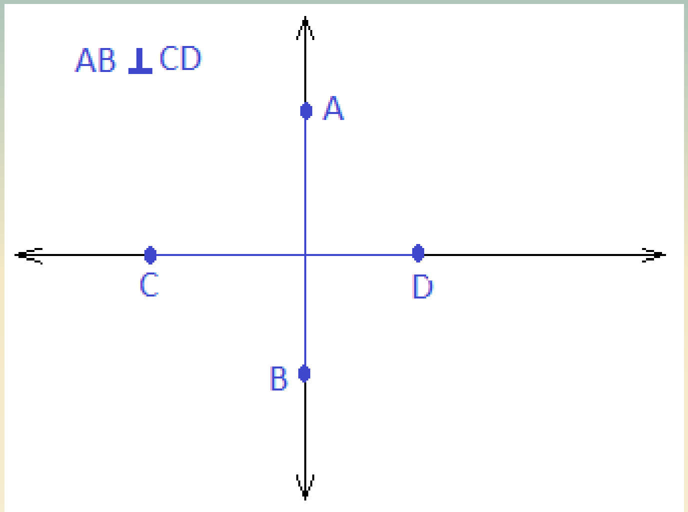
Step 5: Draw $\overrightarrow{YX}$ to complete $\angle Y$.

$\angle Y \cong \angle G$



Perpendicular Lines are two lines that intersect to form right angles. The symbol $\perp$ means "is perpendicular to." In the diagram at the right,

$\overleftrightarrow{AB} \perp \overleftrightarrow{CD}$ and $\overleftrightarrow{CD} \perp \overleftrightarrow{AB}$.

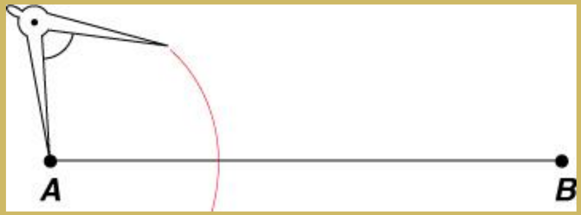


A ***Perpendicular bisector*** of a segment is a line, segment or ray that is perpendicular to the segment at its midpoint, thereby bisecting the segment into two congruent segments.

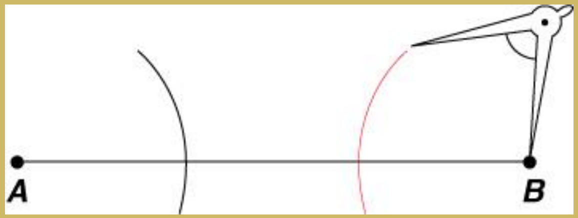
3 EXAMPLE Use a compass opening less than $\frac{1}{2}AB$. Explain why the construction of the perpendicular bisector of $\overline{AB}$ shown in the text is not possible.

Start with $\overline{AB}$.

Step 1: Put the compass point on point A and draw a short arc. Make sure that the opening is less than $\frac{1}{2}AB$.



Step 2: With the same compass setting, put the compass point on point B and draw a short arc.

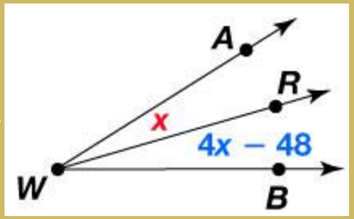


Without two points of intersection, no line can be drawn, so the perpendicular bisector cannot be drawn.

An ***<u>Angle Bisector</u>*** is a ray that divides an angel into two congruent coplanar angles. Its endpoint is at the angle vertex. Within the ray, a segment with the same endpoint is also an angle bisector. You may say that the ray or segments *bisects* the angle.

4 EXAMPLE $\overrightarrow{WR}$ bisects $\angle AWB$. $m\angle AWR = x$ and $m\angle BWR = 4x - 48$. Find $m\angle AWB$.

Draw and label a figure to illustrate the problem



$m\angle AWR = m\angle BWR$ Definition of angle bisector

$x = 4x - 48$ Substitute x for $m\angle AWR$ and $4x - 48$ for $m\angle BWR$.

$-3x = -48$ Subtract $4x$ from each side.

$x = 16$ Divide each side by -3.

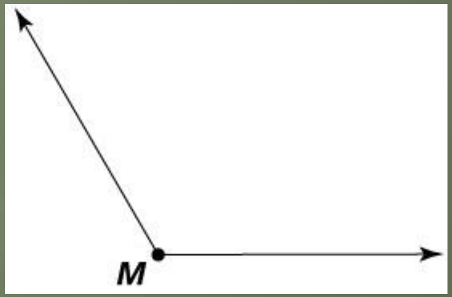
$m\angle AWR = 16$

$m\angle BWR = 4(16) - 48 = 16$ Substitute 16 for x.

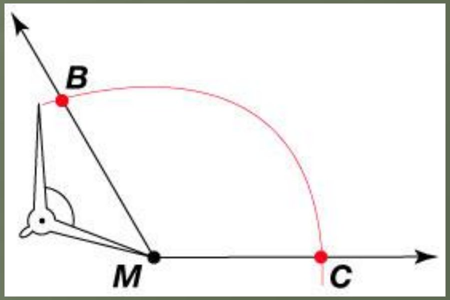
$m\angle AWB = m\angle AWR + m\angle BWR$ Angle Addition Postulate

$m\angle AWB = 16 + 16 = 32$ Substitute 16 for $m\angle AWR$ and for $m\angle BWR$.

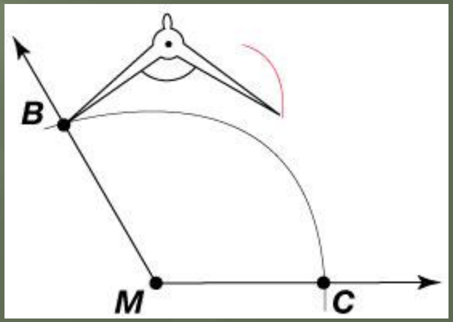
5 EXAMPLE Construct $\overrightarrow{MX}$, the bisector of $\angle M$.



Step 1: Put the compass point on vertex M. Draw an arc that intersects both sides of $\angle M$. Label the points of intersection B and C.

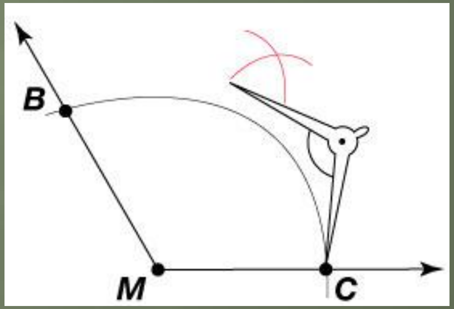


Step 2: Put the compass point on point B. Draw an arc in the interior of $\angle M$.

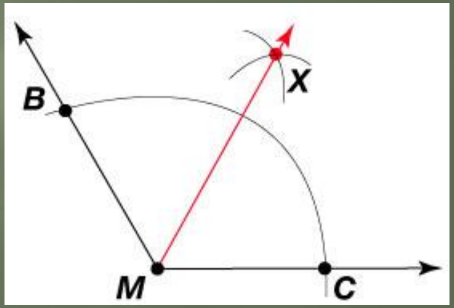


5 EXAMPLE (continued)

Step 3: Put the compass point on point C. Using the same compass setting, draw an arc in the interior of $\angle M$. Make sure that the arcs intersect. Label the point where the two arcs intersect X.



Step 4: Draw $\overrightarrow{MX}$. $\overrightarrow{MX}$ is the angle bisector of $\angle M$.



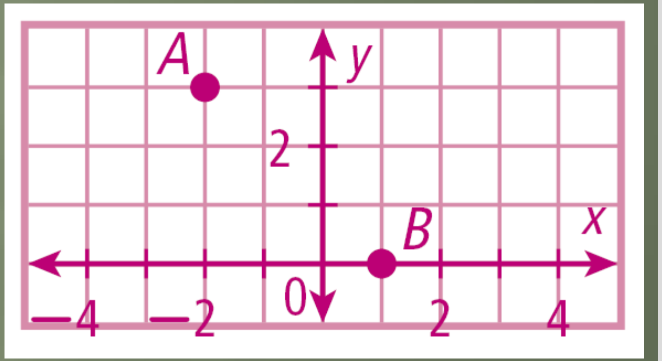
Practice:

Pg. 37-38
1-17 odd,

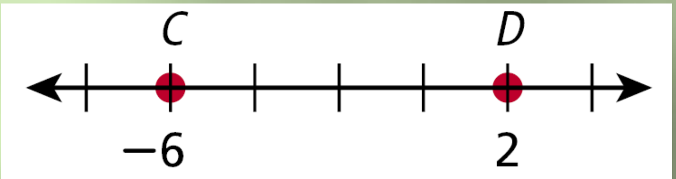
#18, 25, 28

Warm Up

1. Graph *A* (–2, 3) and *B* (1, 0).



2. Find *CD*. 8



3. Find the coordinate of the midpoint of $\overline{CD}$. –2

4. Simplify.

4

Objectives

Develop and apply the formula for midpoint.

Use the Distance Formula and the Pythagorean Theorem to find the distance between two points.

Vocabulary

coordinate plane

leg

hypotenuse

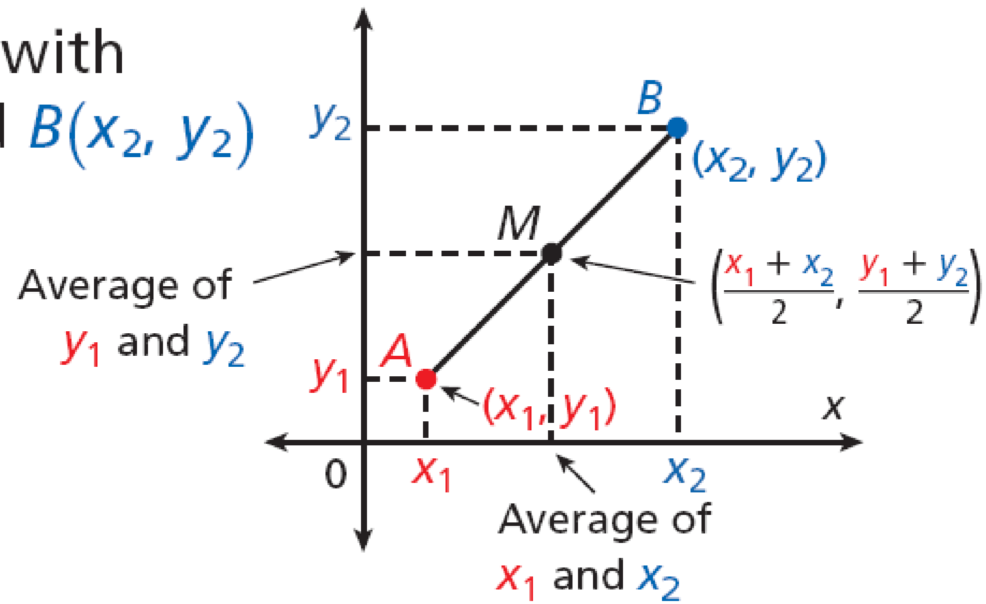
A **coordinate plane** is a plane that is divided into four regions by a horizontal line (x-axis) and a vertical line (y-axis) . The location, or coordinates, of a point are given by an ordered pair (x, y).

You can find the midpoint of a segment by using the coordinates of its endpoints. Calculate the average of the x-coordinates and the average of the y-coordinates of the endpoints.

Midpoint Formula

The midpoint M of $\overline{AB}$ with endpoints $A(x_1, y_1)$ and $B(x_2, y_2)$ is found by

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



Helpful Hint

To make it easier to picture the problem, plot the segment’s endpoints on a coordinate plane.

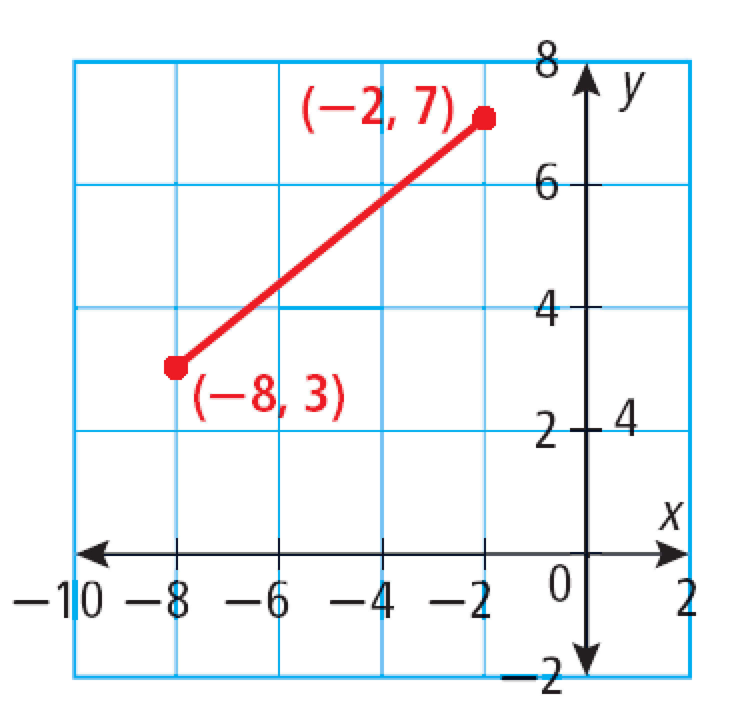
Example 1: Finding the Coordinates of a Midpoint

Find the coordinates of the midpoint of $\overline{PQ}$ with endpoints *P*(–8, 3) and *Q*(–2, 7).

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

$$\left(\frac{-8+(-2)}{2},\frac{3+7}{2}\right)=\left(\frac{-10}{2},\frac{10}{2}\right)$$

$$= (-5, 5)$$

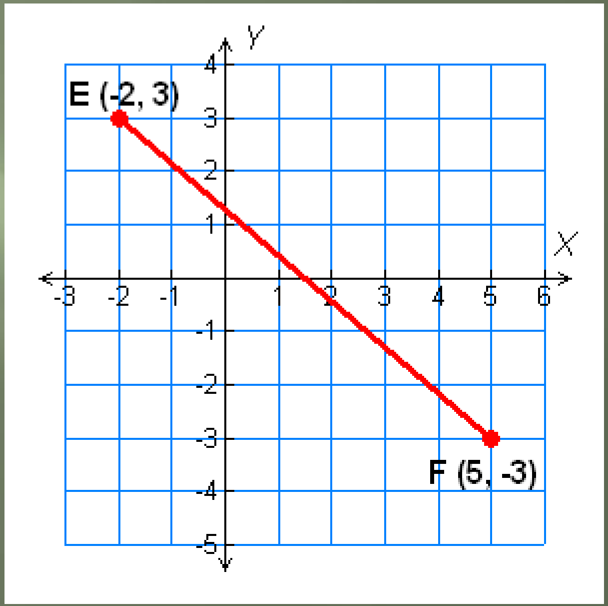


Check It Out! Example 1

Find the coordinates of the midpoint of $\overline{EF}$ with endpoints $E(-2, 3)$ and $F(5, -3)$.

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

$$\left(\frac{-2+5}{2},\frac{3+(-3)}{2}\right)=\left(\frac{3}{2},0\right)$$



Example 2: Finding the Coordinates of an Endpoint

***M* is the midpoint of $\overline{XY}$. *X* has coordinates (2, 7) and *M* has coordinates (6, 1). Find the coordinates of *Y*.**

Step 1 Let the coordinates of *Y* equal (*x*, *y*).

Step 2 Use the Midpoint Formula: $(6,1) = \left(\frac{2+x}{2}, \frac{7+y}{2}\right)$.

Example 2 Continued

Step 3 Find the *x*-coordinate.

$6 = \frac{2+x}{2}$	*Set the coordinates equal.*	$1 = \frac{7+y}{2}$
$2(6) = 2\left(\frac{2+x}{2}\right)$	*Multiply both sides by 2.*	$2(1) = 2\left(\frac{7+y}{2}\right)$
$12 = 2 + x$	*Simplify.*	$2 = 7 + y$
$-2 \quad -2$	*Subtract.*	$-7 \quad -7$
$10 = x$	*Simplify.*	$-5 = y$

The coordinates of *Y* are (10, –5).

Check It Out! Example 2

S **is the midpoint of $\overline{RT}$. *R* has coordinates (–6, –1), and *S* has coordinates (–1, 1). Find the coordinates of *T*.**

Step 1 Let the coordinates of *T* equal (*x*, *y*).

Step 2 Use the Midpoint Formula:

$$(-1, 1) = \left(\frac{-6 + x}{2}, \frac{-1 + y}{2}\right).$$

Check It Out! Example 2 Continued

Step 3 Find the x-coordinate.

$-1 = \dfrac{-6 + x}{2}$	*Set the coordinates equal.*	$1 = \dfrac{-1 + y}{2}$
$2(-1) = 2\left(\dfrac{-6 + x}{2}\right)$	*Multiply both sides by 2.*	$2(1) = 2\left(\dfrac{-1 + y}{2}\right)$
$-2 = -6 + x$	*Simplify.*	$2 = -1 + y$
$+6 \quad +6$	*Add.*	$+1 \quad +1$
$4 = x$	*Simplify.*	$3 = y$

The coordinates of T are (4, 3).

The Ruler Postulate can be used to find the distance between two points on a number line. The Distance Formula is used to calculate the distance between two points in a coordinate plane.

Distance Formula

In a coordinate plane, the distance d between two points (x_1, y_1) and (x_2, y_2) is

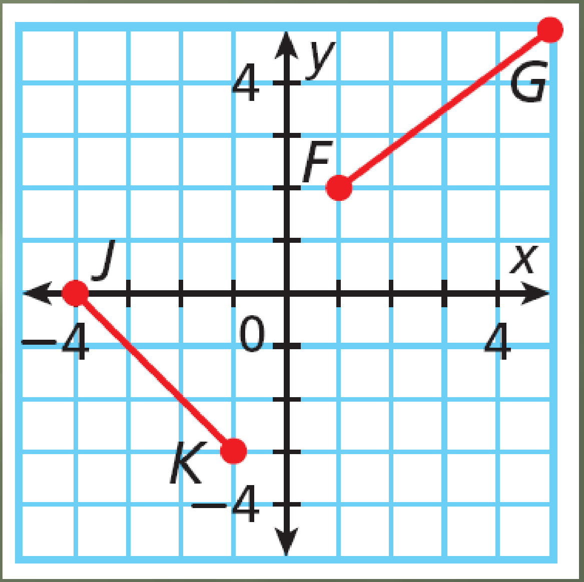
$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$

Example 3: Using the Distance Formula

Find *FG* and *JK*.
Then determine whether $\overline{FG} \cong \overline{JK}$.

Step 1 Find the coordinates of each point.

F(1, 2), *G*(5, 5), *J*(–4, 0), *K*(–1, –3)



Example 3 Continued

Step 2 Use the Distance Formula.

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

$$FG = \sqrt{(5-1)^2 + (5-2)^2}$$

$$= \sqrt{4^2 + 3^2}$$

$$= \sqrt{25} = 5$$

$$JK = \sqrt{[(-1-(-4))]^2 + (-3-0)^2}$$

$$= \sqrt{3^2 + (-3)^2}$$

$$= \sqrt{18} = 3\sqrt{2}$$

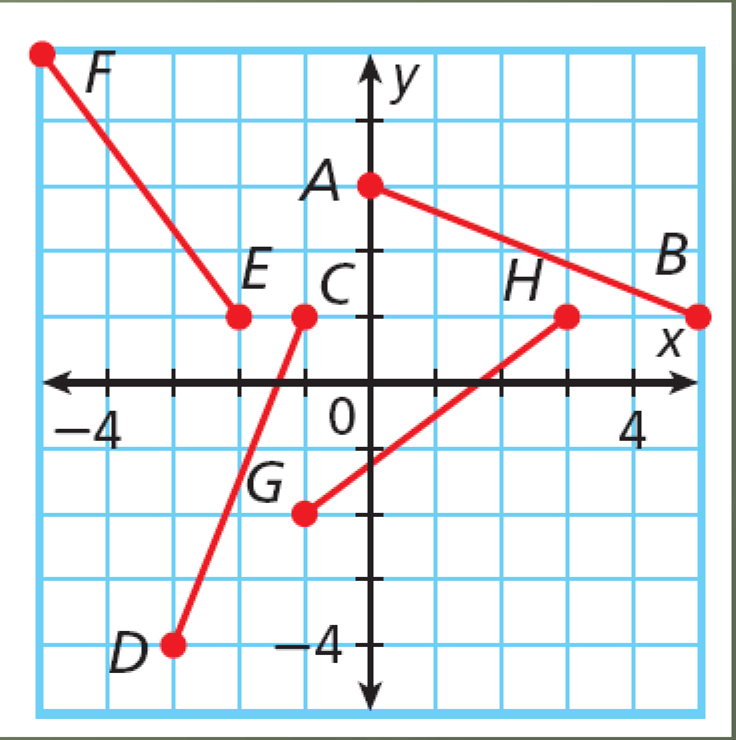
Since $FG \neq JK$, $\overline{FG} \not\cong \overline{JK}$.

Check It Out! Example 3

Find *EF* and *GH*. Then determine if $\overline{EF} \cong \overline{GH}$.

Step 1 Find the coordinates of each point.

E(–2, 1), *F*(–5, 5), *G*(–1, –2), *H*(3, 1)



Check It Out! Example 3 Continued

Step 2 Use the Distance Formula.

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

$$EF = \sqrt{[-5 - (-2)]^2 + (5 - 1)^2}$$

$$= \sqrt{(-3)^2 + 4^2}$$

$$= \sqrt{25} = 5$$

$$GH = \sqrt{[3 - (-1)]^2 + [1 - (-2)]^2}$$

$$= \sqrt{4^2 + 3^2}$$

$$= \sqrt{25} = 5$$

Since $EF = GH$, $\overline{EF} \cong \overline{GH}$.

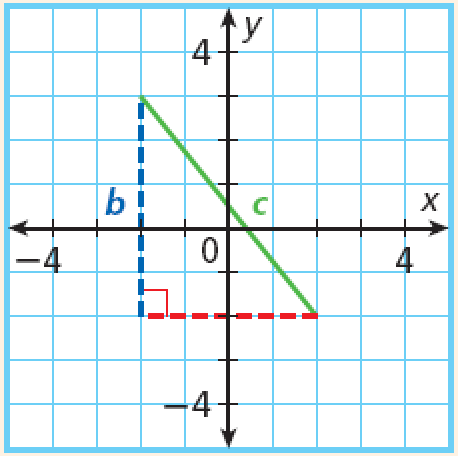
You can also use the Pythagorean Theorem to find the distance between two points in a coordinate plane. You will learn more about the Pythagorean Theorem in Chapter 5.

In a right triangle, the two sides that form the right angle are the **legs**. The side across from the right angle that stretches from one leg to the other is the **hypotenuse**. In the diagram, ***a*** and ***b*** are the lengths of the shorter sides, or legs, of the right triangle. The longest side is called the hypotenuse and has length ***c***.

Theorem 1-6-1 Pythagorean Theorem

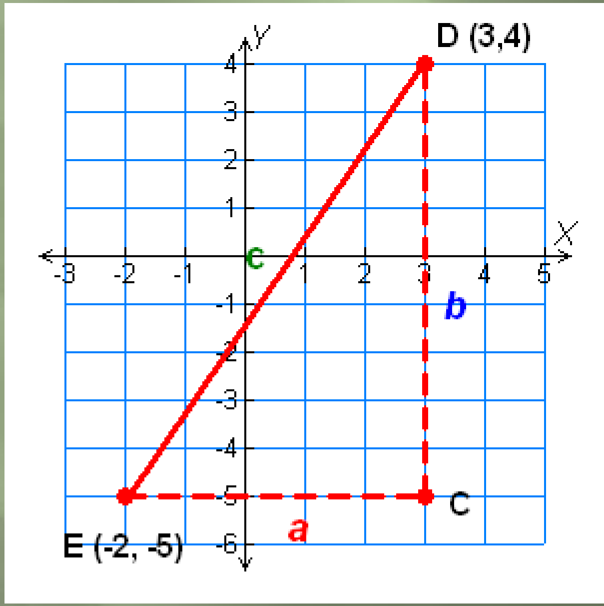
In a right triangle, the sum of the squares of the lengths of the *legs* is equal to the square of the length of the *hypotenuse*.

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



Example 4: Finding Distances in the Coordinate Plane

Use the Distance Formula and the Pythagorean Theorem to find the distance, to the nearest tenth, from *D*(3, 4) to *E*(–2, –5).



Example 4 Continued

Method 1

Use the Distance Formula. Substitute the values for the coordinates of ***D*** and ***E*** into the Distance Formula.

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

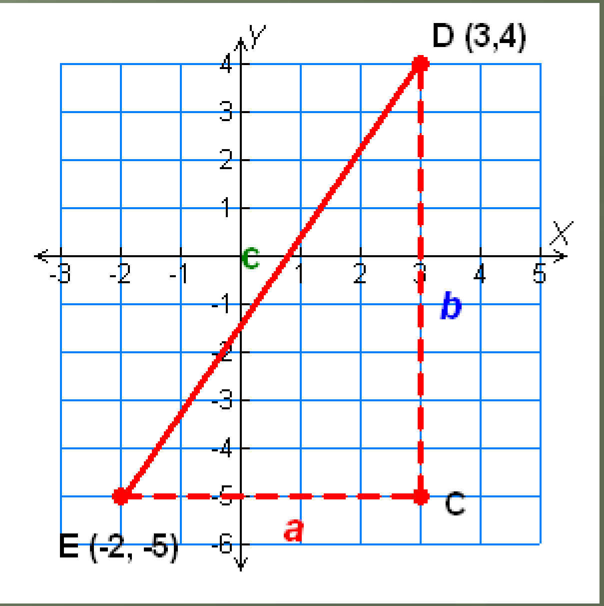
$$= \sqrt{[(-2) - 3]^2 + [(-5) - 4]^2}$$

$$= \sqrt{(-5)^2 + (-9)^2}$$

$$= \sqrt{25 + 81}$$

$$= \sqrt{106}$$

$$\approx 10.3$$



Example 4 Continued

Method 2

Use the Pythagorean Theorem. Count the units for sides ***a*** and ***b***.

$a = 5$ and $b = 9$.

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

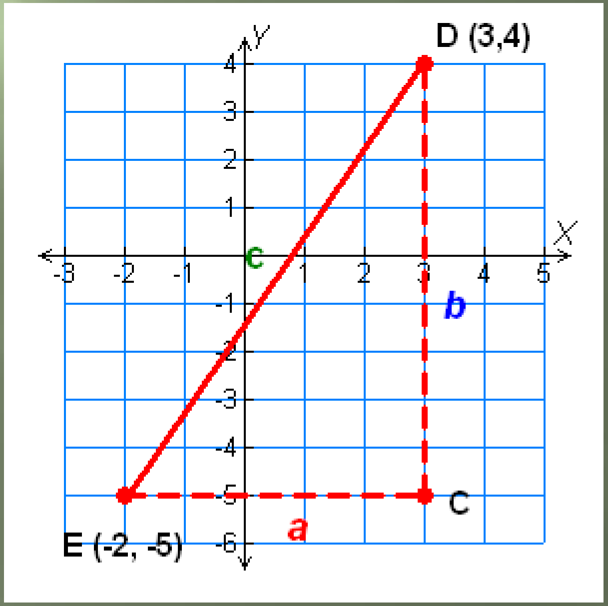
$= 5^2 + 9^2$

$= 25 + 81$

$= 106$

$c = \sqrt{106}$

$c = 10.3$



Check It Out! Example 4a

Use the Distance Formula and the Pythagorean Theorem to find the distance, to the nearest tenth, from *R* to *S*.

***R*(3, 2) and *S*(–3, –1)**

Method 1

Use the Distance Formula. Substitute the values for the coordinates of ***R*** and ***S*** into the Distance Formula.

Check It Out! Example 4a Continued

Use the Distance Formula and the Pythagorean Theorem to find the distance, to the nearest tenth, from *R* to *S*.

***R*(3, 2) and *S*(–3, –1)**

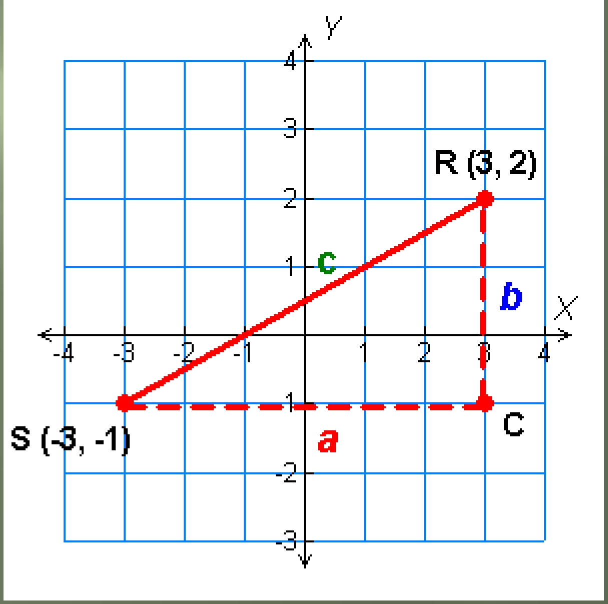
$$RS = \sqrt{(-3-3)^2 + (-1-2)^2}$$

$$= \sqrt{(-6)^2 + (-3)^2}$$

$$= \sqrt{45}$$

$$= 3\sqrt{5}$$

$$\approx 6.7$$



Check It Out! Example 4a Continued

Method 2

Use the Pythagorean Theorem. Count the units for sides ***a*** and ***b***.

a = 6 and b = 3.

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

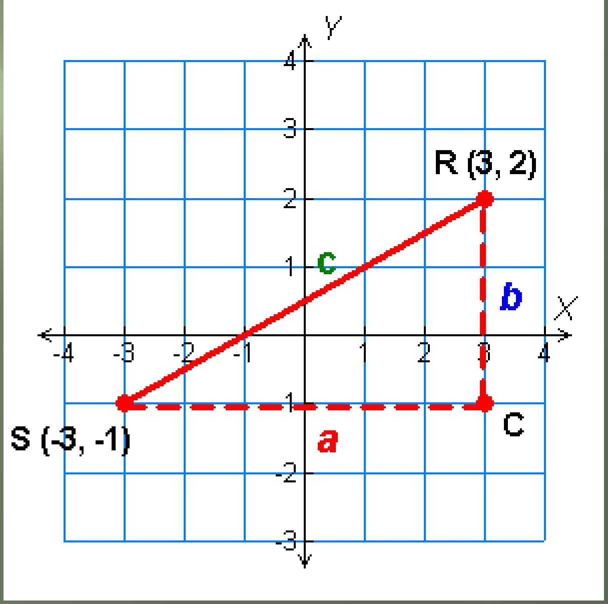
$$= 6^2 + 3^2$$

$$= 36 + 9$$

$$= 45$$

$$c = \sqrt{45}$$

$$c \approx 6.7$$



Check It Out! Example 4b

Use the Distance Formula and the Pythagorean Theorem to find the distance, to the nearest tenth, from *R* to *S*.

***R*(–4, 5) and *S*(2, –1)**

Method 1

Use the Distance Formula. Substitute the values for the coordinates of ***R*** and ***S*** into the Distance Formula.

Check It Out! Example 4b Continued

Use the Distance Formula and the Pythagorean Theorem to find the distance, to the nearest tenth, from *R* to *S*.

***R*(–4, 5) and *S*(2, –1)**

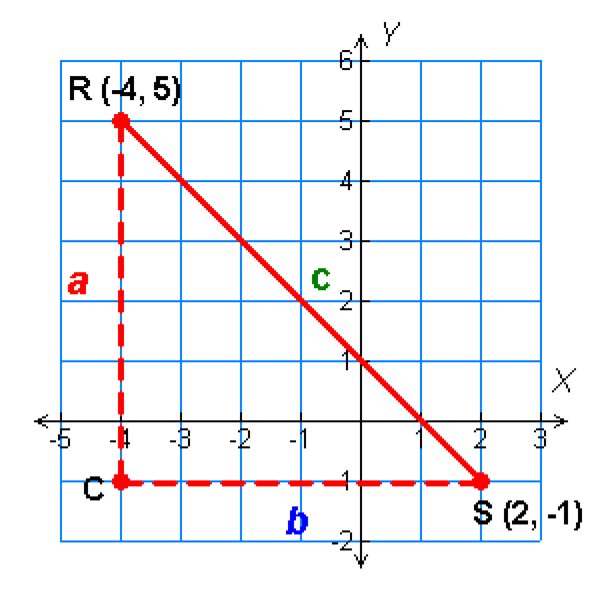
$$RS = \sqrt{[2-(-4)]^2 + (-1-5)^2}$$

$$= \sqrt{6^2 + (-6)^2}$$

$$= \sqrt{72}$$

$$= 6\sqrt{2}$$

$$\approx 8.5$$



Check It Out! Example 4b Continued

Method 2

Use the Pythagorean Theorem. Count the units for sides ***a*** and ***b***.

$a = 6$ and $b = 6$.

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

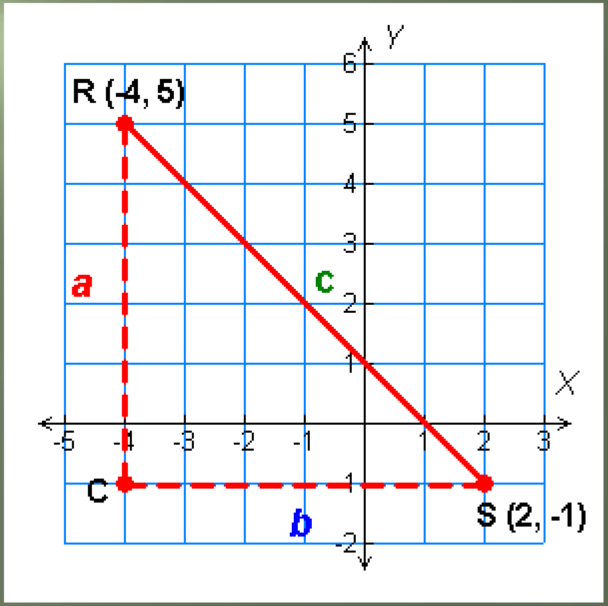
$= 6^2 + 6^2$

$= 36 + 36$

$= 72$

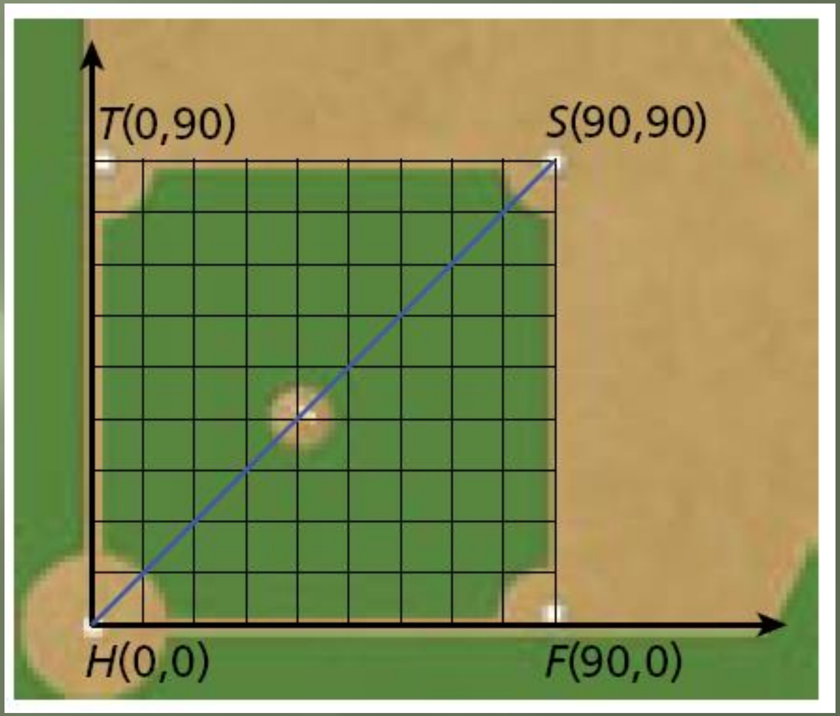
$c = \sqrt{72}$

$c \approx 8.5$



Example 5: Sports Application

A player throws the ball from first base to a point located between third base and home plate and 10 feet from third base. What is the distance of the throw, to the nearest tenth?



Example 5 Continued

Set up the field on a coordinate plane so that home plate *H* is at the origin, first base *F* has coordinates (90, 0), second base *S* has coordinates (90, 90), and third base *T* has coordinates (0, 90).

The target point *P* of the throw has coordinates (0, 80). The distance of the throw is *FP*.

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

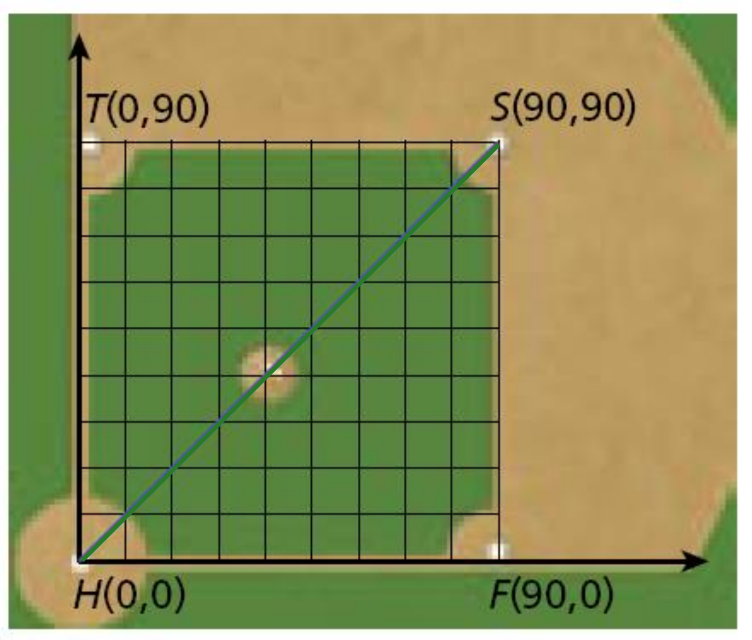
$$= \sqrt{(0 - 90)^2 + (80 - 0)^2}$$

$$= \sqrt{(-90)^2 + (80)^2}$$

$$= \sqrt{8100 + 6400} = \sqrt{14{,}500} \approx 120.4 \text{ ft}$$

Check It Out! Example 5

The center of the pitching mound has coordinates (42.8, 42.8). When a pitcher throws the ball from the center of the mound to home plate, what is the distance of the throw, to the nearest tenth?



$$HP = \sqrt{(42.8-0)^2 + (42.8-0)^2}$$

$$= \sqrt{1831.84 + 1831.84}$$

$$= \sqrt{3663.68}$$

$\approx$ 60.5 ft

Lesson Quiz: Part I

1. Find the coordinates of the midpoint of $\overline{MN}$ with endpoints $M(-2, 6)$ and $N(8, 0)$. (3, 3)

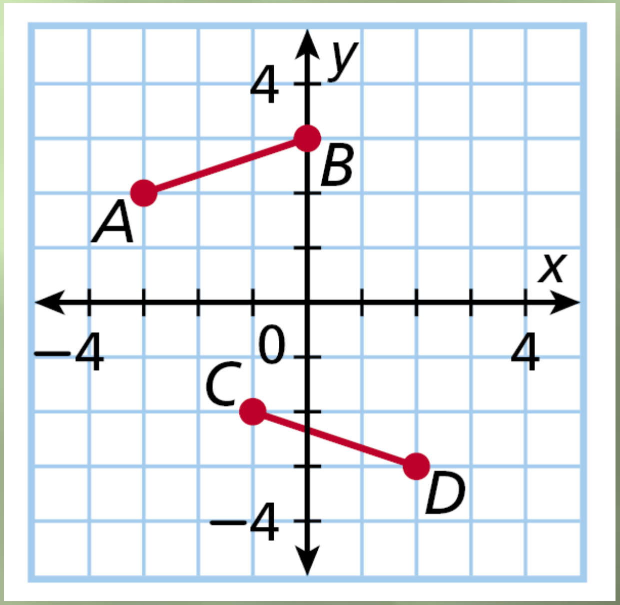
2. K is the midpoint of $\overline{HL}$. H has coordinates $(1, –7)$, and K has coordinates $(9, 3)$. Find the coordinates of L. (17, 13)

3. Find the distance, to the nearest tenth, between $S(6, 5)$ and $T(–3, –4)$. 12.7

4. The coordinates of the vertices of ΔABC are $A(2, 5)$, $B(6, –1)$, and $C(–4, –2)$. Find the perimeter of ΔABC, to the nearest tenth. 26.5

Lesson Quiz: Part II

5. Find the lengths of $\overline{AB}$ and $\overline{CD}$ and determine whether they are congruent.



$\sqrt{10}$; $\sqrt{10}$; yes

1.7 Perimeter, Circumference and Area

Perimeter and area of common plane figures

Perimeter and Area

Perimeter - The length of the edge of an object in the plane.

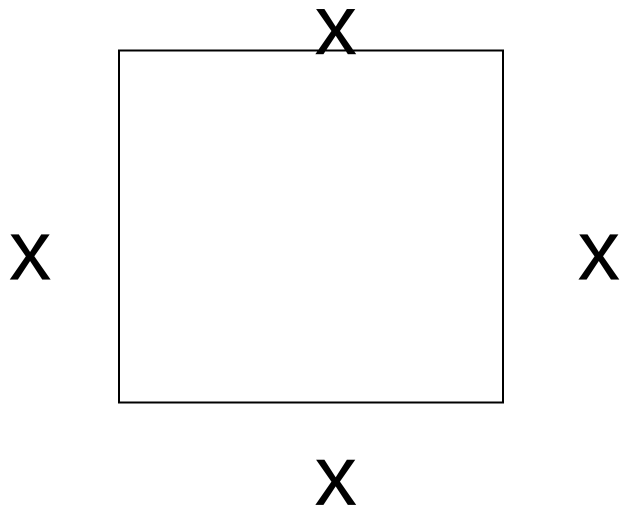
Area - The space in the plane defined by an 2 dimensional object.

Perimeter and Area

Square - side length x

Perimeter – 4x

Area – x^2



Perimeter and Area

Rectangle - length ℓ and width w

Perimeter = 2 ℓ + 2 w

Area = ℓ * w

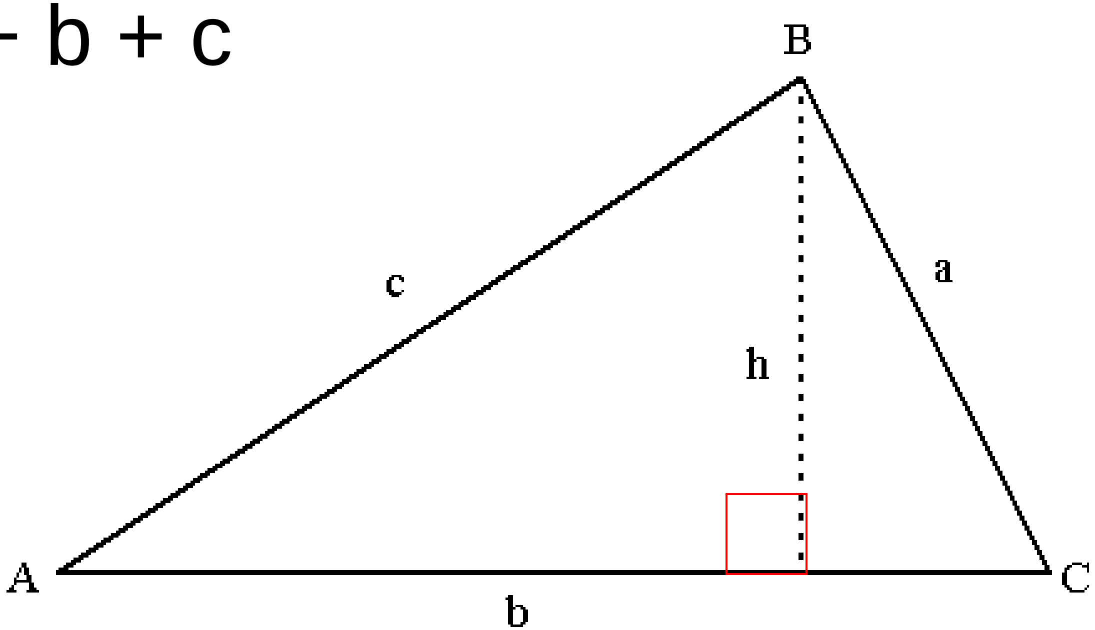
Perimeter and Area

Triangle – sides a, b, and c

Height - h

Perimeter = a + b + c

Area = ½hb



Perimeter and Area

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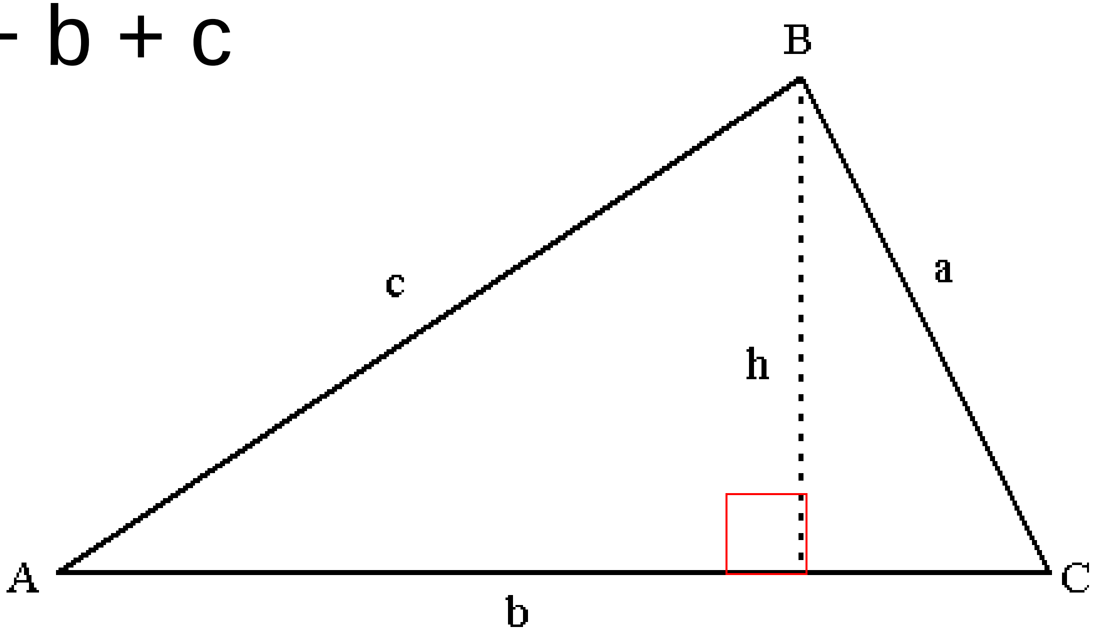
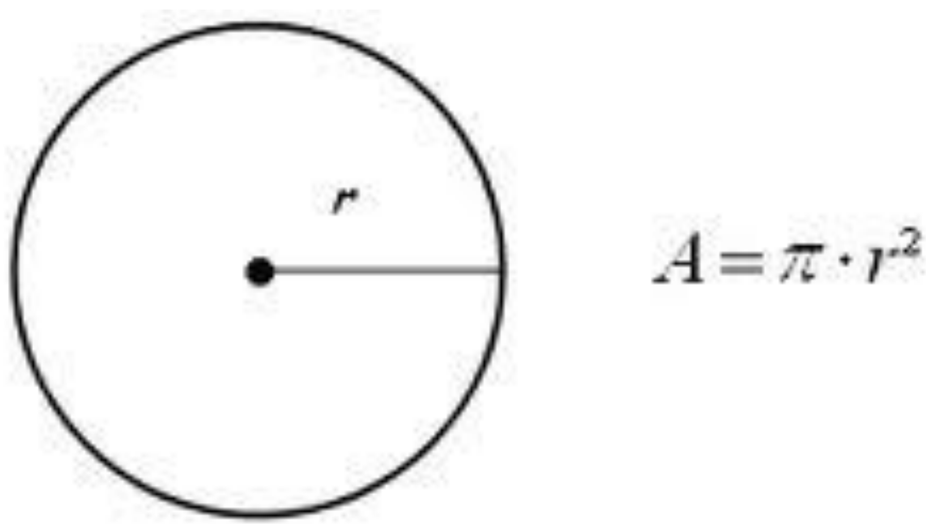


Perimeter and Area

Circle – Radius ***r***

Circumference = $2\pi r$ or $d\pi$

Area = πr^2



Find the perimeter and area

A rectangle of length 4.5 m and width of 0.5 m

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$P = 2(4.5) + 2(0.5)$

Find the perimeter and area

A rectangle of length 4.5 m and width of 0.5 m

P = 2(4.5) + 2(0.5)

P = 9 + 1; so 10m

Area (4.5)(0.5) =

Find the perimeter and area

A rectangle of length 4.5 m and width of 0.5 m

$P = 2(4.5) + 2(0.5)$

$P = 9 + 1$; so 10m

Area $(4.5)(0.5) = 2.25\ m^2$

Find the perimeter and area

A triangle defined by

H(-2, 2), J(3, - 1) and K(- 2, - 4)

Find the side by the distance formula

$$\sqrt{\left(x_1 - x_2\right)^2 + \left(y_1 - y_2\right)^2}$$

Need to find the sides

HJ = $\sqrt{\left(3-(-2)\right)^2+\left(-1-2\right)^2} = \sqrt{34}$

JK = $\sqrt{\left(3-(-2)\right)^2+\left(-1-(-4)\right)^2} = \sqrt{34}$

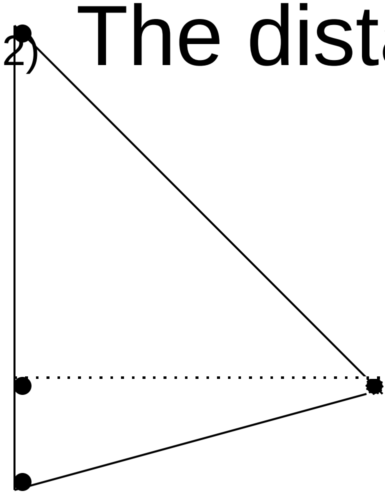
HK = $\sqrt{\left(-2-(-2)\right)^2+\left(2-(-4)\right)^2} = \sqrt{36}$

Perimeter is $\sqrt{34} + \sqrt{34} + 6 = 6 + 2\sqrt{34}$

Area of the triangle

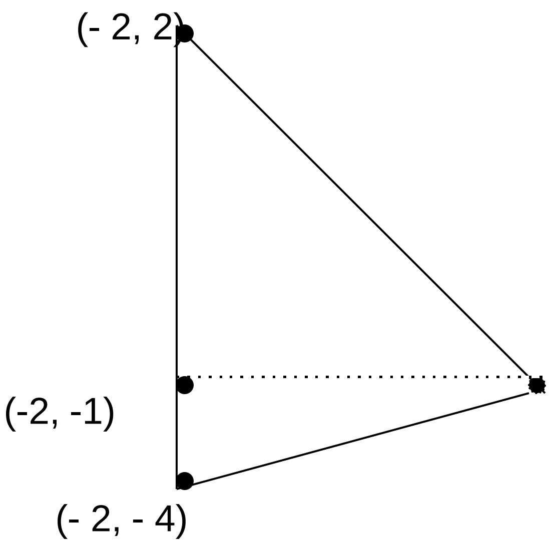
We need to graph the triangle.

- The distance from (-2,- 1) to (3, - 1) is 5



Area of the triangle

We need to graph the triangle.



The distance from (-2,- 1) to (3, - 1) is 5

(- 2, 2) to (- 2, 4) is 6

Area ½(6)(5) = 15

Area of a walkway

You need a 2 foot walkway around a pool. The pool is 16 feet by 8 feet rectangle.

What is the area of the walkway?

What formula do we need?

Area of a walkway

You need a 2 foot walkway around a pool. The pool is 16 feet by 8 feet rectangle.

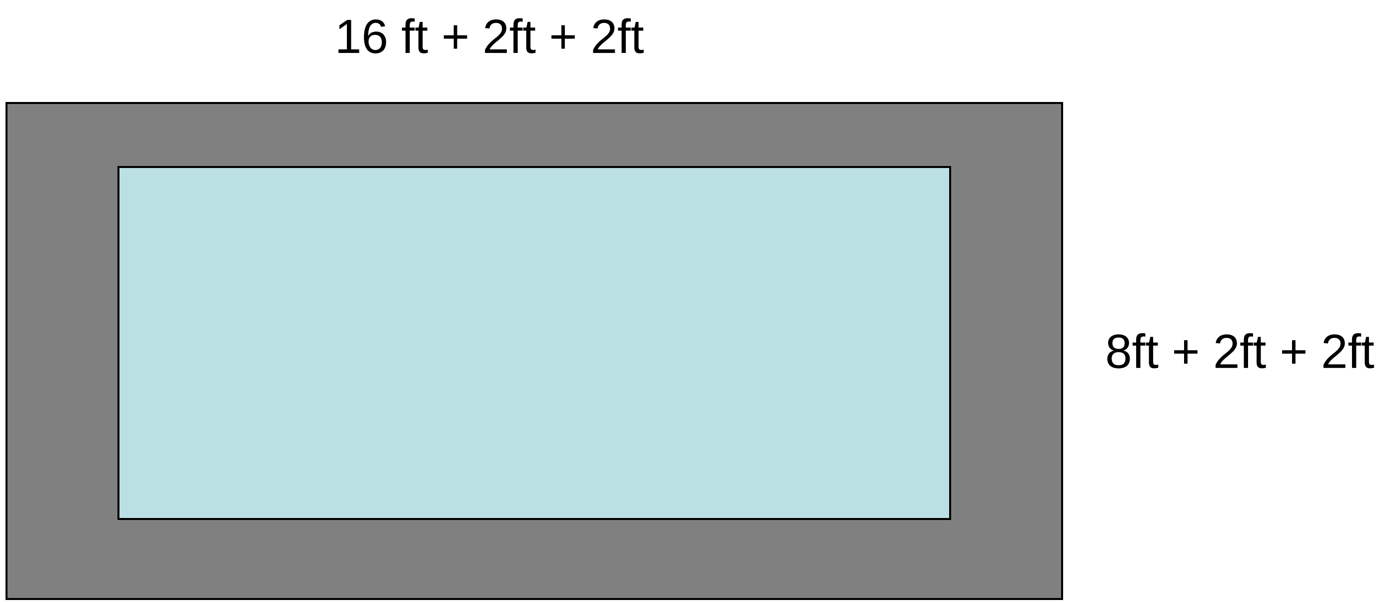
What is the area of the walkway?

What formula do we need? ***Rectangle Area***

We have two rectangles, one inside another.

Write out the verbal model

Pool and walkway minus the pool will give us the walkway.



Equation

Pool and walkway - the pool = walkway.

(16 + 2 + 2)(2 + 8 + 2) – (16)(8)

Equation

Pool and walkway - the pool = walkway.

(16 + 2 + 2)(2 + 8 + 2) – (16)(8)

(20)(12) – (16)(8) = walkway

240 – 128 = walkway

112 ft^2 is the walkway

Practice

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9 – 20, 21 – 35 odd, 39 – 47 odd