Classroom Copy

1.1 Understanding Points, Lines, and Planes

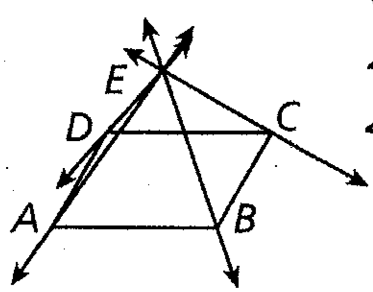
Learning Goal: <u>You should be able to identify, name, and draw points, lines, segments, rays, and planes and apply basic facts about points, lines, and planes.</u>

The most basic figures in geometry are Undefined, which cannot be defined by using other figures. The undefined terms Point, Line, and Plane are the building blocks of geometry.

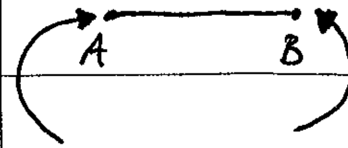
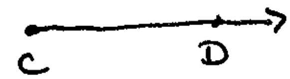
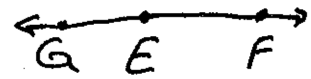
Term and Definition	How to Label	Draw it
Point place in space No size	Capital Letter	A • •B •C
Line Continuous goes on forever	$\overleftrightarrow{AB}$ or $\overleftrightarrow{BA}$ ℓ	$\overleftrightarrow{AB}$ ℓ
Plane Flat Surface Goes on forever	3 pts. on the plane, CDE or Capital Script Letter, $\mathcal{S}$	•C •D •E $\mathcal{S}$

Points that lie on the same line are colinear.
Otherwise they are non colinear.
Points that lie on the same plane are coplanar.
Otherwise they are non coplanar.

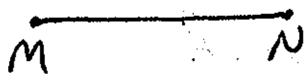
Example 1: A. Name four coplanar points A, B, C, D
B. Name three lines.



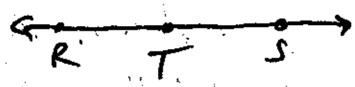
$\overleftrightarrow{AE}$
$\overleftrightarrow{DE}$
$\overleftrightarrow{CE}$
$\overleftrightarrow{BE}$

Term and Definition	How to Label it	Draw it
Segment 2 points and all the points between.	$\overline{AB}$	
Endpoint end of segment	Capital letters	
Ray starting point and goes in one direction for ever.	start with the endpoint first (order matters) $\overrightarrow{CD}$	
Opposite Rays Rays that go in opposite direction. Same starting Point.	$\overrightarrow{EG}$ + $\overrightarrow{EF}$	

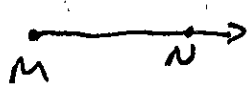
Example 2: A. Draw a segment with endpoints M and N.



B. Draw opposite rays with a common endpoint T.



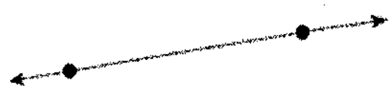
c. Draw and label a ray with endpoint M that contains N.



A Postulate, or axiom, is a statement that is accepted as true without proof. Postulates about points, lines, and planes help describe geometric properties.

Postulates **Points, Lines, and Planes**

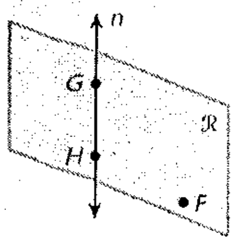
1-1-1 Through any two points there is exactly one line.



1-1-2 Through any three noncollinear points there is exactly one plane containing them.

1-1-3 If two points lie in a plane, then the line containing those points lies in the plane.

Example 3: Name a plane that contains three noncollinear points.



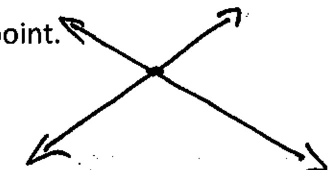
GHF or R

Postulates **Intersection of Lines and Planes**

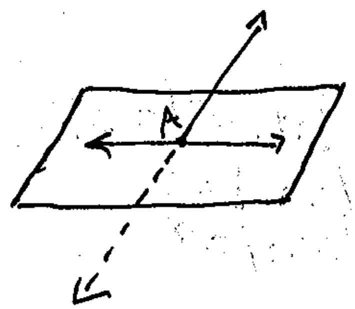
1-1-4 If two lines intersect, then they intersect in exactly one point.

1-1-5 If two planes intersect, then they intersect in exactly one line.

Example 4: A. Sketch two lines intersecting in exactly one point.



B. Sketch a figure that shows two lines intersect in one point in a plane, but only one of the lines lies in the plane.



HOTS Problem

Homework: Page 9, 14-26 Evens, 31-34.

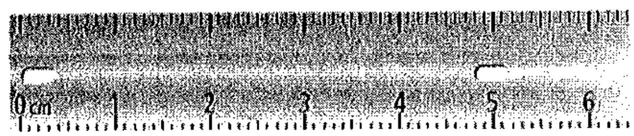
1.2 Measuring and Constructing Segments

Learning Goal: You should be able to use length and midpoint of a segment and construct midpoints and congruent segments.

A ruler can be used to measure the distance between two points. A point corresponds to one and only one number on a ruler. The number is called a ________________. The following postulate summarizes this concept.

Postulate 1-2-1 Ruler Postulate

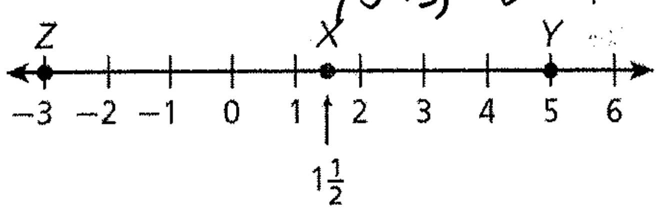
The points on a line can be put into a one-to-one correspondence with the real numbers.



The Distance between any two points is the absolute value of the difference of the coordinates. If the coordinates of points A and B are a and b, then the distance between A and B is $|a - b|$ or $|b - a|$. The distance between A and B is also called the length of $\overline{AB}$, or AB.

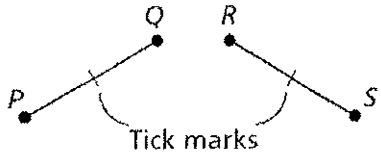
$$AB = |a - b| \text{ or } |b - a|$$

Example 1:
A. Find length XY $|1\tfrac{1}{2} - 5| = 3\tfrac{1}{2}$
B. Find length ZY $|-3-5| = 8$
C. Find length YZ $|5-3| = 8$

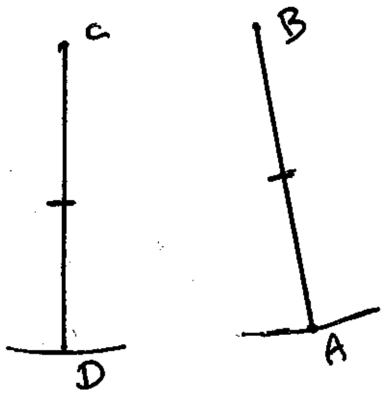


Why are all the lengths in Example 1 positive? Absolute Value

Congruent Segments are segments that have the same length. In the diagram below PQ = RS, so you can write $\overline{PQ} \cong \overline{RS}$. This is read as "segment PQ is congruent to segment RS." tick marks are used in a figure to show congruent segments.



Construct 2 congruent segments:

Construction	Describe the process in your words
	

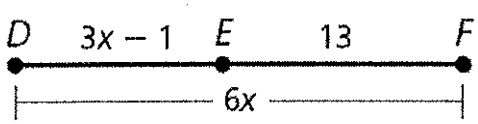
Postulate 1-2-2 Segment Addition Postulate

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

Restate Postulate in your own words.	Draw a diagram

Example 3: A: Y is between X and Z, XZ = 3, and XY = 1 ⅓. Find YZ.

B: E is between D and F. Find DF.



$6(4) = 24$

$DE + EF = DF$

$3x - 1 + 13 = 6x$

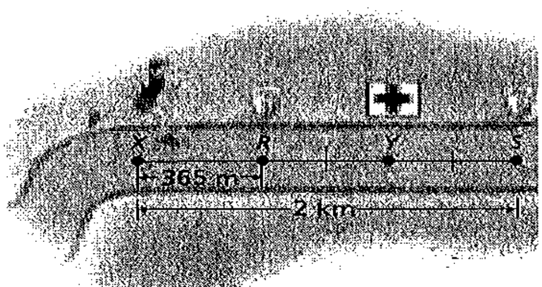
$-3x \quad 12 \quad -3x$

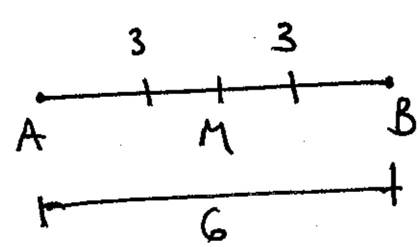
$\frac{12}{3} = \frac{3x}{3}$

$x = 4$

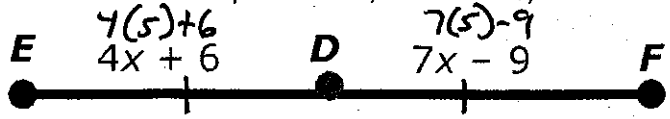
The <u>Midpoint</u>, M of $\overline{AB}$ is the point that bisects, or divides, the segment into two congruent segments. If M is the midpoint of $\overline{AB}$, then AM = MB.
So if AB = 6, then AM = 3 and MB = 3.

Example 4: You are 1182.5 m from the first-aid station. What is the distance to a drink station located at the midpoint between your current location and the first-aid station?



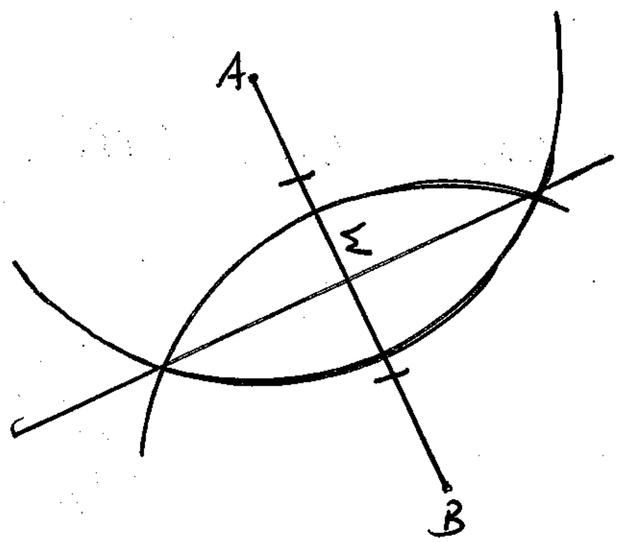


Example 5: D is the midpoint of EF, ED = 4x + 6, and DF = 7x – 9. Find ED, DF, and EF.



$4x+6 = 7x-9$
$-4x \quad +9 \quad -4x \quad +9$
$\frac{15}{3} = \frac{3x}{3}$
$x = 5$

ED = 26 DF = 26 EF = 52

Draw the midpoint of a line segment	Describe the procedure in your own words
	

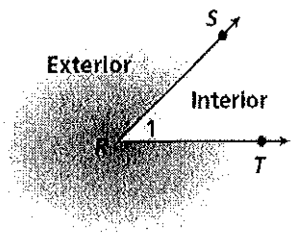
Homework: Page 17, 12-22 Even, 28,32

1.3 Measuring and Constructing Angles

Learning Goal: <u>You should be able to name, classify, measure and construct angles and angle bisectors.</u>

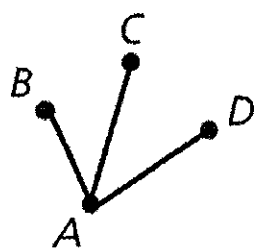
An Angle is a figure formed by two rays, or sides, with a common endpoint called the Vertex (plural: vertices). You can name an angle several ways: by its vertex, by a point on each ray and the vertex, or by a number.

The set of all points between the sides of the angle is the interior of an angle. The exterior of an angle is the set of all points outside the angle.



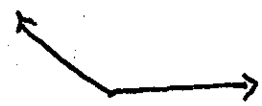
Angle Name: ∠1, ∠R, ∠SRT, ∠TRS

Example 1: A surveyor recorded the angles formed by a transit (point A) and three distant points, B, C, and D. Name three of the angles.

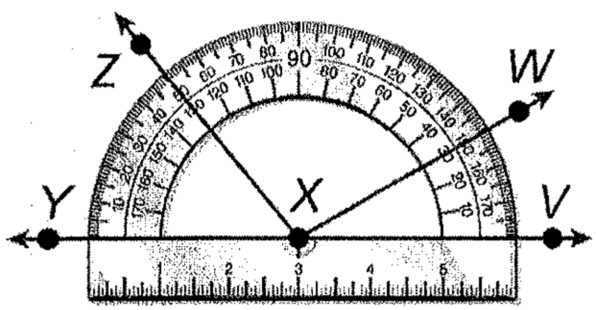


∠BAC, ∠CAD, ∠BAD

Explain why the angle in the above diagram cannot be named Angle A: ____________________

Type of Angle and Definition	Draw an Example and Label Properly
Acute angle less than 90° greater than 0°	
Right angle measure of 90°	
Obtuse angle greater than 90° less than 180°	
Straight angle measure of 180°	

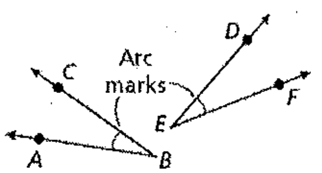
Example 2: Find the measure of each angle. Then classify each as acute, right, or obtuse.

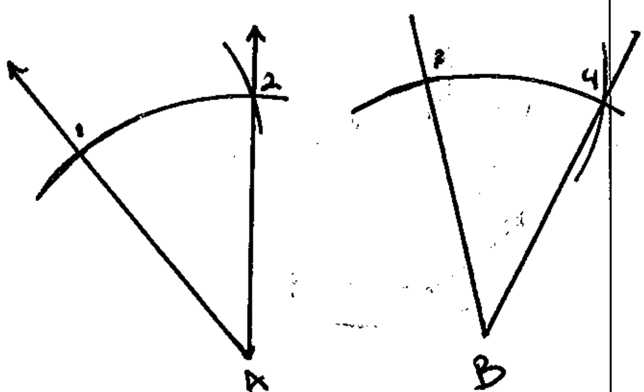


A. $m\angle WXV$ = 30°
Classify: Acute

B. $m\angle ZXW$ = 100°
Classify: obtuse

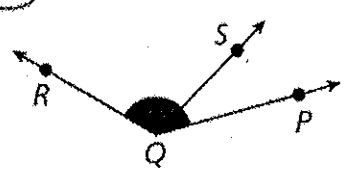
Congruent ∠s are angles that have the same measure. In the diagram, $m\angle ABC = m\angle DEF$, so you can write $\angle ABC \cong \angle DEF$. This is read as "angle ABC is congruent to angle *DEF*."
Arc marks are used to show that the two angles are congruent.



Draw 2 congruent angles	Describe the Steps to this procedure
	1) Draw an angle 2) Draw an arc 3) Draw another line and arc it the same as step 2. 4) Measure and arc from intersection 1 to 2 on angle A 5) Make an Arc from intersection 3 to make intersection 4. 6) Draw a line from the vertex of angle B through intersection 4

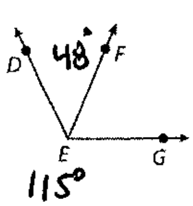
Postulate 1-3-2 **Angle Addition Postulate**

If S is in the interior of $\angle PQR$, then
$m\angle PQS + m\angle SQR = m\angle PQR$.
($\angle$ Add. Post.)



Restate the Postulate in your own words.	Draw it.
add the two parts of the angle to get the whole angle	

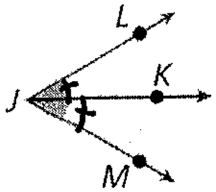
Example 3: **m$\angle$*DEG* = 115°, and m$\angle$*DEF* = 48°. Find m$\angle$*FEG***

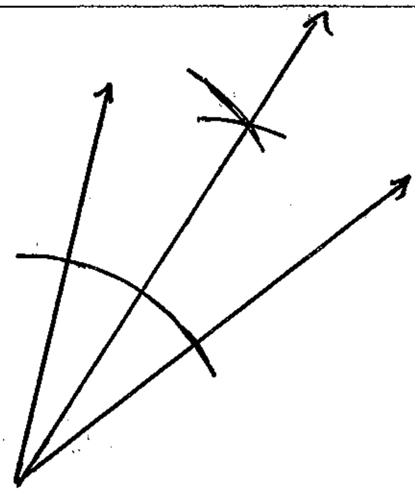


115 − 48 = 67

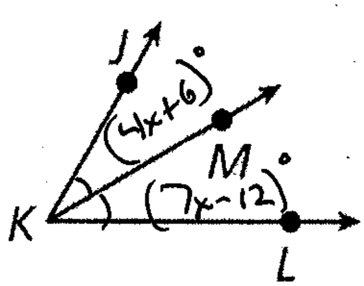
An Angle Bisector is a ray that divides an angle into two congruent angles.

JK bisects ∠*LJM*; thus ∠*LJK* ≅ ∠*KJM*.



Construct an Angle Bisector	Describe the Steps to this procedure
	1) Draw an Angle 2) Make an Arc. on that Angle 3) Keeping the Same measurement from Step 2 make an Arc from both intersection pts. 4) Draw a line from the vertex throught the x formed.

Example 4: ***KM* bisects ∠*JKL*, m∠*JKM* = (4*x* + 6)°, and m∠*MKL* = (7*x* – 12)°. Find m∠*JKM*.**



$4x+6 = 7x-12$
$-4x \ +12 \quad -4x \ +12$

$\frac{18}{3} = \frac{3x}{3} \quad x = 6$

$4(6)+6 = 30$

x = 6 m∠JKM = 30°

Homework:

1.4 Pairs of Angles

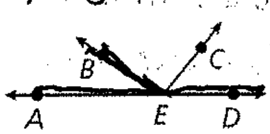
Learning Goal: You should be able to identify and find the measures of adjacent, vertical, complementary, and supplementary angles.

Pairs of Angles	Draw it
Adjacent Angles - common vertex - common side	
Linear Pair - Adjacent ∠s - Non-common sides form a straight ∠	

Tell whether the angles are only adjacent, adjacent and form a linear pair, or not adjacent.

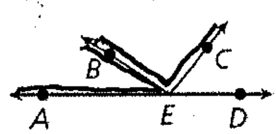
Example 1A: $\angle AEB$ and $\angle BED$

Adj. + L.P.



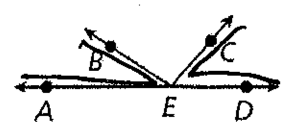
1B: $\angle AEB$ and $\angle BEC$

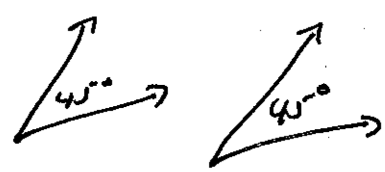
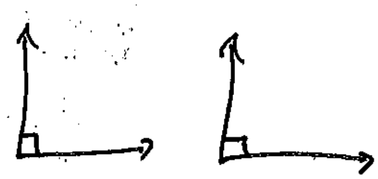
Adj.



1C: $\angle DEC$ and $\angle AEB$

Not Adj.



Type of Angle	**Draw it**
Complementary Angles 2 ∠s that sum to 90°	 45° 45°
Supplementary Angles 2 ∠'s that sum to 180°	

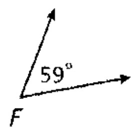
You can find the complement of an angle that measures x° by subtracting its measure from 90°, or $90 - x$

You can find the supplement of an angle that measures x° by subtracting its measure from 180°, or $180 - x$

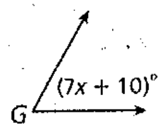
Example 2: Find the measure of each of the following.

A. complement of $\angle F$

$90 - 59 = 31^\circ$



B. supplement of $\angle G$



$180 - (7x + 10)$

$\underbrace{180 - 7x - 10}$

$(170 - 7x)^\circ$

Example 3: **An angle is 10° more than 3 times the measure of its complement. Find the measure of the complement.**

$x = 3(90 - x) + 10$

$x = 270 - 3x + 10$

$x = 280 - 3x$

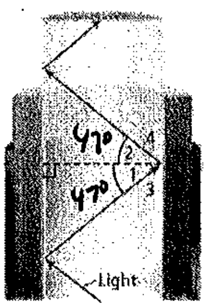
$+3x \quad +3x$

$\frac{4x}{4} = \frac{280}{4} \quad x = 70$

$(90 - 70) = 20$

Example 4: **Light passing through a fiber optic cable reflects off the walls of the cable in such a way that $\angle 1 \cong \angle 2$, $\angle 1$ and $\angle 3$ are complementary, and $\angle 2$ and $\angle 4$ are complementary.**

If $m\angle 1 = 47°$, find $m\angle 2$, $m\angle 3$, and $m\angle 4$.

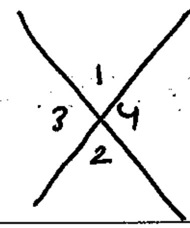


$m\angle 2 = 47^\circ$

$m\angle 3 = 90 - 47 = 43^\circ$

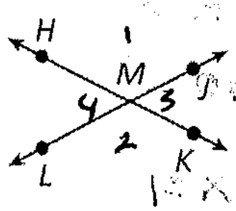
$m\angle 4 = 90 - 47 = 43^\circ$

Another angle pair relationship ~~exists between~~ two angles whose sides form two pairs of opposite rays. ______________ Vertical ∠'s are two nonadjacent ~~angles formed~~ by two intersecting lines. ______________ are vertical angles, as are ______________.

Type of Angle	Draw it
Vertical Angles ∠'s that share only a vertex and are across from each other.	 ∠1 + ∠2 ∠3 + ∠4

Example 5: **Name the pairs of vertical angles.**

∠1 And ∠2 ∠4 and ∠3



Homework: Page 32, # 14-30 Even, 34-37

1.6 Midpoint and Distance in the Coordinate Plane

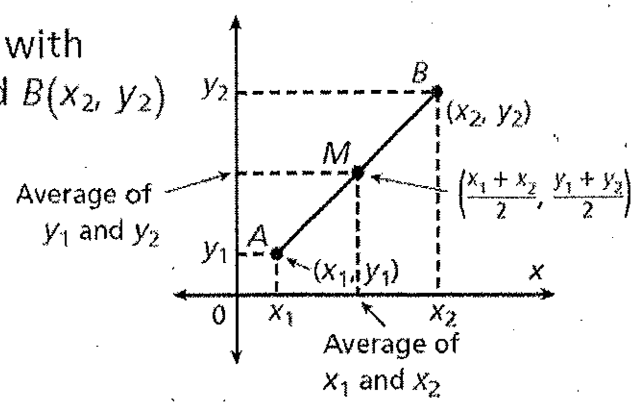
Learning Goal: You should be able to develop and apply the formula for midpoint, distance and the Pythagorean Theorem.

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)**. The midpoint is the** Average **of the x's, and the** average **of the y's.**

Midpoint Formula

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

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



Rewrite the Midpoint Formula sot you understand it.

- Add your X values and divide by 2
- Add your Y values and divide by 2

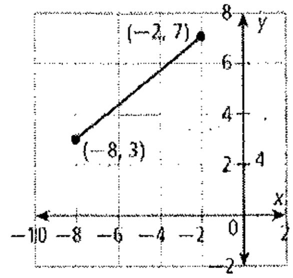
Example 1: A. **Find the coordinates of the midpoint of *PQ* with endpoints *P*(–8, 3) and *Q*(–2, 7).**

$(-2, 7)$ $(-8, 3)$

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

$\left(\frac{-10}{2}, \frac{10}{2}\right)$

$(-5, 5)$



B. Draw your own Midpoint Problem and have a partner solve it for you.

Example 2: ***M* is the midpoint of *XY*. *X* has coordinates (2, 7) and *M* has coordinates (6, 1). Find the coordinates of *Y*.**

M = (6, 1) X = (2, 7) y = (10, -5)

$6 = \frac{2+x}{2}$ $1 = \frac{7+y}{2}$

$2(6) = \left(\frac{2+x}{2}\right)2$ $2(1) = \left(\frac{7+y}{2}\right)2$

$12 = 2 + x$ $2 = 7 + y$

$-2 \quad -2$ $-7 \quad -7$

$x = 10$ $-5 = y$

Homework: Page 47, 12-15, 24,25,27

Distance Formula

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

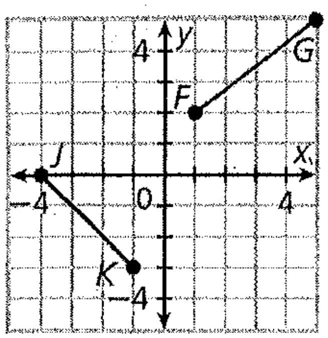
$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$

Write the Distance Formula in your own Words.
The difference in the x values squared plus the difference in the y values squared. Then square root the answer.

Example 3: **Find *FG* and *JK*. Then determine whether $\overline{FG} \cong \overline{JK}$.**

F = (1 , 2) G = (5 , 5)

J = (-4 , 0) K = (-1 , -3)



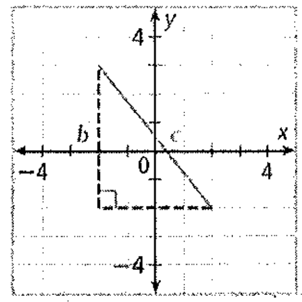
$FG = \sqrt{(5-1)^2 + (5-2)^2} = \sqrt{25} = 5$

$JK = \sqrt{(-1 - -4)^2 + (-3-0)^2} = \sqrt{18} = 3\sqrt{2}$

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

<u>Distance Formula:</u>

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

10.3

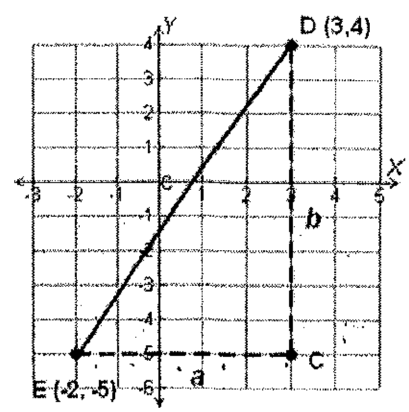
<u>Pythagorean Theorem:</u>

$5^2+9^2=c^2$

$25+81=c^2$

$\sqrt{106}=\sqrt{c^2}$

$c=10.3$

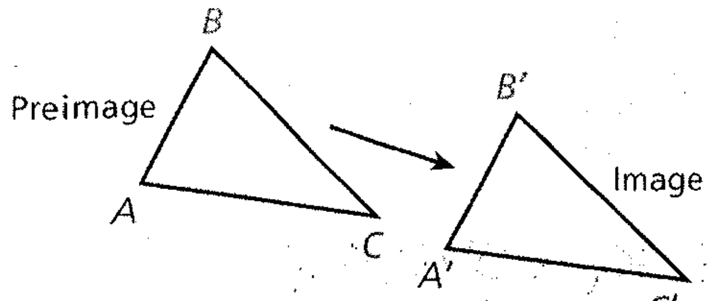


Homework: Page 47, 16-23, 27-28,30

1.7 Transformations in the Coordinate Plane

Learning Goal: You should be able to identify and graph reflections, rotations, and translations in the coordinate plane.

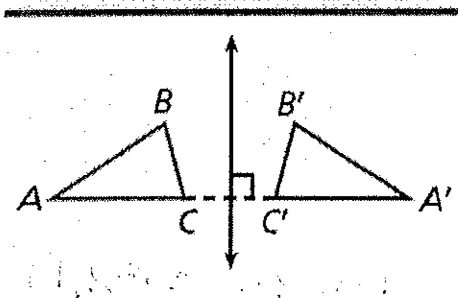
A Transformation **is a change in the position, size, or shape of a figure. The original figure is called the** preimage**. The resulting figure is called the** Image**. A transformation *maps* the preimage to the image. (→) is used to describe a transformation, and (′) are used to label the image.**



$\triangle ABC \rightarrow \triangle A'B'C'$

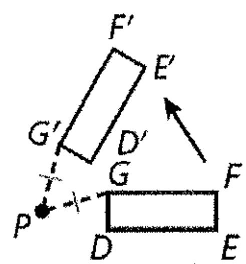
Transformations

REFLECTION



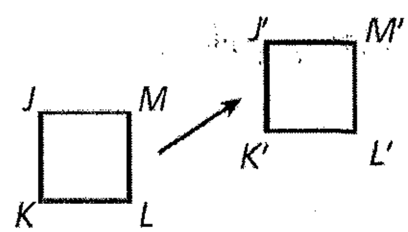
A **reflection** (or *flip*) is a transformation across a line, called the line of reflection. Each point and its image are the same distance from the line of reflection.

ROTATION



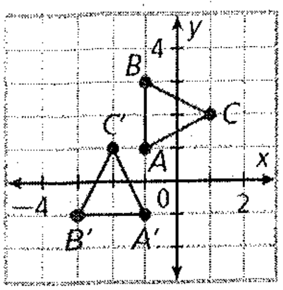
A **rotation** (or *turn*) is a transformation about a point *P*, called the center of rotation. Each point and its image are the same distance from *P*.

TRANSLATION



A **translation** (or *slide*) is a transformation in which all the points of a figure move the same distance in the same direction.

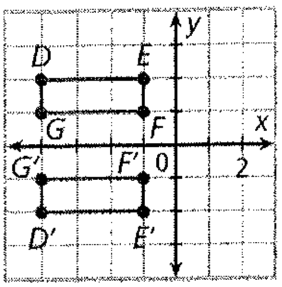
Example 1A: **Identify the transformation. Then use arrow notation to describe the transformation.**



Rotation

ABC → A'B'C'

Example 1B: **Identify the transformation. Then use arrow notation to describe the transformation.**

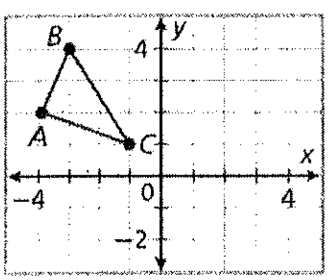


Reflection DEFG → D'E'F'G'

To find coordinates for the image of a figure in a translation, add *a* to the *x*-coordinates of the pre-image and add *b* to the *y*-coordinates of the preimage. Translations can also be described by a rule such as

$(x, y) \rightarrow ($ $x+a, y+b$ **$)$**

Example 3: **Find the coordinates for the image of ΔABC after the translation $(x, y) \rightarrow (x + 2, y - 1)$. Draw the image.**



A (−4, 2) A' −4+2, 2−1 = (−2, 1)

B (−3, 4) B' −3+2, 4−1 = (1, 1)

C (−1, 1) C' −1+2, 1−1 = (1, 0)

Homework: Page 53, 8-26 Even