MAT-222-840

Activities for Chapter 1

Name: ____________________

Spring 2017

Date: ____________________

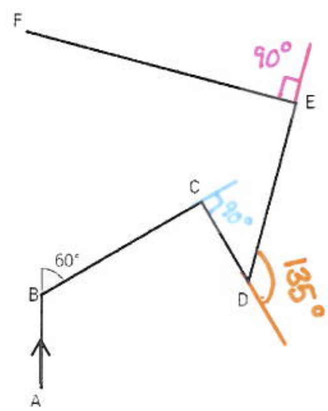
Activity #1: Guide the Robot

The map in the next figure shows a route that you must program Dave, a robot, to "walk." On the map, ½ inch represents 5 of Dave's paces. Dave starts at point A, facing the route, so that he is ready to start walking along it. Use a protractor and a ruler to help you describe how Dave should get to point F.

For example, here's what Dave should do to get from point A to point C:

> Starting at A, go 5 paces to B. At B, turn clockwise (to your right) 60°. Go another 10 paces to C.

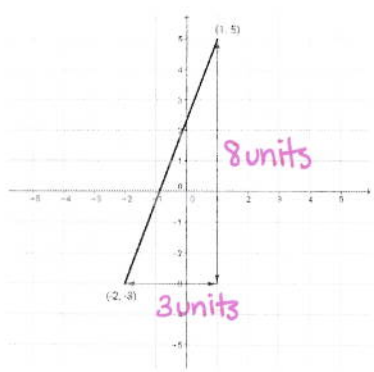
Each step should have a turn direction (clockwise/counterclockwise), a number of degrees, and a number of paces.



From:	Turn Direction	# of degrees	# of paces
C to D	Clockwise	90°	5 paces
D to E	Counterclockwise	135°	10 paces
E to F	counterclockwise	90°	15 paces

Activity #2: The Distance Formula

Use the picture below, which represents finding the distance from $(-2,-3)$ to $(1,5)$, and the Pythagorean Theorem (provided below) to find the distance between these points.



> **Pythagorean Theorem**
> If a and b are the lengths of legs of a right triangle and c is the length its hypotenuse, then
> $$a^2 + b^2 = c^2$$

Find the distance by using the Pythagorean Theorem:

$$3^2 + 8^2 = c^2$$
$$73 = c^2 \longrightarrow c = \sqrt{73} \approx 8.54 \text{ units}$$

Find the distance by using the distance formula:

$$d = \sqrt{(1-(-2))^2 + (5-(-3))^2} = \sqrt{3^2 + 8^2} = \sqrt{73} \approx 8.54 \text{ units}$$

Activity #5: The Midpoint Formula

Points $P(-4,6), Q(2,4)$, and R are collinear. One of the points is the midpoint of the segment formed by the other two points.

What are the possible coordinates of R?

If R is the midpoint of P & Q: $R = \left(\frac{-4+2}{2}, \frac{6+4}{2}\right) = \boxed{(1,5)}$

If Q is the midpoint of R & P: $R = (x,y)$ where $(2,4) = \left(\frac{-4+x}{2}, \frac{6+y}{2}\right)$

$2 = \frac{-4+x}{2}$

$4 = -4+x$

$x = 8$

$\frac{6+y}{2} = 4$

$6+y = 8$

$y = 2$

$\boxed{R = (8,2)}$

If P is the midpoint of R & Q:

$R = (x,y)$ where $(-4,6) = \left(\frac{2+x}{2}, \frac{4+y}{2}\right)$

$\frac{2+x}{2} = -4$

$2+x = -8$

$x = -10$

$\frac{4+y}{2} = 6$

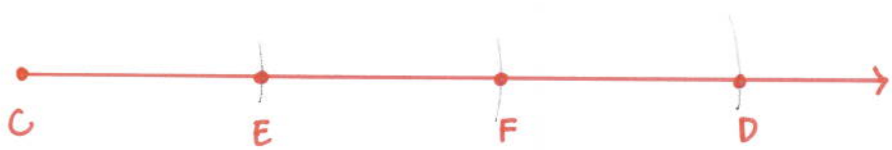
$4+y = 12$

$y = 8$

$\boxed{R = (-10,8)}$

Activity #6: Geometry Constructions

1. Construct a segment $\overline{CD}$ that is three times as long as $\overline{AB}$.



Step 1: Construct a ray from pt C.

Step 2: Use a compass to measure AB & copy this distance to ray $\overrightarrow{CE}$

Step 3: Repeat the distance from E to F and F to D.

Step 4: Mark pt D.

Exam 1 Tip: I highly recommend that you practice the following constructions until you can produce them from memory!

EXAMPLE 1 **Constructing Congruent Segments**

Construct a segment congruent to a given segment.

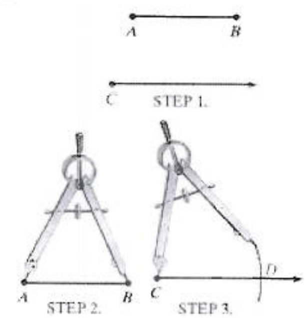
Given: $\overline{AB}$
Construct: $\overline{CD}$ so that $\overline{CD} \cong \overline{AB}$

Solution

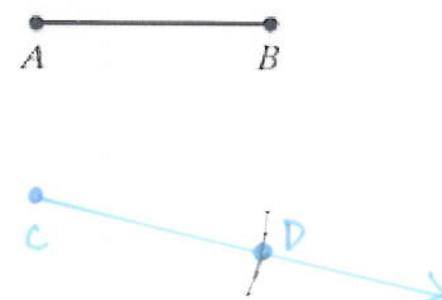
STEP 1. Draw a ray with endpoint C.

STEP 2. Open the compass to the length of $\overline{AB}$.

STEP 3. With the same compass setting, put the compass point on point C. Draw an arc that intersects the ray. Label the point of intersection D.



The segments are congruent, or $\overline{CD} \cong \overline{AB}$.



EXAMPLE 2 **Constructing Congruent Angles**

Construct an angle congruent to a given angle.

Given: $\angle A$
Construct: $\angle S$ so that $\angle S \cong \angle A$

Solution

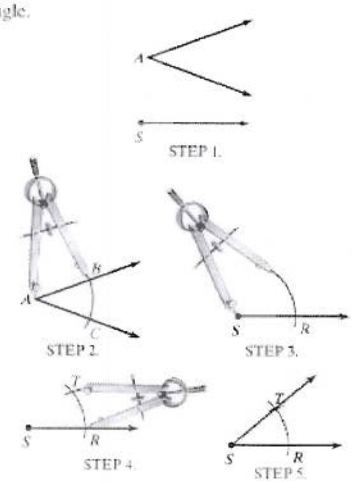
STEP 1. Draw a ray with endpoint S.

STEP 2. With the compass point on vertex A, draw an arc that intersects the sides of $\angle A$. Label the points of intersection B and C.

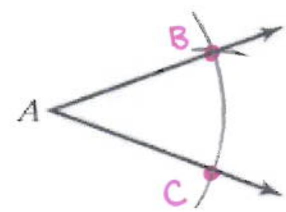
STEP 3. With the same compass setting, put the compass point on point S. Draw an arc and label its point of intersection with the ray as R.

STEP 4. Open the compass to the length BC. Keeping the same compass setting, put the compass point on R. Draw an arc to locate point T.

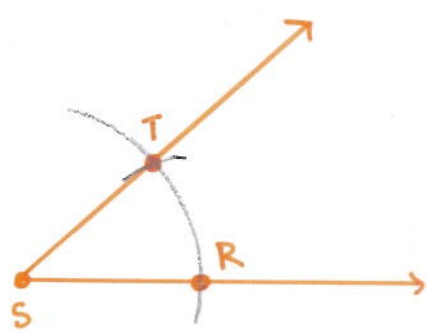
STEP 5. Draw $\overrightarrow{ST}$.



The angles are congruent, or $\angle S \cong \angle A$.



On Exam 1, I will look for markings identical to those on this page.



EXAMPLE 3 **Constructing the Perpendicular Bisector**

Construct the perpendicular bisector of a segment.

Given: $\overline{AB}$

Construct: $\overleftrightarrow{XY}$ so that $\overleftrightarrow{XY}$ is the perpendicular bisector of $\overline{AB}$.

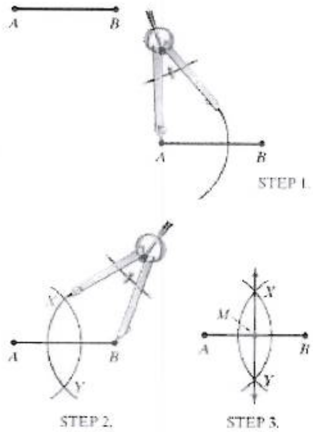
Solution

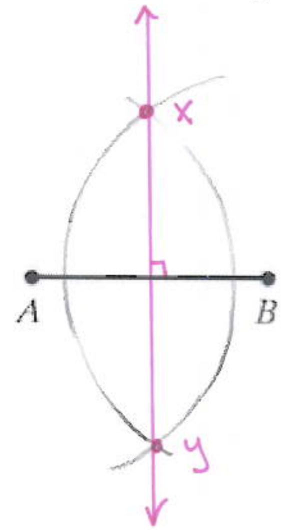
STEP 1. Put the compass point on point A and draw a long arc as shown. Be sure the opening is greater than $\frac{1}{2}AB$.

STEP 2. With the same compass setting, put the compass point on point B and draw another long arc. Label the points where the two arcs intersect as X and Y.

STEP 3. Draw $\overleftrightarrow{XY}$. Label the point of intersection of $\overline{AB}$ and $\overleftrightarrow{XY}$ as M, the midpoint of $\overline{AB}$.

$\overleftrightarrow{XY} \perp \overline{AB}$ at midpoint M, so $\overleftrightarrow{XY}$ is the perpendicular bisector of $\overline{AB}$. □





EXAMPLE 4 **Constructing the Angle Bisector**

Construct the bisector of an angle.

Given: $\angle A$

Construct: $\overrightarrow{AD}$, the bisector of $\angle A$

Solution

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

STEP 2. Put the compass point on point C and draw an arc. With the same compass setting, draw an arc using point B. Be sure the arcs intersect. Label the point where the two arcs intersect as D.

STEP 3. Draw $\overrightarrow{AD}$.

$\overrightarrow{AD}$ is the angle bisector of $\angle CAB$. □