Name ______________________ Date __________

Let's Get This Started!

Points, Lines, Planes, Rays, and Line Segments

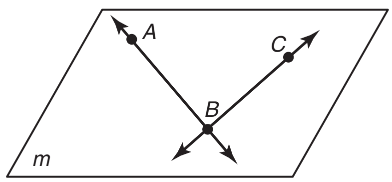
Vocabulary

Write the term that best completes each statement.

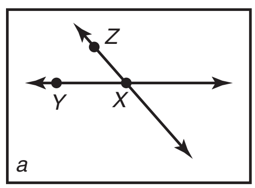
1. A geometric figure created without using tools is a(n) sketch.
2. Skew lines are two or more lines that are not in the same plane.
3. A(n) point is a location in space.
4. The points where a line segment begins and ends are the endpoints of a line segment.
5. A(n) line is a straight continuous arrangement of an infinite number of points.
6. Two or more line segments of equal measure are congruent line segments.
7. You construct a geometric figure when you use only a compass and straightedge.
8. Points that are all located on the same line are collinear points.
9. A(n) line segment is a portion of a line that includes two points and all of the collinear points between the two points.
10. A flat surface is a(n) plane.
11. A(n) ray is a portion of a line that begins with a single point and extends infinitely in one direction.
12. Two or more lines located in the same plane are coplanar lines.
13. When you draw a geometric figure, you use tools such as a ruler, straightedge, compass, or protractor.

Problem Set

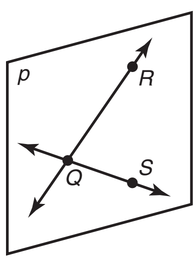
Identify the point(s), line(s), and plane(s) in each figure.

1. 

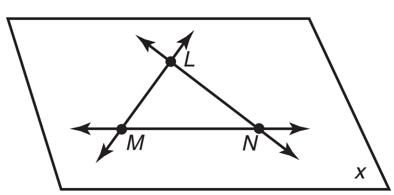
Points: A, B, and C
Lines: $\overleftrightarrow{AB}$ and $\overleftrightarrow{BC}$
Plane: m

2. 

Points: X, Y, and Z
Lines: $\overleftrightarrow{XY}$ and $\overleftrightarrow{XZ}$
Plane: a

3. 

Points: R, S, and Q
Lines: $\overleftrightarrow{QR}$ and $\overleftrightarrow{QS}$
Plane: p

4. 

Points: L, M, and N
Lines: $\overleftrightarrow{LM}$, $\overleftrightarrow{LN}$, and $\overleftrightarrow{MN}$
Plane: x

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Draw a figure for each description. Label all points mentioned in the description.

5. Points *R*, *S*, and *T* are collinear such that point *T* is located halfway between points *S* and *R*.

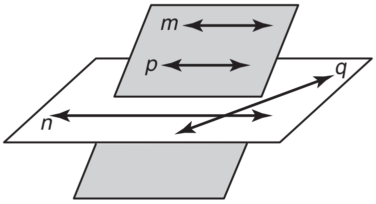
6. Points *A*, *D*, and *X* are collinear such that point *A* is located halfway between points *D* and *X*.

7. Points *A*, *B*, and *C* are collinear such that point *B* is between points *A* and *C* and the distance between points *A* and *B* is twice the distance between points *B* and *C*.

8. Points *F*, *G*, and *H* are collinear such that point *F* is between points *G* and *H* and the distance between points *F* and *G* is one third the distance between points *G* and *H*.

Identify all examples of coplanar lines in each figure.

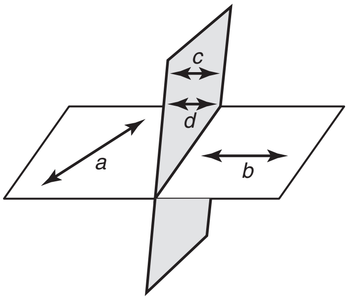
9.



Lines *m* and *p* are coplanar.

Lines *n* and *q* are coplanar.

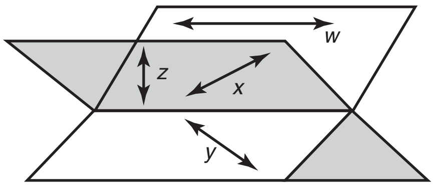
10.



Lines *a* and *b* are coplanar.

Lines *c* and *d* are coplanar.

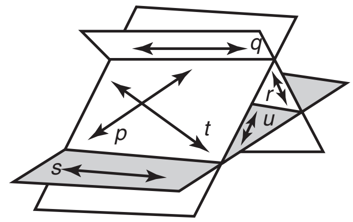
11.



Lines *x* and *z* are coplanar.

Lines *w* and *y* are coplanar.

12.



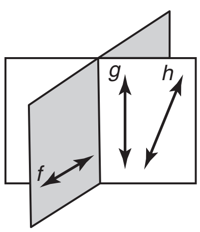
Lines *p* and *t* are coplanar.

Lines *q* and *r* are coplanar.

Lines *s* and *u* are coplanar.

Identify all skew lines in each figure.

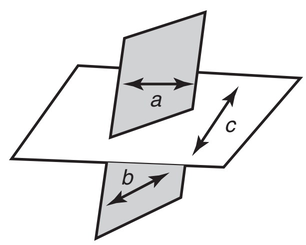
13.



Lines *f* and *g* are skew.

Lines *f* and *h* are skew.

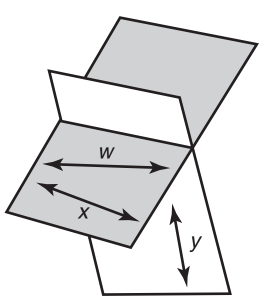
14.



Lines *a* and *c* are skew.

Lines *b* and *c* are skew.

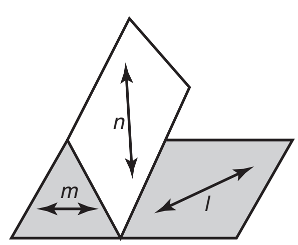
15.



Lines *w* and *y* are skew.

Lines *x* and *y* are skew.

16.



Lines *l* and *n* are skew.

Lines *m* and *n* are skew.

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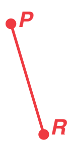
Draw and label an example of each geometric figure.

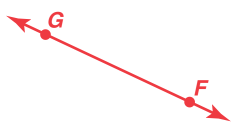
17. $\overleftrightarrow{XY}$

18. $\overline{CD}$

19. $\overline{PR}$

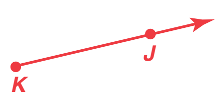


20. $\overleftrightarrow{FG}$



21. $\overleftrightarrow{HM}$

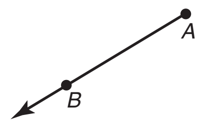
22. $\overrightarrow{KJ}$



Use symbols to write the name of each geometric figure.

23. 

$\overline{RT}$

24. 

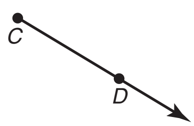
$\overrightarrow{AB}$

25. 

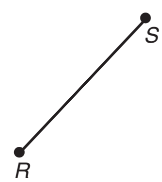
$\overleftrightarrow{XY}$

26. 

$\overleftrightarrow{MN}$

27. 

$\overrightarrow{CD}$

28. 

$\overline{RS}$

Use a ruler to measure each segment to the nearest centimeter. Then use symbols to express the measure of each segment.

29. 

$AB = 4$ centimeters or $m\,\overline{AB} = 4$ centimeters

30. 

$AB = 6$ centimeters or $m\,\overline{AB} = 6$ centimeters

31. 

$AB = 3.5$ centimeters or $m\,\overline{AB} = 3.5$ centimeters

32. 

$AB = 5.2$ centimeters or $m\,\overline{AB} = 5.2$ centimeters

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Attack of the Clones

Translating and Constructing Line Segments

Vocabulary

Choose the term from the box that best completes each statement.

Distance Formula	transformation	pre-image
rigid motion	translation	arc
copying (duplicating) a line segment	image	

1. A(n) ___rigid motion___ is a transformation of points in space.

2. The new figure created from a translation is called the ___image___.

3. A(n) ___arc___ is a part of a circle and can be thought of as the curve between two points on a circle.

4. A(n) ___transformation___ is the mapping, or movement, of all the points of a figure in a plane according to a common operation.

5. The ___Distance Formula___ can be used to calculate the distance between two points on a coordinate place.

6. In a translation, the original figure is called the ___pre-image___.

7. A(n) ___translation___ is a rigid motion that "slides" each point of a figure the same distance and direction.

8. A basic geometric construction called ___copying (or duplicating) a line segment___ can be used to translate a line segment when measurement is not possible.

Problem Set

Calculate the distance between each given pair of points. Round your answer to the nearest tenth, if necessary.

1. (3, 1) and (6, 5)

$x_1 = 3, y_1 = 1, x_2 = 6, y_2 = 5$

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

$d = \sqrt{(6 - 3)^2 + (5 - 1)^2}$

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

$d = \sqrt{9 + 16}$

$d = \sqrt{25}$

$d = 5$

2. (2, 8) and (4, 3)

$x_1 = 2, y_1 = 8, x_2 = 4, y_2 = 3$

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

$d = \sqrt{(4 - 2)^2 + (3 - 8)^2}$

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

$d = \sqrt{4 + 25}$

$d = \sqrt{29}$

$d \approx 5.4$

3. (−6, 4) and (5, −1)

$x_1 = -6, y_1 = 4, x_2 = 5, y_2 = -1$

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

$d = \sqrt{[5 - (-6)]^2 + [(-1) - 4]^2}$

$d = \sqrt{11^2 + (-5)^2}$

$d = \sqrt{121 + 25}$

$d = \sqrt{146}$

$d \approx 12.1$

4. (9, −2) and (2, −9)

$x_1 = 9, y_1 = -2, x_2 = 2, y_2 = -9$

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

$d = \sqrt{(2 - 9)^2 + [(-9) - (-2)]^2}$

$d = \sqrt{(-7)^2 + (-7)^2}$

$d = \sqrt{49 + 49}$

$d = \sqrt{98}$

$d \approx 9.9$

5. (0, −6) and (8, 0)

$x_1 = 0, y_1 = -6, x_2 = 8, y_2 = 0$

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

$d = \sqrt{(8 - 0)^2 + [0 - (-6)]^2}$

$d = \sqrt{8^2 + 6^2}$

$d = \sqrt{64 + 36}$

$d = \sqrt{100}$

$d = 10$

6. (−5, −8) and (−2, −9)

$x_1 = -5, y_1 = -8, x_2 = -2, y_2 = -9$

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

$d = \sqrt{[(-2) - (-5)]^2 + [(-9) - (-8)]^2}$

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

$d = \sqrt{9 + 1}$

$d = \sqrt{10}$

$d \approx 3.2$

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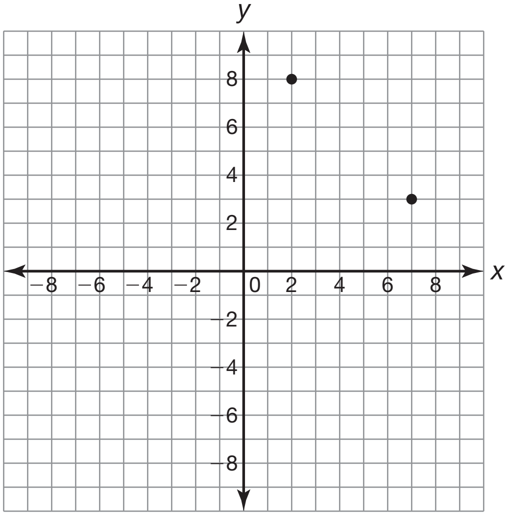
Calculate the distance between each given pair of points on the coordinate plane. Round your answer to the nearest tenth, if necessary.

7.



$x_1 = 2, y_1 = 8, x_2 = 7, y_2 = 3$

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

$d = \sqrt{(7 - 2)^2 + (3 - 8)^2}$

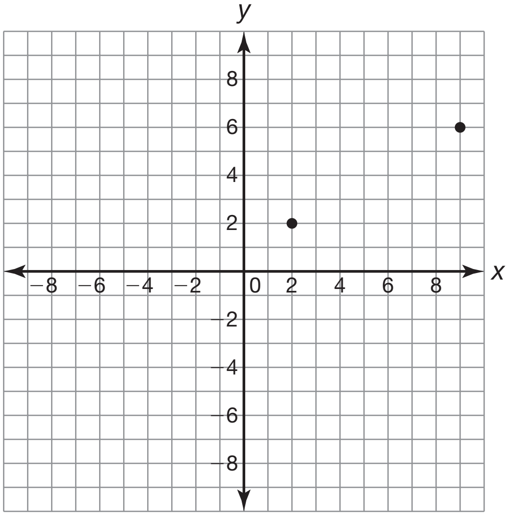
$d = \sqrt{5^2 + (-5)^2}$

$d = \sqrt{25 + 25}$

$d = \sqrt{50}$

$d \approx 7.1$

8.



$x_1 = 2, y_1 = 2, x_2 = 9, y_2 = 6$

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

$d = \sqrt{(9 - 2)^2 + (6 - 2)^2}$

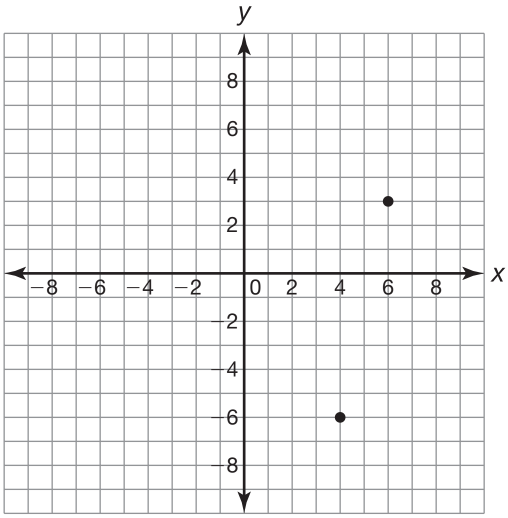
$d = \sqrt{7^2 + 4^2}$

$d = \sqrt{49 + 16}$

$d = \sqrt{65}$

$d \approx 8.1$

9.



$x_1 = 4, y_1 = -6, x_2 = 6, y_2 = 3$

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

$d = \sqrt{(6 - 4)^2 + [3 - (-6)]^2}$

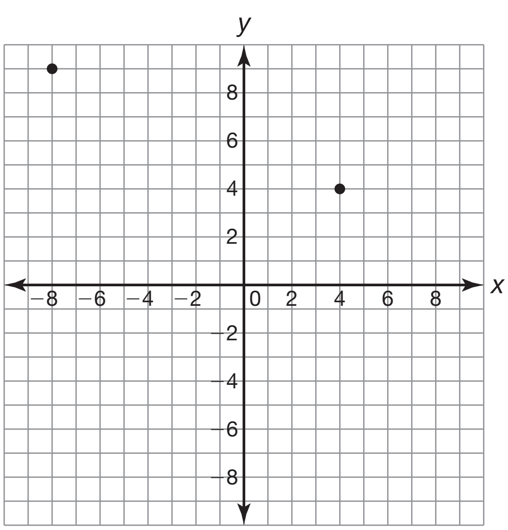
$d = \sqrt{2^2 + 9^2}$

$d = \sqrt{4 + 81}$

$d = \sqrt{85}$

$d \approx 9.2$

10.



$x_1 = -8, y_1 = 9, x_2 = 4, y_2 = 4$

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

$d = \sqrt{[4 - (-8)]^2 + (4 - 9)^2}$

$d = \sqrt{12^2 + (-5)^2}$

$d = \sqrt{144 + 25}$

$d = \sqrt{169}$

$d = 13$

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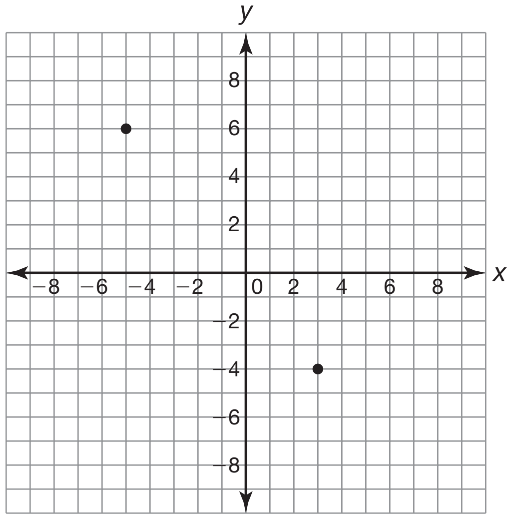
11.



$x_1 = -5, y_1 = 6, x_2 = 3, y_2 = -4$

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

$d = \sqrt{[3 - (-5)]^2 + (-4 - 6)^2}$

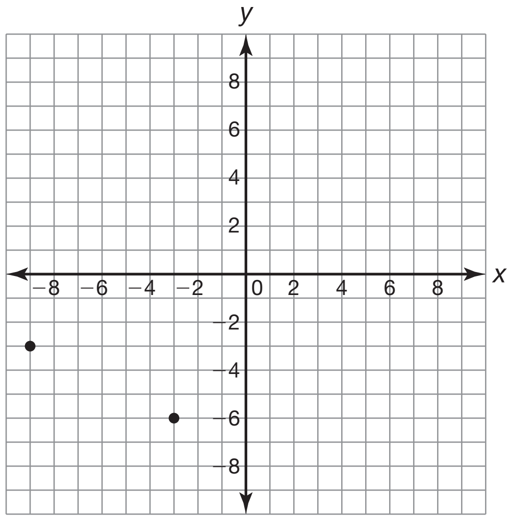
$d = \sqrt{8^2 + (-10)^2}$

$d = \sqrt{64 + 100}$

$d = \sqrt{164}$

$d \approx 12.8$

12.



$x_1 = -9, y_1 = -3, x_2 = -3, y_2 = -6$

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

$d = \sqrt{[(-3) - (-9)]^2 + [(-6) - (-3)]^2}$

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

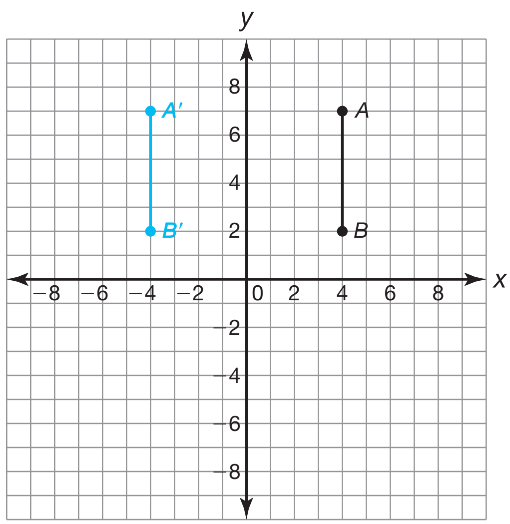
$d = \sqrt{36 + 9}$

$d = \sqrt{45}$

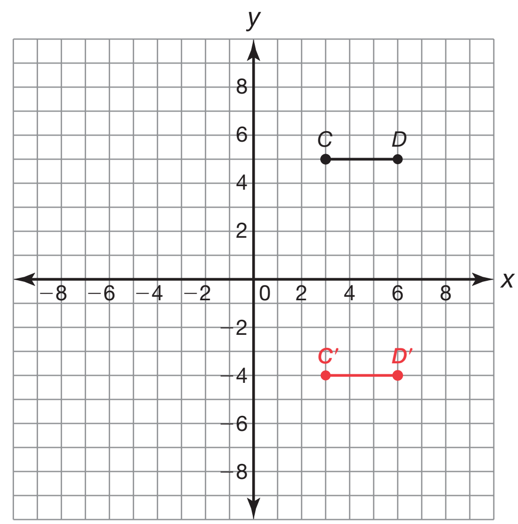
$d \approx 6.7$

Translate each given line segment on the coordinate plane as described.

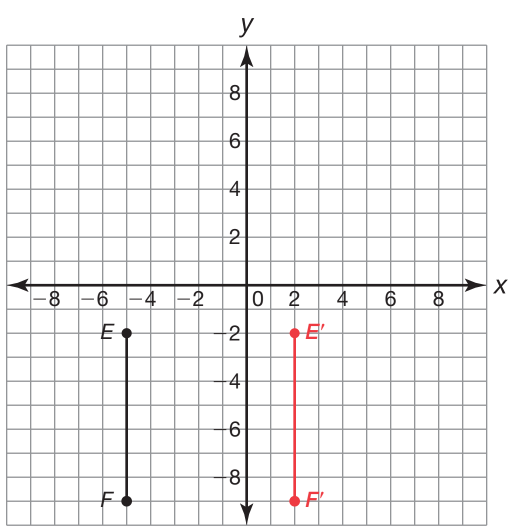
13. Translate $\overline{AB}$ 8 units to the left.



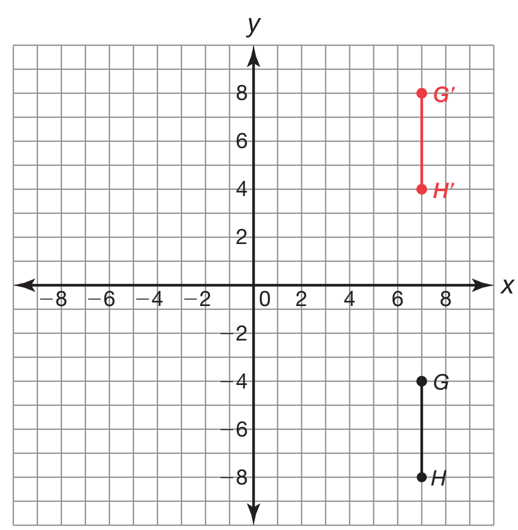
14. Translate $\overline{CD}$ 9 units down.



15. Translate $\overline{EF}$ 7 units to the right.



16. Translate $\overline{GH}$ 12 units up.



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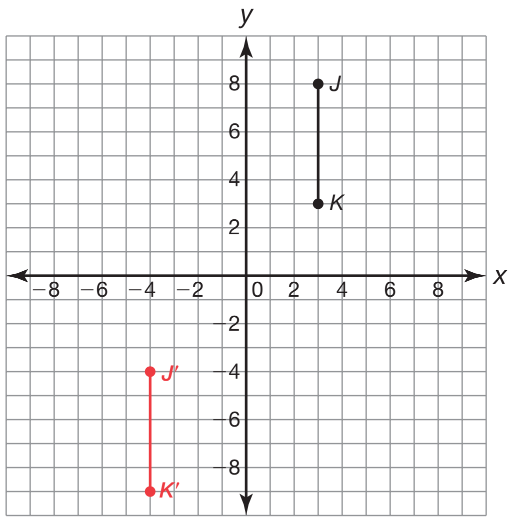
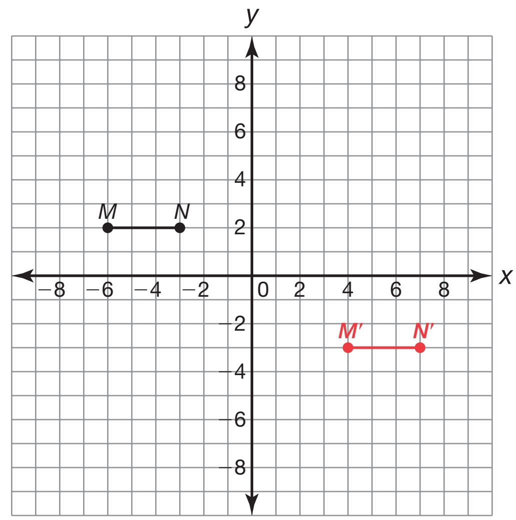
17. Translate $\overline{JK}$ 12 units down and 7 units to the left.

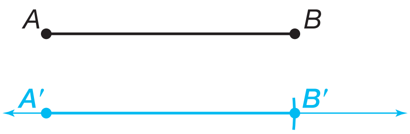


18. Translate $\overline{MN}$ 5 units down and 10 units to the right.

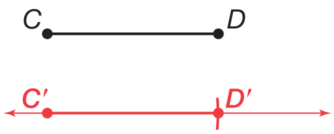


Construct each line segment described.

19. Duplicate $\overline{AB}$.



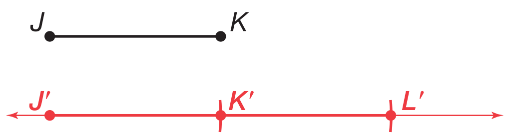
20. Duplicate $\overline{CD}$.



21. Duplicate $\overline{EF}$.

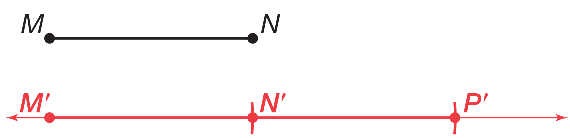
22. Duplicate $\overline{GH}$.

23. Construct a line segment twice the length of $\overline{JK}$.



$\overline{J'L'}$ is twice the length of $\overline{JK}$.

24. Construct a line segment twice the length of $\overline{MN}$.



$\overline{M'P'}$ is twice the length of $\overline{MN}$.

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Stuck in the Middle
Midpoints and Bisectors

Vocabulary

Match each definition to the corresponding term.

1. midpoint
c.

2. Midpoint Formula
d.

3. segment bisector
a.

4. bisecting a line segment
b.

a. a line, line segment, or ray that divides a line segment into two line segments of equal measure

b. a basic geometric construction used to locate the midpoint of a line segment

c. a point exactly halfway between the endpoints of a line segment

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

Problem Set

Determine the midpoint of a line segment with each set of given endpoints.

1. (8, 0) and (4, 6)

$x_1 = 8, y_1 = 0$

$x_2 = 4, y_2 = 6$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{8 + 4}{2}, \frac{0 + 6}{2}\right)$$
$$= \left(\frac{12}{2}, \frac{6}{2}\right)$$
$$= (6, 3)$$

2. (3, 8) and (9, 10)

$x_1 = 3, y_1 = 8$

$x_2 = 9, y_2 = 10$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{3 + 9}{2}, \frac{8 + 10}{2}\right)$$
$$= \left(\frac{12}{2}, \frac{18}{2}\right)$$
$$= (6, 9)$$

3. (−7, 2) and (3, 6)

$x_1 = -7, y_1 = 2$

$x_2 = 3, y_2 = 6$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{-7 + 3}{2}, \frac{2 + 6}{2}\right)$$
$$= \left(\frac{-4}{2}, \frac{8}{2}\right)$$
$$= (-2, 4)$$

4. (6, −3) and (−4, 5)

$x_1 = 6, y_1 = -3$

$x_2 = -4, y_2 = 5$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{6 + (-4)}{2}, \frac{-3 + 5}{2}\right)$$
$$= \left(\frac{2}{2}, \frac{2}{2}\right)$$
$$= (1, 1)$$

5. (−10, −1) and (0, 4)

$x_1 = -10, y_1 = -1$

$x_2 = 0, y_2 = 4$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{-10 + 0}{2}, \frac{-1 + 4}{2}\right)$$
$$= \left(\frac{-10}{2}, \frac{3}{2}\right)$$
$$= (-5, 1.5)$$

6. (−2, 7) and (−8, −9)

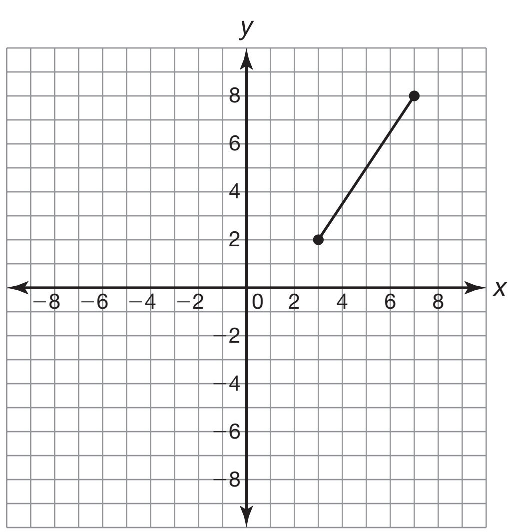
$x_1 = -2, y_1 = 7$

$x_2 = -8, y_2 = -9$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{-2 + (-8)}{2}, \frac{7 + (-9)}{2}\right)$$
$$= \left(\frac{-10}{2}, \frac{-2}{2}\right)$$
$$= (-5, -1)$$

Determine the midpoint of the given line segment on each coordinate plane using the Midpoint Formula.

7.



$x_1 = 3, y_1 = 2$

$x_2 = 7, y_2 = 8$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{3 + 7}{2}, \frac{2 + 8}{2}\right)$$
$$= \left(\frac{10}{2}, \frac{10}{2}\right)$$
$$= (5, 5)$$

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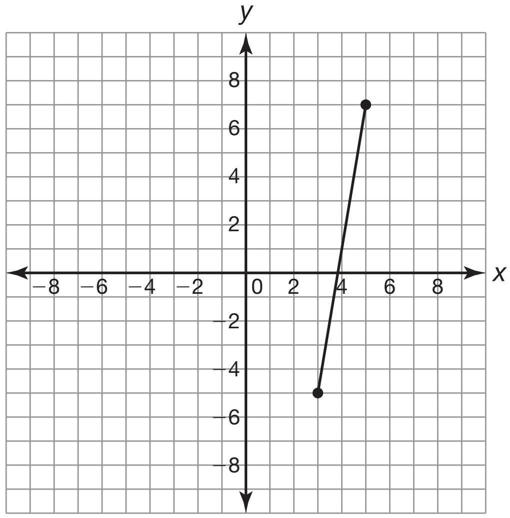
8.

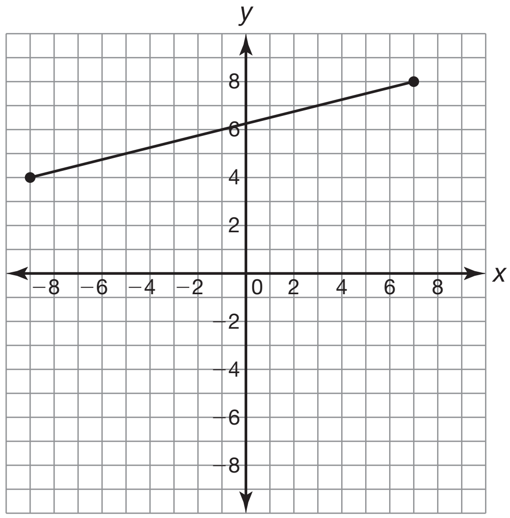


$x_1 = 3, y_1 = -5$

$x_2 = 5, y_2 = 7$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{3 + 5}{2}, \frac{-5 + 7}{2}\right)$$
$$= \left(\frac{8}{2}, \frac{2}{2}\right)$$
$$= (4, 1)$$

9.

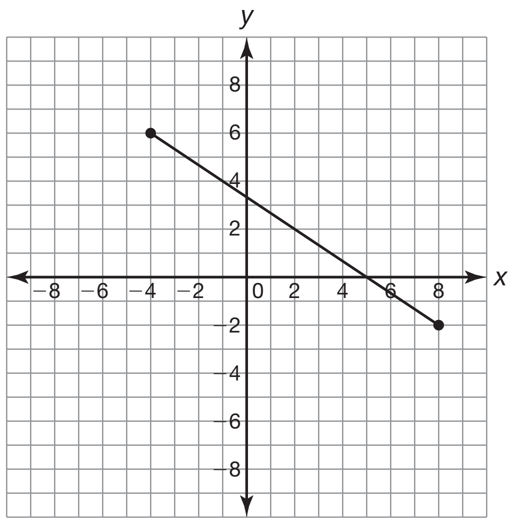


$x_1 = -9, y_1 = 4$

$x_2 = 7, y_2 = 8$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{-9 + 7}{2}, \frac{4 + 8}{2}\right)$$
$$= \left(\frac{-2}{2}, \frac{12}{2}\right)$$
$$= (-1, 6)$$

10.

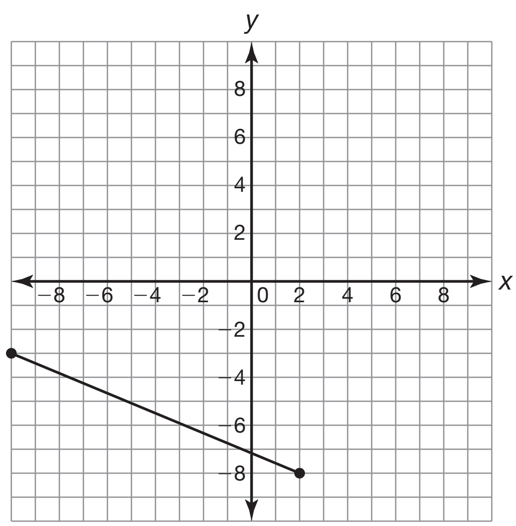


$x_1 = -4, y_1 = 6$

$x_2 = 8, y_2 = -2$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{-4 + 8}{2}, \frac{6 + (-2)}{2}\right)$$
$$= \left(\frac{4}{2}, \frac{4}{2}\right)$$
$$= (2, 2)$$

11.



$x_1 = -10, y_1 = -3$

$x_2 = 2, y_2 = -8$

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{-10 + 2}{2}, \frac{-3 + (-8)}{2}\right)$$
$$= \left(\frac{-8}{2}, \frac{-11}{2}\right)$$
$$= (-4, -5.5)$$

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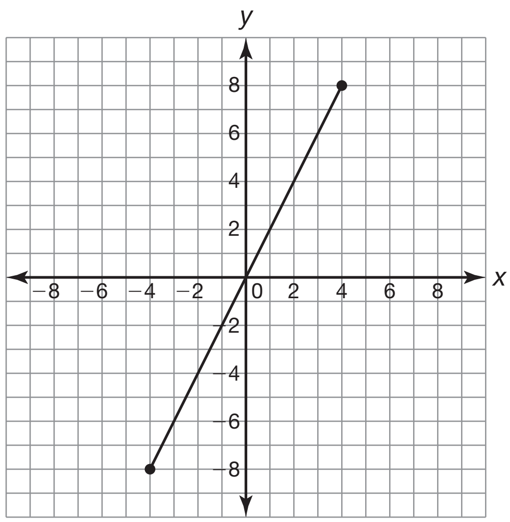
12.



$x_1 = -4, y_1 = -8$

$x_2 = 4, y_2 = 8$

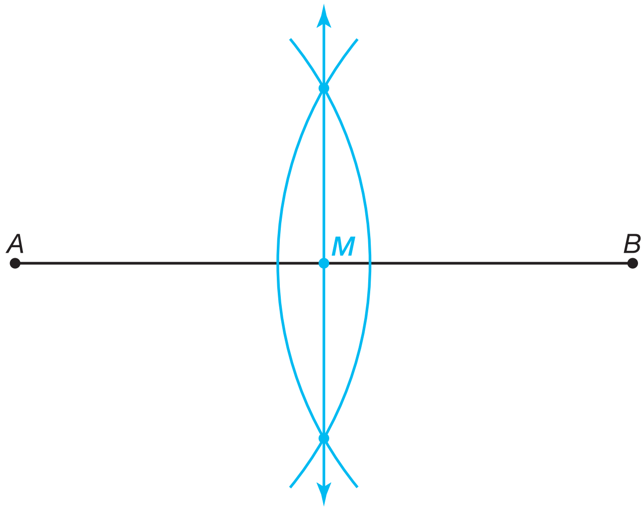
$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) = \left(\frac{-4 + 4}{2}, \frac{-8 + 8}{2}\right)$$

$$= \left(\frac{0}{2}, \frac{0}{2}\right)$$

$$= (0, 0)$$

Locate the midpoint of each line segment using construction tools and label it point *M*.

13.



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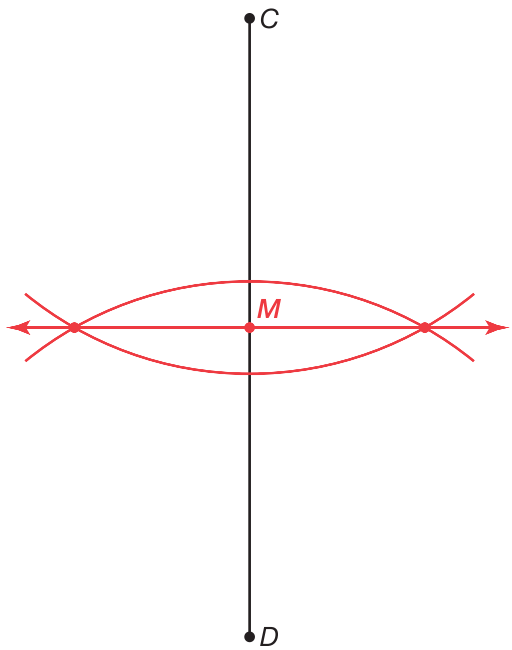

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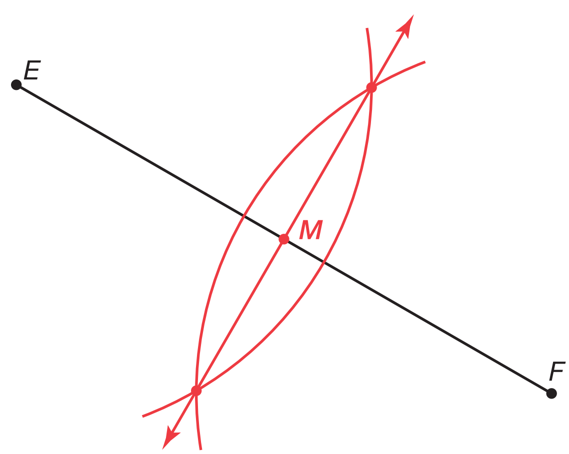

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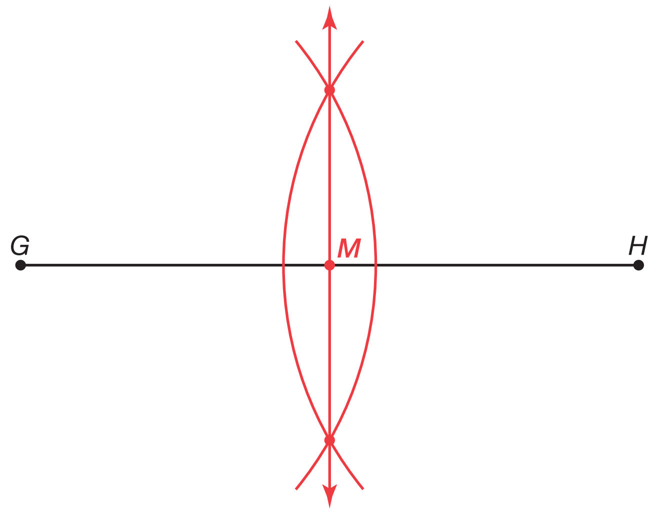
16.



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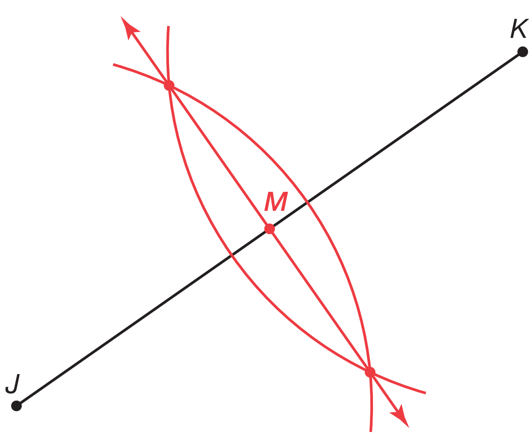

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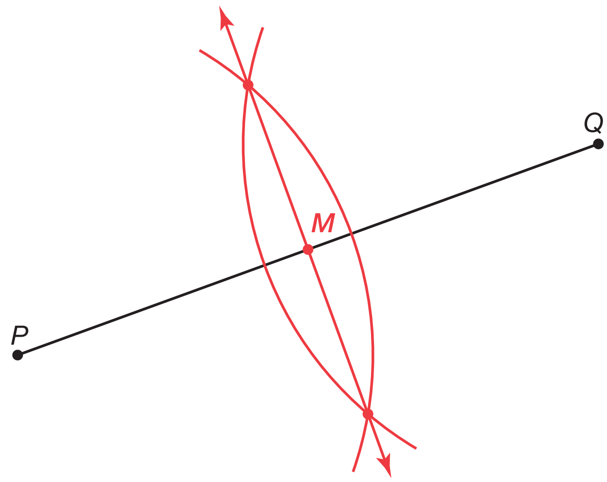

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What's Your Angle?
Translating and Constructing Angles and Angle Bisectors

Vocabulary

Define each term in your own words.

1. angle
   An angle is formed by two rays that share a common endpoint. The sides of the angle are represented by the two rays.

2. angle bisector
   An angle bisector is a ray drawn through the vertex of an angle that divides the angle into two congruent angles.

Describe how to perform each construction in your own words.

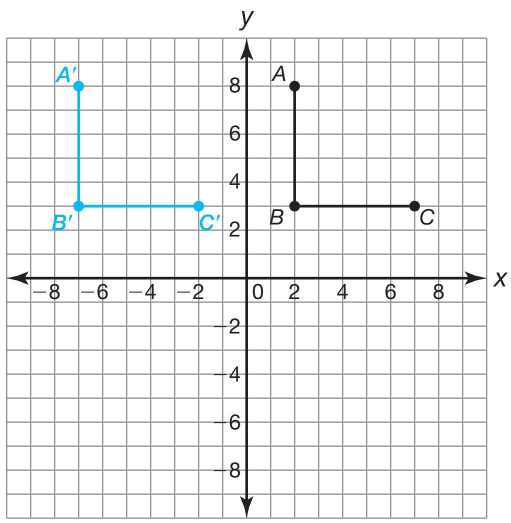
3. copying or duplicating an angle
   To copy $\angle A$, use a straightedge to draw a starter line and draw a point C on the line. Draw an arc with point A as its center that passes through both sides of $\angle A$. Using the same radius, draw a similar arc with center C that passes through the starter line. Label the points where the arc intersects the sides of $\angle A$ as points B and D. Label the point where the arc intersects the starter line as point E. Draw an arc with radius BD and center E that intersects the arc which passes through the starter line. Label the intersection of these two arcs point F. Draw $\overline{CF}$. Now, $\angle FCE \cong \angle BAD$.

4. bisecting an angle
   To bisect $\angle C$, draw an arc with center C that intersects both sides of the angle. Label the intersections A and B. Draw an arc with center A across the interior of the angle. Using the same radius, draw an arc with center B that intersects the previous arc and label the intersection D. Use a straightedge to draw $\overline{CD}$ which bisects $\angle C$.

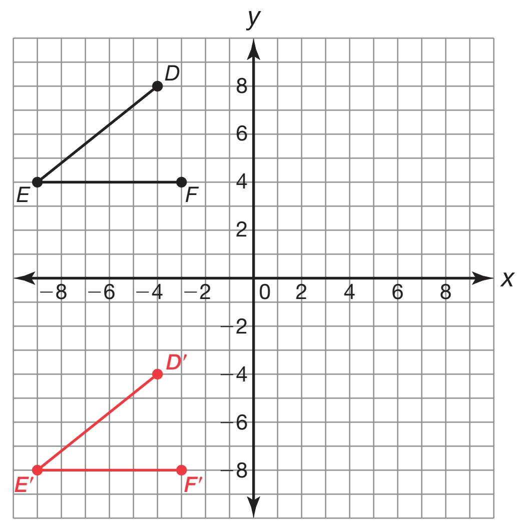
Problem Set

Translate each given angle on the coordinate plane as described.

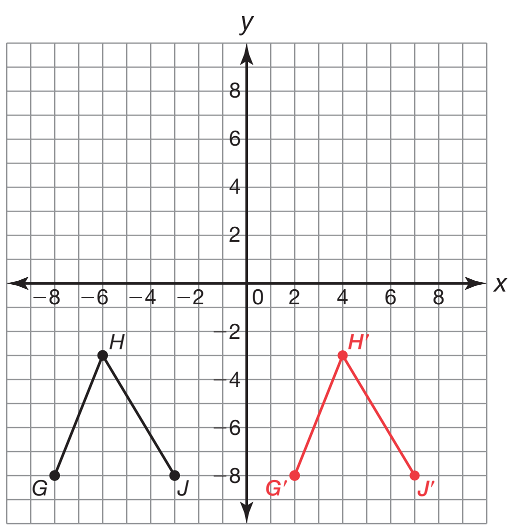
1. Translate $\angle ABC$ 9 units to the left.



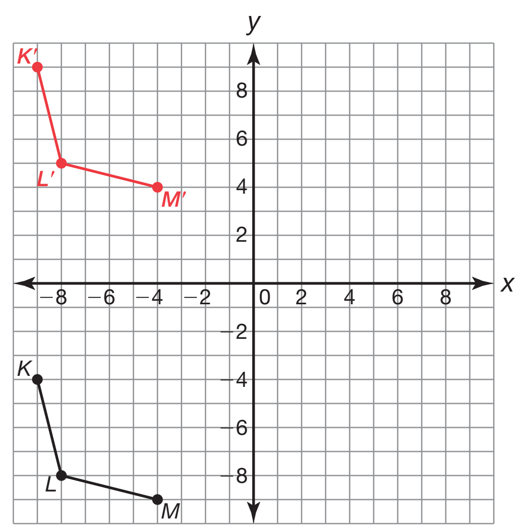
2. Translate $\angle DEF$ 12 units down.



3. Translate $\angle GHJ$ 10 units to the right.



4. Translate $\angle KLM$ 13 units up.



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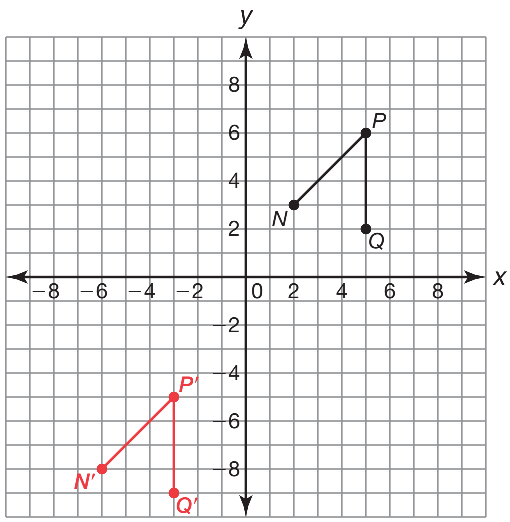
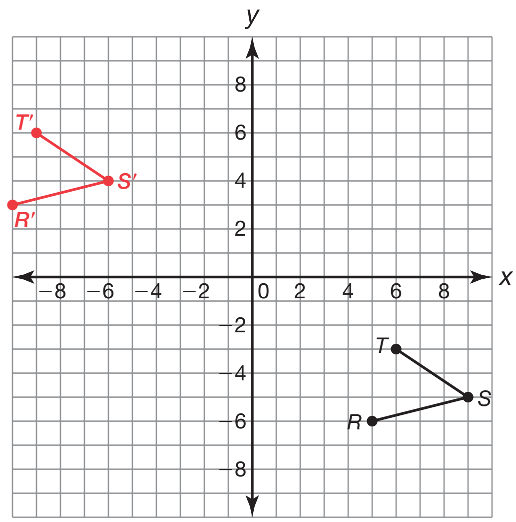
5. Translate $\angle NPQ$ 8 units to the left and 11 units down.

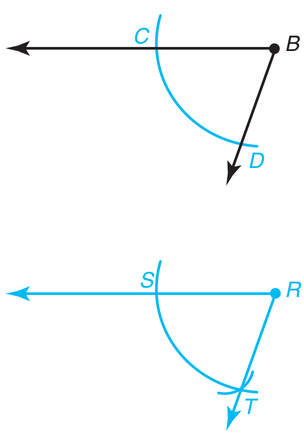


6. Translate $\angle RST$ 15 units to the left and 9 units up.



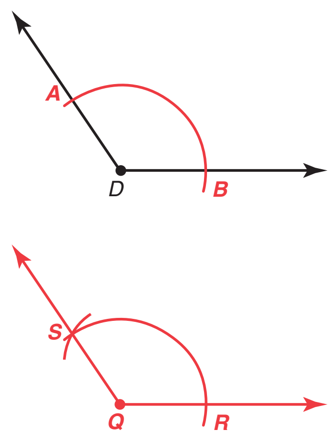
Construct each angle as described.

7. Copy $\angle B$.



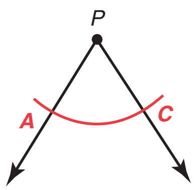
$\angle CBD \cong \angle SRT$

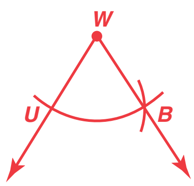
8. Copy $\angle D$.



$\angle ADB \cong \angle SQR$

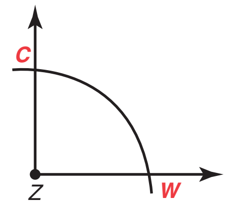
9. Copy $\angle P$.

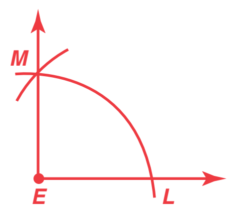




$\angle APC \cong \angle UWB$

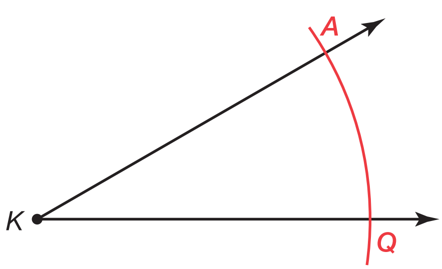
10. Copy $\angle Z$.

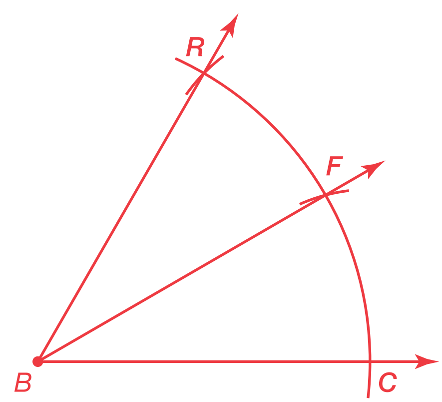




$\angle CZW \cong \angle MEL$

11. Construct an angle that is twice the measure of $\angle K$.





$\angle RBC$ is twice the measure of $\angle AKQ$.

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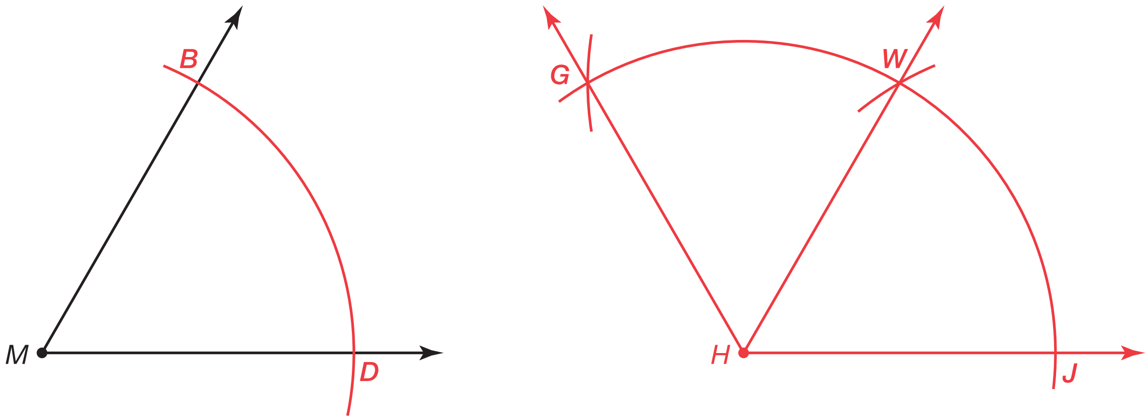
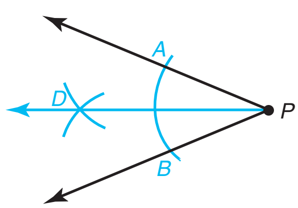
12. Construct an angle that is twice the measure of $\angle M$.



$\angle GHJ$ is twice the measure of $\angle BMD$.

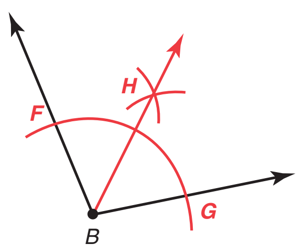
Construct the angle bisector of each given angle.

13.



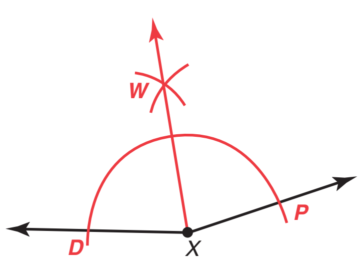
$\overline{PD}$ is the angle bisector of $\angle P$.

14.



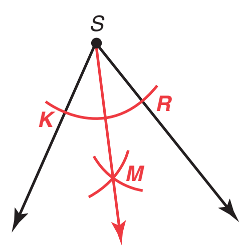
$\overline{BH}$ is the angle bisector of $\angle B$.

15.



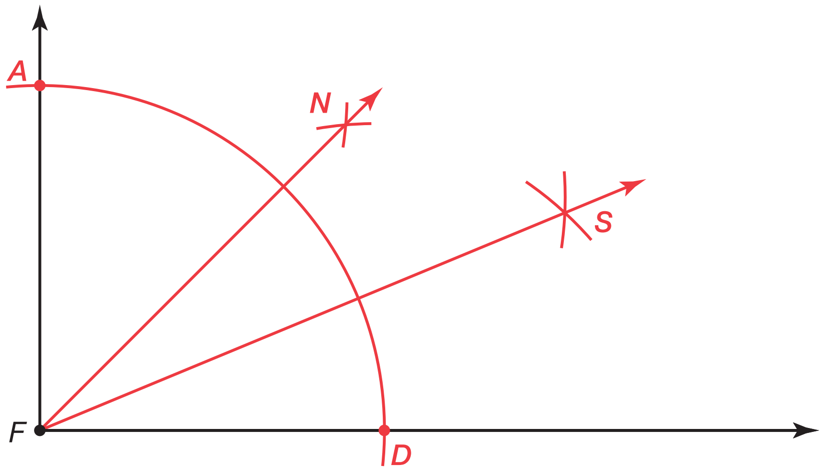
$\overline{XW}$ is the angle bisector of $\angle X$.

16.



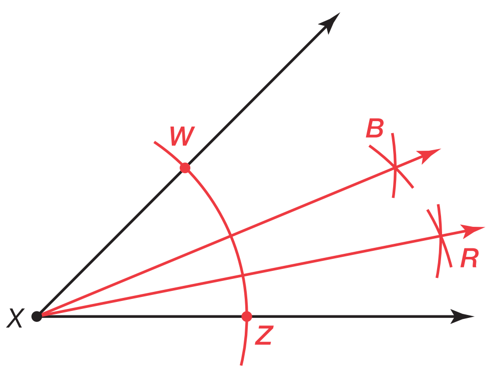
$\overline{SM}$ is the angle bisector of $\angle S$.

17. Construct an angle that is one-fourth the measure of $\angle F$.



$\angle NFS$ and $\angle SFD$ are each one-fourth the measure of $\angle F$.

18. Construct an angle that is one-fourth the measure of $\angle X$.



$\angle BXR$ and $\angle RXZ$ are each one-fourth the measure of $\angle X$.

Name ______________________________ Date ____________

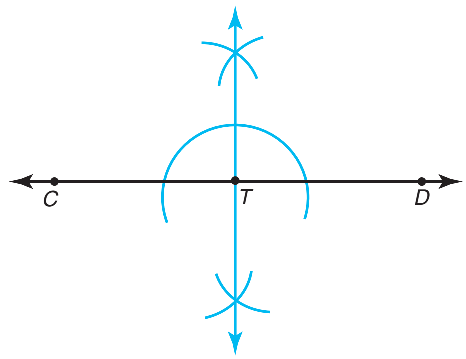
If You Build It . . .

Constructing Perpendicular Lines, Parallel Lines, and Polygons

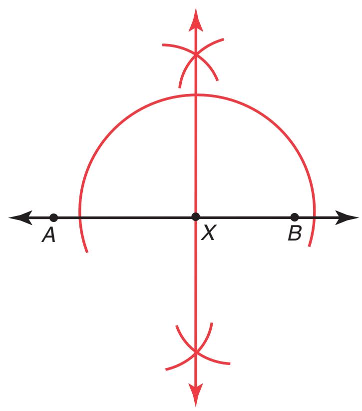
Problem Set

Construct a line perpendicular to each given line and through the given point.

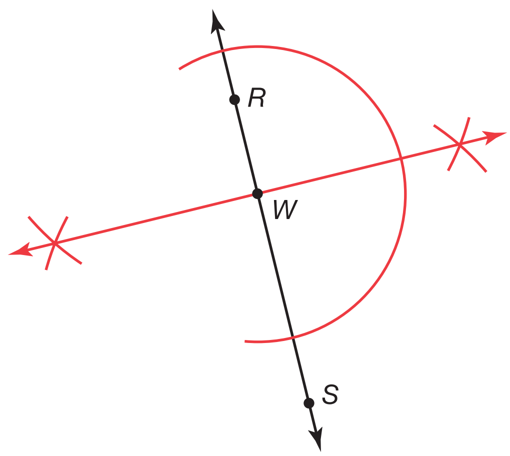
1. Construct a line that is perpendicular to $\overleftrightarrow{CD}$ and passes through point T.



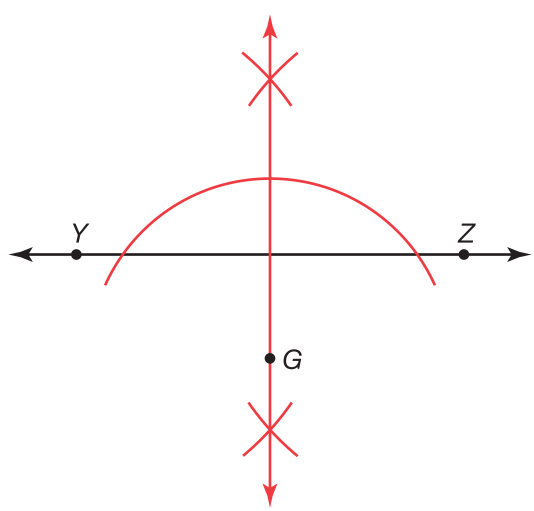
2. Construct a line that is perpendicular to $\overleftrightarrow{AB}$ and passes through point X.



3. Construct a line that is perpendicular to $\overleftrightarrow{RS}$ and passes through point W.



4. Construct a line that is perpendicular to $\overleftrightarrow{YZ}$ and passes through point G.



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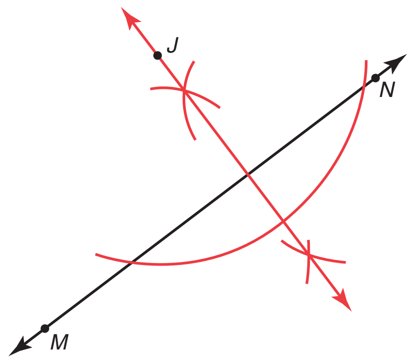
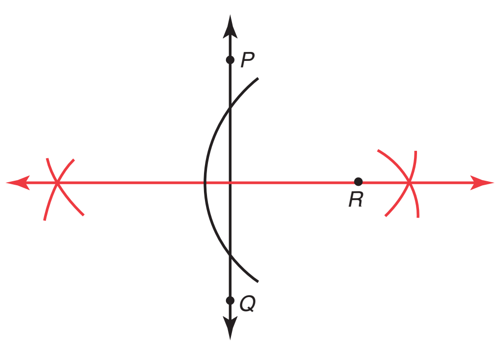
5. Construct a line that is perpendicular to $\overleftrightarrow{MN}$ and passes through point J.

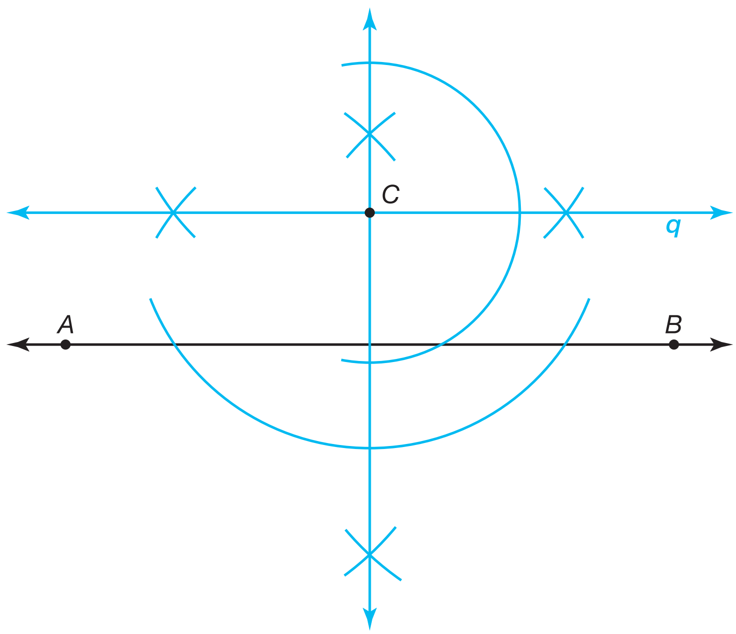


6. Construct a line that is perpendicular to $\overleftrightarrow{PQ}$ and passes through point R.



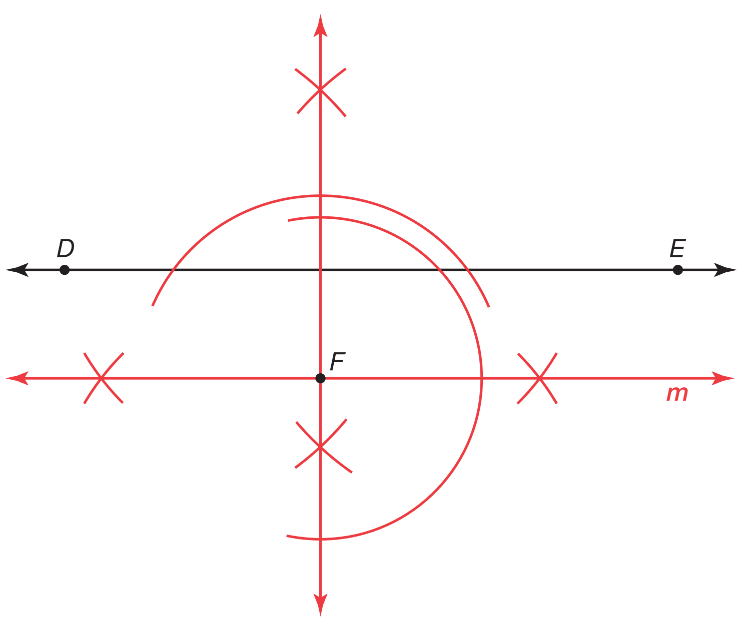
Construct a line parallel to each given line and through the given point.

7. Construct a line that is parallel to $\overleftrightarrow{AB}$ and passes through point C.



Line q is parallel to $\overleftrightarrow{AB}$.

8. Construct a line that is parallel to $\overleftrightarrow{DE}$ and passes through point F.



Line m is parallel to $\overleftrightarrow{DE}$.

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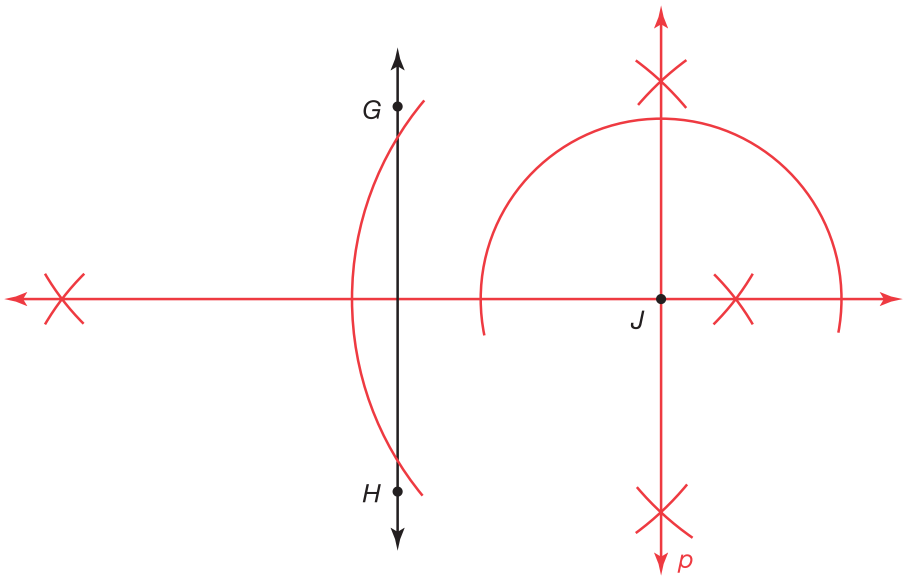
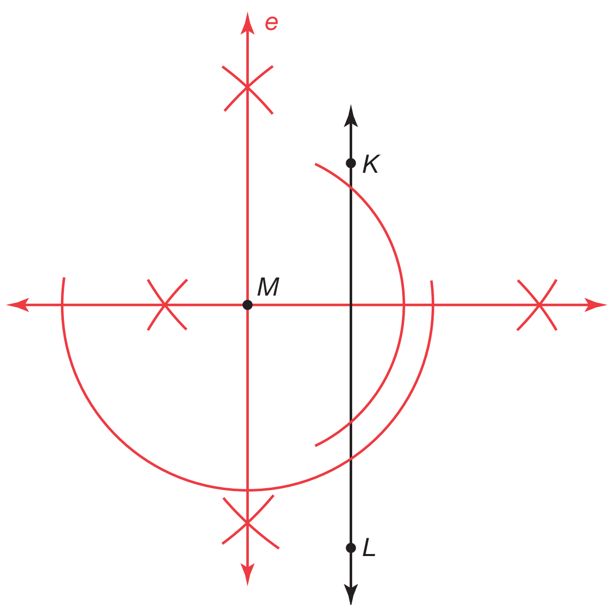
9. Construct a line that is parallel to $\overleftrightarrow{GH}$ and passes through point *J*.



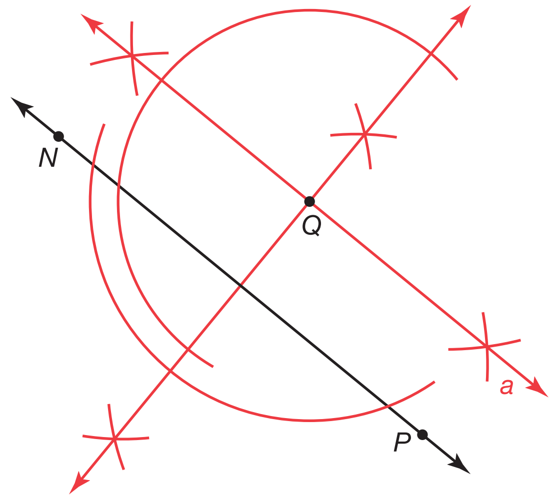
Line *p* is parallel to $\overleftrightarrow{GH}$.

10. Construct a line that is parallel to $\overleftrightarrow{KL}$ and passes through point *M*.



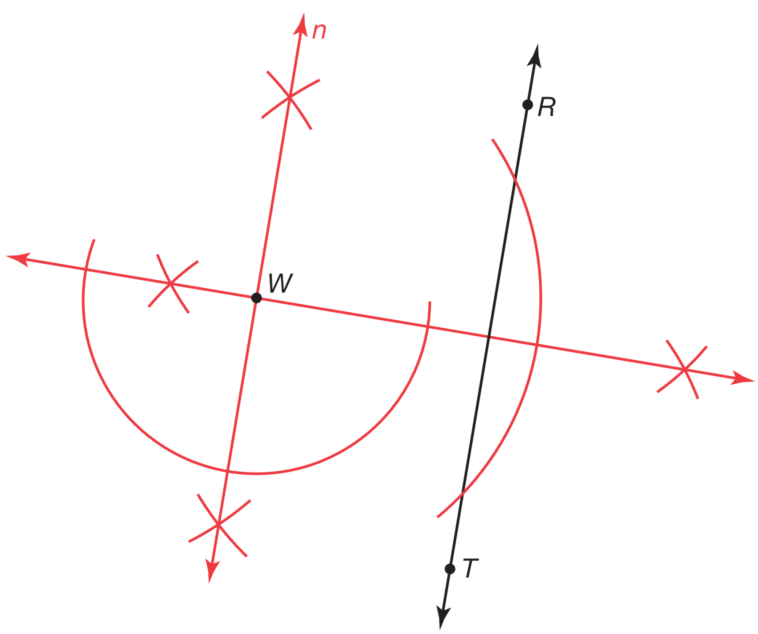
Line *e* is parallel to $\overleftrightarrow{KL}$.

11. Construct a line that is parallel to $\overleftrightarrow{NP}$ and passes through point Q.



Line a is parallel to $\overleftrightarrow{NP}$.

12. Construct a line that is parallel to $\overleftrightarrow{RT}$ and passes through point W.



Line n is parallel to $\overleftrightarrow{RT}$.

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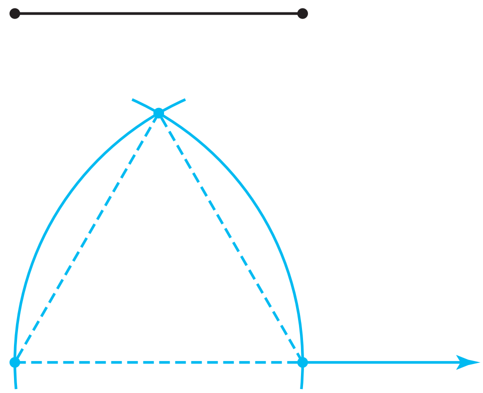
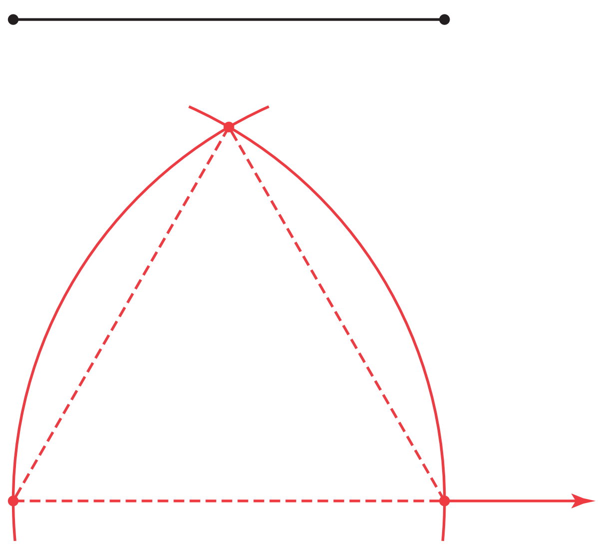
Construct each geometric figure.

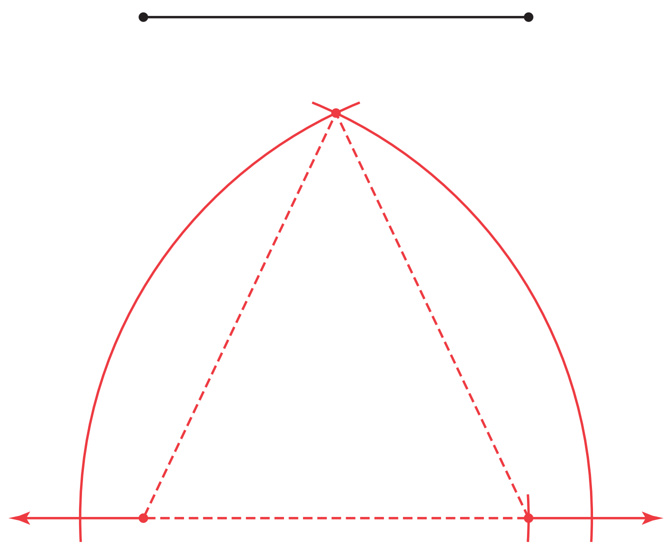
13. Construct an equilateral triangle. The length of one side is given.



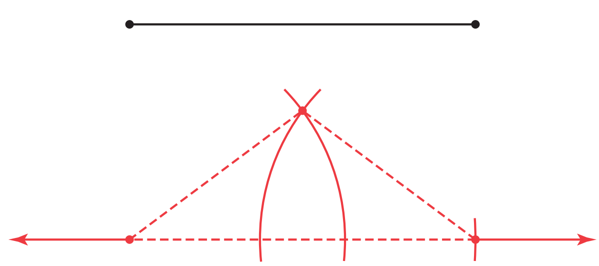
14. Construct an equilateral triangle. The length of one side is given.



15. Construct an isosceles triangle that is not an equilateral triangle such that each leg is longer than the base. The length of the base is given.

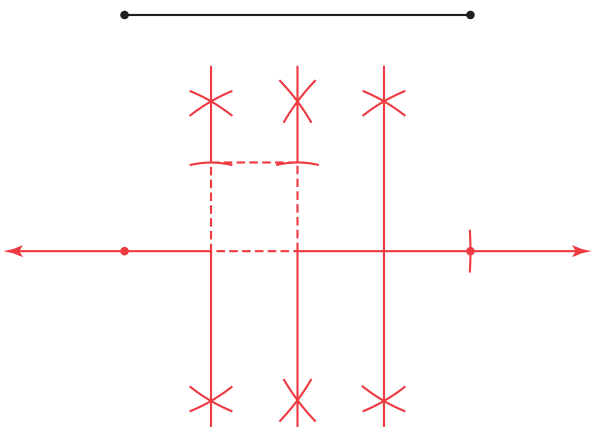


16. Construct an isosceles triangle that is not an equilateral triangle such that each leg is shorter than the base. The length of the base is given.

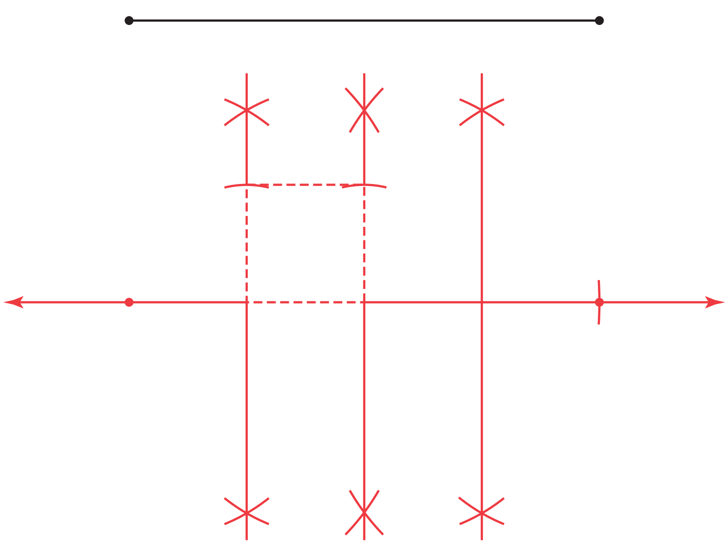


Name ______________________________ Date ______________

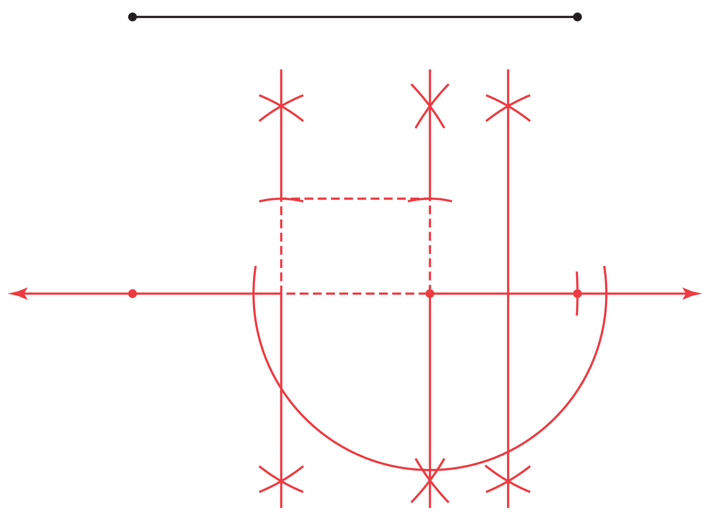
17. Construct a square. The perimeter of the square is given.



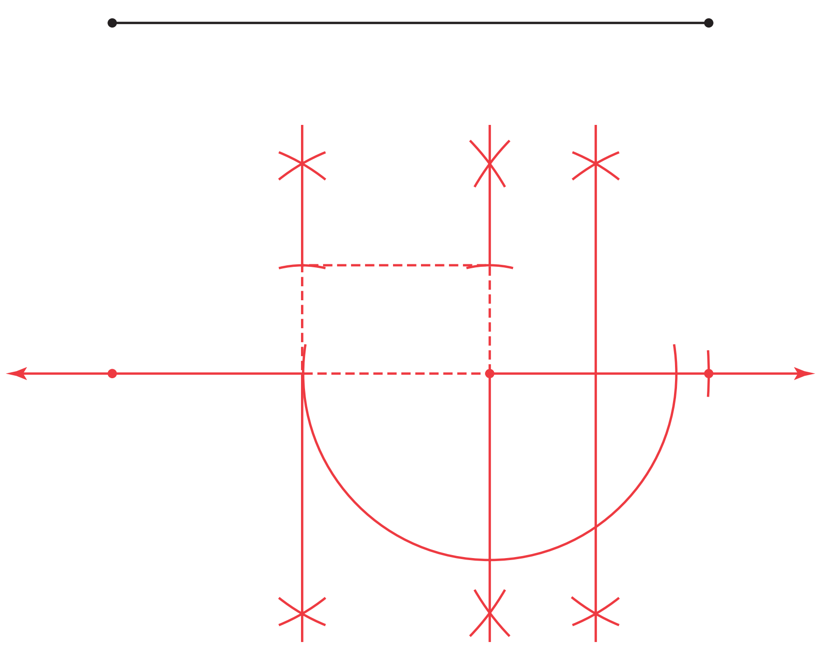
18. Construct a square. The perimeter of the square is given.



19. Construct a rectangle that is not a square. The perimeter of the rectangle is given.



20. Construct a rectangle that is not a square. The perimeter of the rectangle is given.



Name ____________________ Date ________

What's the Point?
Points of Concurrency

Vocabulary

Describe similarities and differences between each pair of terms.

1. concurrent and point of concurrency

   Concurrent lines, rays, or line segments are three or more lines, rays, or line segments intersecting at a single point. The point of concurrency is the point at which they intersect.

2. incenter and orthocenter

   Both the incenter and the orthocenter are points where three line segments of a triangle intersect, and each of the three segments connects a vertex to the side opposite the vertex. The incenter is the point where the three angle bisectors of the triangle are concurrent. The orthocenter is the point at which the three altitudes, or the lines containing the altitudes, of a triangle are concurrent.

3. centroid and circumcenter

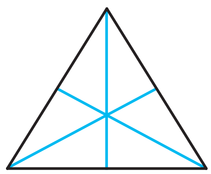
   Both the centroid and the circumcenter are points where bisectors of the sides of the triangle intersect. The centroid is the point at which the medians of the triangle are concurrent. The circumcenter is the point at which the three perpendicular bisectors of the sides of a triangle are concurrent.

4. altitude and median

   Both the altitude and median are line segments that extend from a vertex to the opposite side of a triangle. The altitude is perpendicular to the side that it intersects, and the median intersects the side at its midpoint.

Problem Set

Draw the incenter of each triangle.

1.


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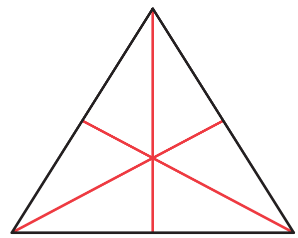

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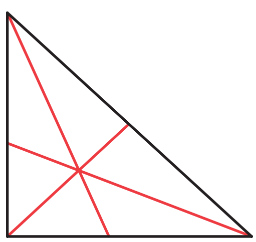

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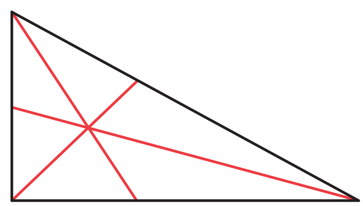

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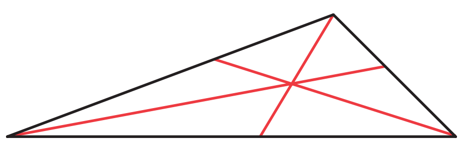

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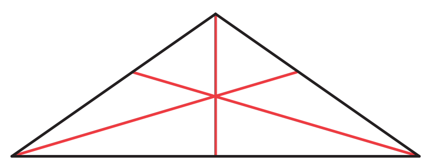

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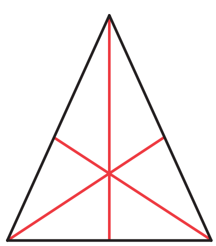

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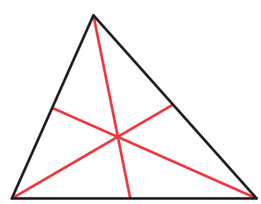
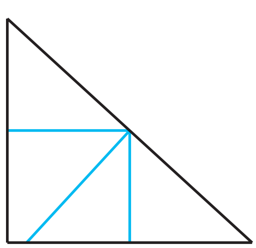


Draw the circumcenter of each triangle.

9.


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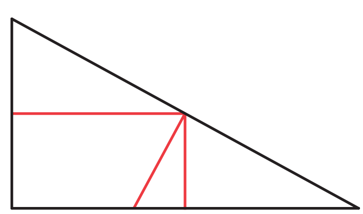

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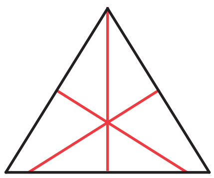
11.



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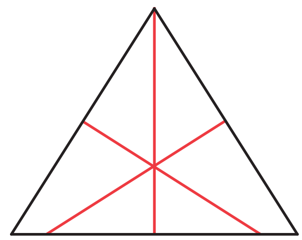

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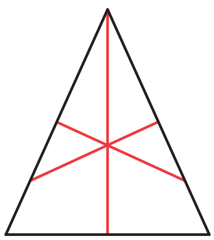

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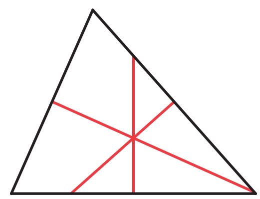

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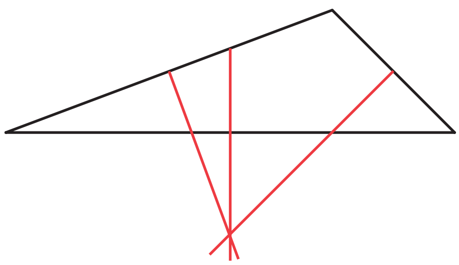

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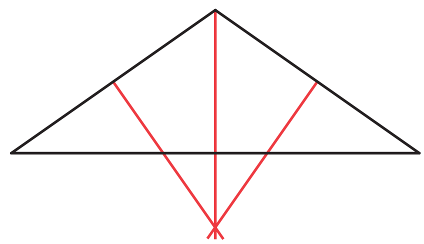
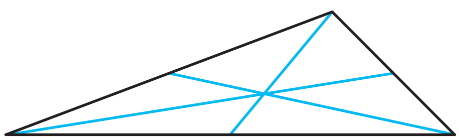


Draw the centroid of each triangle.

17.



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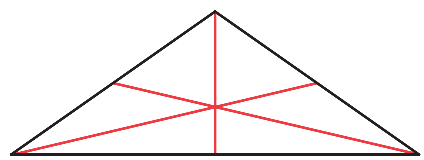

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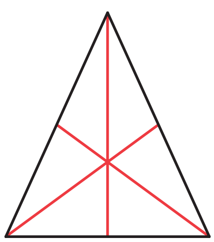

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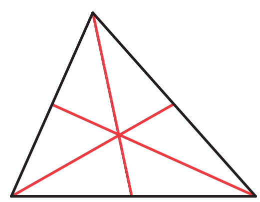

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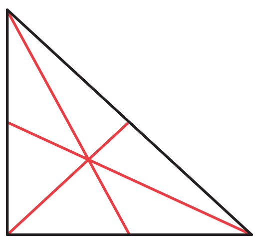

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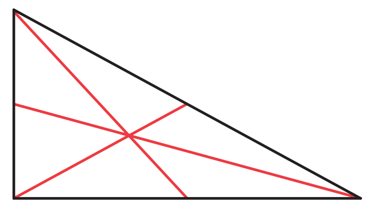

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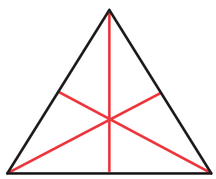

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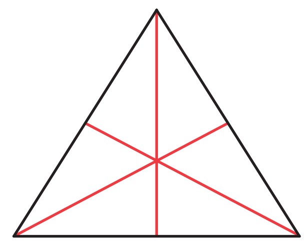
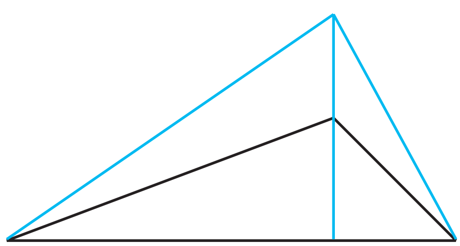


Draw the orthocenter of each triangle.

25.



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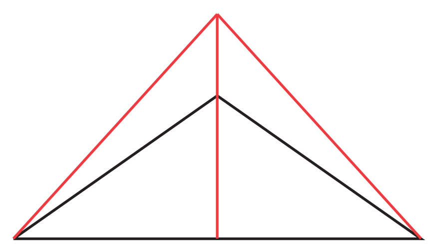

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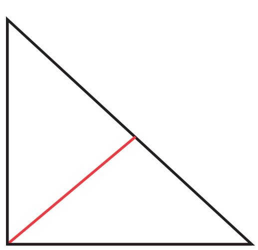

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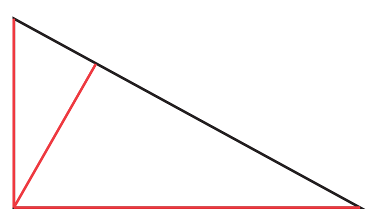

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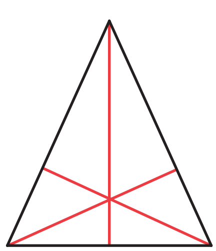

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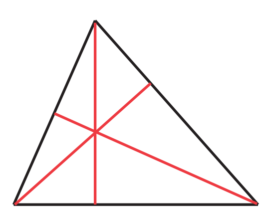

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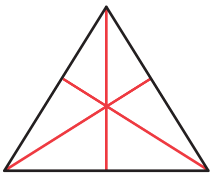
31.



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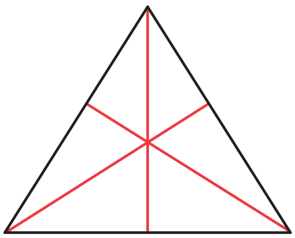
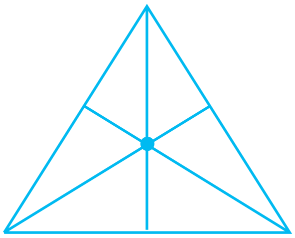


Answer each question about points of concurrency. Draw an example to illustrate your answer.

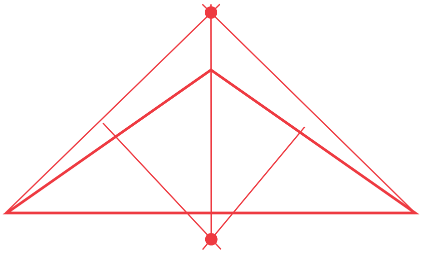
33. For which type of triangle are the incenter, circumcenter, centroid, and orthocenter the same point?

equilateral triangles



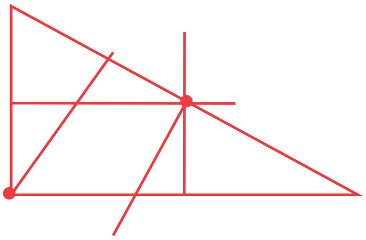
34. For which type of triangle are the orthocenter and circumcenter outside of the triangle?

obtuse triangles



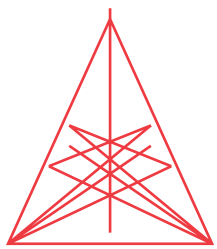
35. For which type of triangle are the circumcenter and orthocenter on the triangle?

right triangles



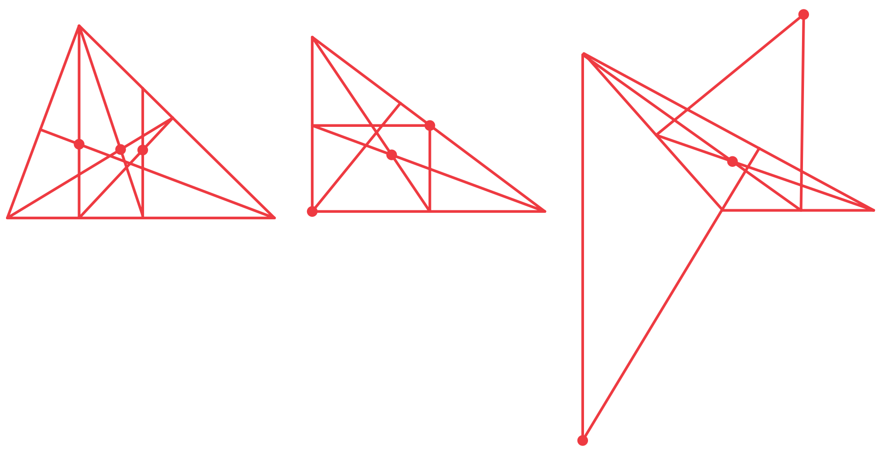
36. For which type of triangle are the incenter, circumcenter, centroid, and orthocenter all inside the triangle?

acute triangles



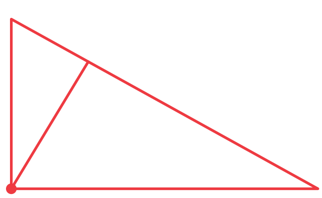
37. For what type(s) of triangle(s) do the centroid, circumcenter, and orthocenter all lie on a straight line?

all types of triangles



38. For what type of triangle is the orthocenter a vertex of the triangle?

right triangles



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Given the coordinates of the vertices of a triangle, classify the triangle using algebra.

39. $A(-5, 5)$, $B(5, 5)$, $C(0, -5)$

segment AB

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

$d = \sqrt{10^2 + 0^2}$

$d = \sqrt{100}$

$d = 10$

segment AC

$d = \sqrt{[0 - (-5)]^2 + (-5 - 5)^2}$

$d = \sqrt{5^2 + (-10)^2}$

$d = \sqrt{125}$

$d \approx 11.18$

segment BC

$d = \sqrt{(0 - 5)^2 + (-5 - 5)^2}$

$d = \sqrt{(-5)^2 + (-10)^2}$

$d = \sqrt{125}$

$d \approx 11.18$

The lengths of two of the segments are equal, so the triangle is isosceles.

40. $R(-3, -1)$, $S(1, 2)$, $T(4, -2)$

segment RS

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

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

$d = \sqrt{25}$

$d = 5$

segment RT

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

$d = \sqrt{7^2 + (-1)^2}$

$d = \sqrt{50}$

$d \approx 7.07$

segment ST

$d = \sqrt{(4 - 1)^2 + (-2 - 2)^2}$

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

$d = \sqrt{25}$

$d = 5$

The lengths of two of the segments are equal, so the triangle is isosceles.

41. $F(-2, 5)$, $G(1, 6)$, $H(5, -4)$

segment FG

$d = \sqrt{[1 - (-2)]^2 + (6 - 5)^2}$

$d = \sqrt{3^2 + 1^2}$

$d = \sqrt{10}$

$d \approx 3.16$

segment FH

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

$d = \sqrt{(7)^2 + (-9)^2}$

$d = \sqrt{130}$

$d \approx 11.40$

segment GH

$d = \sqrt{(5 - 1)^2 + (-4 - 6)^2}$

$d = \sqrt{(4)^2 + (-10)^2}$

$d = \sqrt{116}$

$d \approx 10.77$

The lengths of the three segments are different, so the triangle is scalene.

42. $M(5, -1)$, $N(3, -5)$, $P(-1, -3)$

segment *MN*

$d = \sqrt{(3 - 5)^2 + [-5 - (-1)]^2}$

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

$d = \sqrt{20}$

$d \approx 4.47$

segment *MP*

$d = \sqrt{(-1 - 5)^2 + [-3 - (-1)]^2}$

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

$d = \sqrt{40}$

$d \approx 6.32$

segment *NP*

$d = \sqrt{(-1 - 3)^2 + [-3 - (-5)]^2}$

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

$d = \sqrt{20}$

$d \approx 4.47$

The lengths of two of the segments are equal, so the triangle is isosceles.

43. $K(-2, 1)$, $L(4, -3)$, $M(-1, 5)$

segment *KL*

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

$d = \sqrt{6^2 + (-4)^2}$

$d = \sqrt{52}$

$d \approx 7.21$

segment *KM*

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

$d = \sqrt{1^2 + 4^2}$

$d = \sqrt{17}$

$d \approx 4.12$

segment *LM*

$d = \sqrt{(-1 - 4)^2 + [5 - (-3)]^2}$

$d = \sqrt{(-5)^2 + 8^2}$

$d = \sqrt{89}$

$d \approx 9.43$

The lengths of the three segments are different, so the triangle is scalene.

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44. $E(-5, 7)$, $F(3, 4)$, $G(-8, -1)$

segment *EF*

$d = \sqrt{[3 - (-5)]^2 + (4 - 7)^2}$

$d = \sqrt{8^2 + (-3)^2}$

$d = \sqrt{73}$

$d \approx 8.54$

segment *EG*

$d = \sqrt{[-8 - (-5)]^2 + (-1 - 7)^2}$

$d = \sqrt{(-3)^2 + (-8)^2}$

$d = \sqrt{73}$

$d \approx 8.54$

segment *FG*

$d = \sqrt{(-8 - 3)^2 + (-1 - 4)^2}$

$d = \sqrt{(-11)^2 + (-5)^2}$

$d = \sqrt{146}$

$d \approx 12.08$

The lengths of two of the segments are equal, so the triangle is isosceles.

1