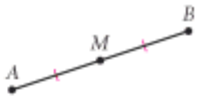
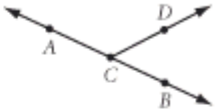
Often geometric definitions are easier to write if you refer to labeled figures. For example, you can define the midpoint of a line segment by saying: "Point M is the midpoint of segment AB if M is a point on segment AB, and AM is equal to MB."



EXAMPLE C | Use a labeled figure to define a linear pair of angles.



▶ Solution | $\angle ACD$ and $\angle BCD$ form a linear pair of angles if point C is on $\overleftrightarrow{AB}$ and lies between points A and B.

Compare this definition with the one you wrote in the investigation. Can there be more than one correct definition?

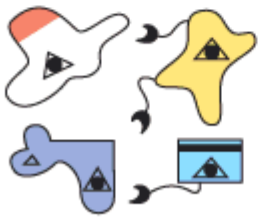
The design of this African Kente cloth contains examples of parallel and perpendicular lines, obtuse and acute angles, and complementary and supplementary angle pairs. To learn about the significance of Kente cloth designs, visit math.kendallhunt.com/DG

EXERCISES

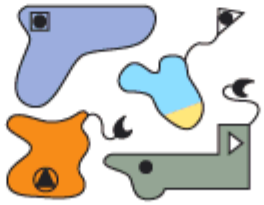
Practice Your Skills

For Exercises 1–8, draw and carefully label the figures. Use the appropriate marks to indicate right angles, parallel lines, congruent segments, and congruent angles. Use a protractor and a ruler when you need to.

1. Acute angle DOG with a measure of 45°
2. Right angle RTE
3. Obtuse angle BIG with angle bisector $\overrightarrow{IE}$
4. $\overrightarrow{DG} \parallel \overrightarrow{MS}$
5. $\overrightarrow{PE} \perp \overrightarrow{AR}$
6. Vertical angles ABC and DBE
7. Complementary angles $\angle A$ and $\angle B$ with $m\angle A = 40°$
8. Supplementary angles $\angle C$ and $\angle D$ with $m\angle D = 40°$
9. Which creatures in the last group below are Zoids? What makes a Zoid a Zoid?



Zoids



Not Zoids

Which are Zoids?

10. What are the characteristics of a good definition?
11. What is the difference between complementary and supplementary angles?

12. If $\angle X$ and $\angle Y$ are supplementary angles, are they necessarily a linear pair? Why or why not?

13. Write these definitions using the classify and differentiate method to fill in the blanks:

a. An acute angle is _____ that _____.

b. Complementary angles are _____ that _____.

c. A midpoint is _____ that _____.

d. A protractor is _____ that _____.

14. There is something wrong with this definition for a pair of vertical angles: "If $\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ intersect at point P, then $\angle APC$ and $\angle BPD$ are a pair of vertical angles." Sketch a counterexample to show why it is not correct. Can you add a phrase to correct it?

For Exercises 15–24, four of the statements are true. Make a sketch or demonstrate each true statement. For each false statement, draw a counterexample.

15. For every line segment there is exactly one midpoint.

16. For every angle there is exactly one angle bisector.

17. If two different lines intersect, then they intersect at one and only one point.

18. If two different circles intersect, then they intersect at one and only one point.

19. Through a given point on a line, there is one and only one line perpendicular to the given line.

20. In every triangle there is exactly one right angle.

21. Through a point not on a line, one and only one line can be constructed parallel to the given line.

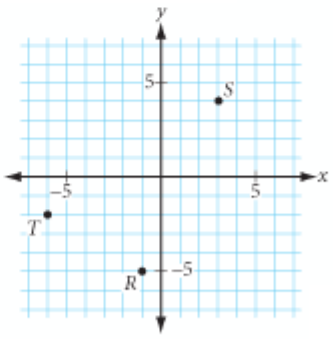
22. If $CA = AT$, then A is the midpoint of CT.

23. If $m\angle D = 40°$ and $m\angle C = 140°$, then angles C and D are a linear pair.

24. If point A is not the midpoint of $\overline{CT}$, then $CA \neq AT$.

Review

For Exercises 25 and 26, refer to the graph at right.

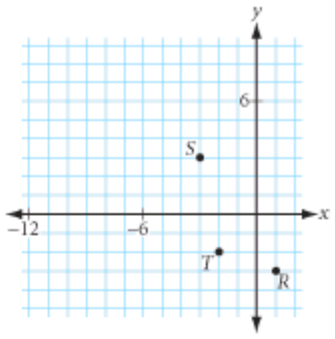


25. Find possible coordinates of a point P so that points P, T, and S are collinear.

26. Find possible coordinates of a point Q so that $\overleftrightarrow{QR} \parallel \overleftrightarrow{TS}$.

27. A *partial mirror* reflects some light and lets the rest of the light pass through. In the figure at right, half the light from point A passes through the partial mirror to point B. Copy the figure, then draw the outgoing angle for the light reflected from the mirror. What do you notice about the ray of reflected light and the ray of light that passes through?

28. Find possible coordinates of points *A, B,* and *C* on the graph at right so that $\angle BAC$ is a right angle, $\angle BAT$ is an acute angle, $\angle ABS$ is an obtuse angle, and the points *C, T,* and *R* are collinear.



29. If *D* is the midpoint of *AC* and *C* is the midpoint of *AB*, and $AD = 3\text{cm}$, what is the length of $\overline{AB}$?

30. If $\overrightarrow{BD}$ is the angle bisector of $\angle ABC$, $\overrightarrow{BE}$ is the angle bisector of $\angle ABD$, and $m\angle DBC = 24°$, what is $m\angle EBC$?

31. Draw and label a figure that has two congruent segments and three congruent angles. Mark the congruent angles and congruent segments.

32. Show how three lines in a plane can have zero, exactly one, exactly two, or exactly three points of intersection.

33. Show how it is possible for two triangles to intersect in one point, two points, three points, four points, five points, or six points, but not seven points. Show how they can intersect in infinitely many points.

34. Each pizza is cut into slices from the center.

a. What fraction of the pizza is left?

b. What fraction of the pizza is missing?

c. If the pizza is cut into nine equal slices, how many degrees is each angle at the center of the pizza?

IMPROVING YOUR VISUAL THINKING SKILLS

Polyominoes

In 1953, United States mathematician Solomon Golomb introduced polyominoes at the Harvard Mathematics Club, and they have been played with and enjoyed throughout the world ever since. Polyominoes are shapes made by connecting congruent squares. The squares are joined together side to side. (A complete side must touch a complete side.) Some of the smaller polyominoes are shown below. There is only one monomino and only one domino, but there are two trominoes, as shown. There are five tetrominoes—one is shown. Sketch the other four.

Monomino Domino Trominoes Tetromino