

Practice
Your Skills

EXERCISES

You will need



1. Surgeons, engineers, carpenters, plumbers, electricians, and furniture movers all rely on trained experience with visual thinking. Describe how one of these tradespeople or someone in another occupation uses visual thinking in his or her work.

Read each problem, determine what you are trying to find, draw a diagram, and solve the problem.

2. In the city of Rectangulus, all the streets running east–west are numbered and those streets running north–south are lettered. The even-numbered streets are one-way east and the odd-numbered streets are one-way west. All the vowel-lettered avenues are one-way north and the rest are two-way. Can a car traveling south on S Street make a legal left turn onto 14th Street?

3. Midway through a 2000-meter race, a photo is taken of five runners. It shows Meg 20 meters behind Edith. Edith is 50 meters ahead of Wanda, who is 20 meters behind Olivia. Olivia is 40 meters behind Nadine. Who is ahead? In your diagram, use M for Meg, E for Edith, and so on.

4. Mary Ann is building a fence around the outer edge of a rectangular garden plot that measures 25 feet by 45 feet. She will set the posts 5 feet apart. How many posts will she need?

5. Freddie the Frog is at the bottom of a 30-foot well. Each day he jumps up 3 feet, but then, during the night, he slides back down 2 feet. How many days will it take Freddie to get to the top and out?

6. Here is an exercise taken from Marilyn vos Savant's Ask Marilyn® column in *Parade* magazine. It is a good example of a difficult-sounding problem becoming clear once a diagram has been made. Try it.

A 30-foot cable is suspended between the tops of two 20-foot poles on level ground. The lowest point of the cable is 5 feet above the ground. What is the distance between the two poles?

7. Points A and B lie in a plane. Sketch the locus of points in *the plane* that are equally distant from points A and B . Sketch the locus of points in *space* that are equally distant from points A and B .

8. Draw an angle. Label it $\angle A$. Sketch the locus of points in the plane of angle A that are the same distance from the two sides of angle A .

9. Line AB lies in plane \mathcal{P} . Sketch the locus of points in plane \mathcal{P} that are 3 cm from AB . Sketch the locus of points in space that are 3 cm from AB .

10. Create a Venn diagram showing the relationships among triangles, trapezoids, polygons, obtuse triangles, quadrilaterals, and isosceles triangles.

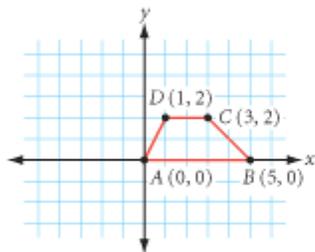


11. Beth Mack and her dog Trouble are exploring in the woods east of Birnam Woods Road, which runs north-south. They begin walking in a zigzag pattern: 1 km south, 1 km west, 1 km south, 2 km west, 1 km south, 3 km west, and so on. They walk at the rate of 4 km/h. If they started 15 km east of Birnam Woods Road at 3:00 P.M., and the sun sets at 7:30 P.M., will they reach Birnam Woods Road before sunset?

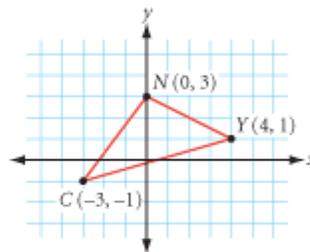


In geometry you will use visual thinking all the time. In Exercises 12 and 13 you will be asked to locate and recognize congruent geometric figures even if they are in different positions due to translations (slides), rotations (turns), or reflections (flips).

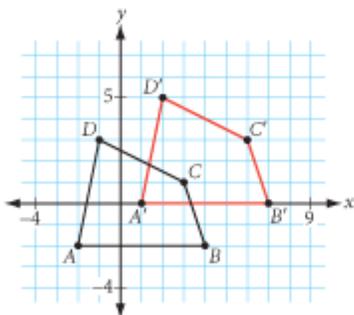
12. If trapezoid $ABCD$ were rotated 90° counterclockwise about $(0, 0)$, to what (x, y) location would points $A, B, C,$ and D be relocated?



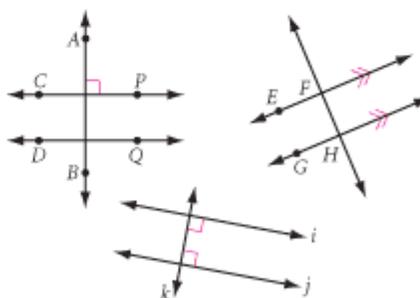
13. If $\triangle CYN$ were reflected across the y -axis, to what location would points $C, N,$ and Y be relocated?



14. What was the ordered pair rule used to relocate the four vertices of $ABCD$ to $A'B'C'D'$?



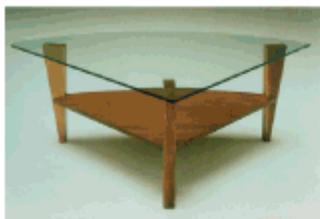
15. Which lines are perpendicular? Which lines are parallel?



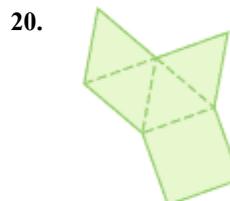
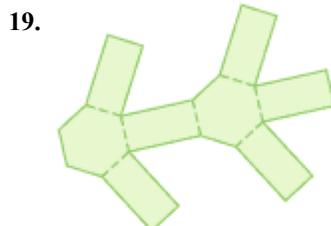
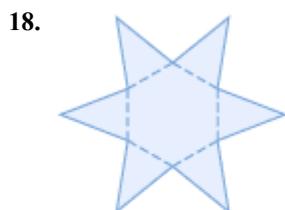
16. Sketch the next two figures in the pattern below. If this pattern were to continue, what would be the perimeter of the eighth figure in the pattern? (Assume the length of each segment is 1 cm.)



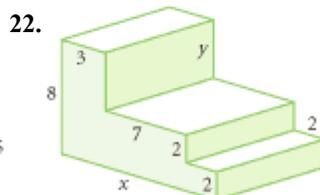
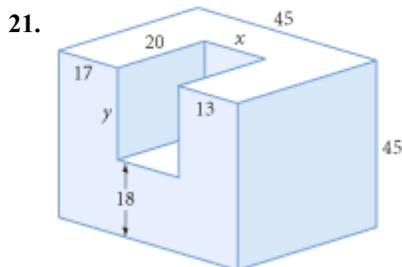
17. A tabletop represents a plane. Examine the combination of points and lines that hold each tabletop in place. Removing one point or line would cause the tabletop to wobble or fall. In geometry, we say that these combinations of points and lines **determine** a plane. For each photo, use geometric terms to describe what determines the plane represented by the tabletop.



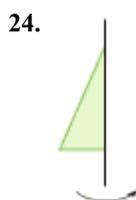
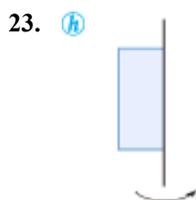
For Exercises 18–20, sketch the three-dimensional figure formed by folding each net into a solid. Name the solid.



For Exercises 21 and 22, find the lengths x and y . (Every angle on each block is a right angle.)



In Exercises 23 and 24, each figure represents a two-dimensional figure with a wire attached. The three-dimensional solid formed by spinning the figure on the wire between your fingers is called a **solid of revolution**. Sketch the solid of revolution formed by each two-dimensional figure.



A real-life example of a "solid of revolution" is a clay pot on a potter's wheel.

Review

For Exercises 25–34, write the words or the symbols that make the statement true.

25. The three undefined terms of geometry are ?, ?, and ?.
26. “Line AB ” may be written using a symbol as ?.
27. “Arc AB ” may be written using a symbol as ?.
28. The point where the two sides of an angle meet is the ? of the angle.
29. “Ray AB ” may be written using a symbol as ?.
30. “Line AB is parallel to segment CD ” is written in symbolic form as ?.
31. The geometry tool you use to measure an angle is a ?.
32. “Angle ABC ” is written in symbolic form as ?.
33. The sentence “Segment AB is perpendicular to line CD ” is written in symbolic form as ?.
34. The angle formed by a light ray coming into a mirror is ? the angle formed by a light ray leaving the mirror.
35. Use your compass and straightedge to draw two congruent circles intersecting in exactly one point. How does the distance between the two centers compare with the radius?
36. Use your compass and straightedge to construct two congruent circles so that each circle passes through the center of the other circle. Label the centers P and Q . Construct PQ connecting the centers. Label the points of intersection of the two circles A and B . Construct chord AB . What is the relationship between AB and PQ ?



William Thomas Williams, DO YOU THINK A IS B, acrylic on canvas, 1975–77, Fisk University Galleries, Nashville, Tennessee.

IMPROVING YOUR VISUAL THINKING SKILLS

Hexominoes

Polyominoes with six squares are called hexominoes. There are 35 different hexominoes. There is 1 with a longest string of six squares; there are 3 with a longest string of five squares, and 1 with a longest string of two squares. The rest have a longest string of either four squares or three squares. Use graph paper to sketch all

35 hexominoes. Which ones are nets for cubes? Here is one hexomino that does fold into a cube.

