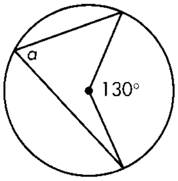
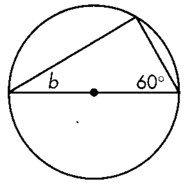
Exercise Set 7.4

Use your new conjectures to solve Exercises 1–16.

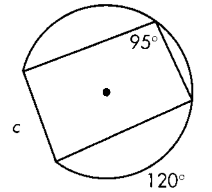
1. $a = $ -?-



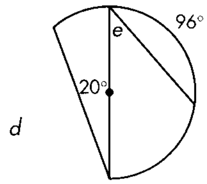
2. $b = $ -?-



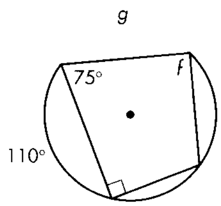
3.* $c = $ -?-



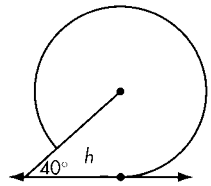
4. $d = $ -?-
$e = $ -?-



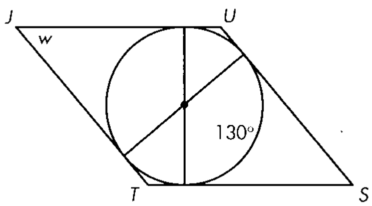
5. $f = $ -?-
$g = $ -?-



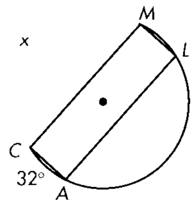
6.* $h = $ -?-



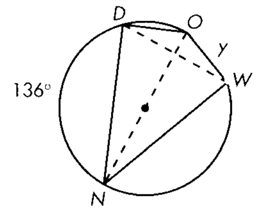
7. *JUST* is a rhombus.
$w = $ -?-



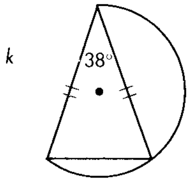
8. *CALM* is a rectangle.
$x = $ -?-



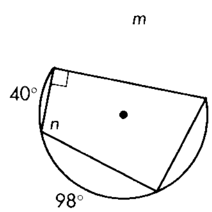
9. *DOWN* is a kite.
$y = $ -?-



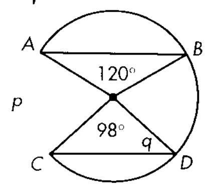
10. $k = $ -?-



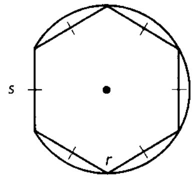
11. $m = $ -?-
$n = $ -?-



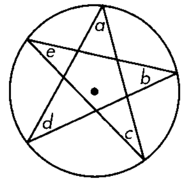
12.* $\overline{AB} \parallel \overline{CD}$
$p = $ -?-
$q = $ -?-



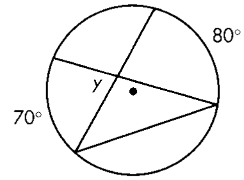
13. $r = $ -?-
$s = $ -?-



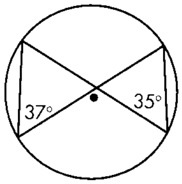
14.* What is the sum of
$a + b + c + d + e$?



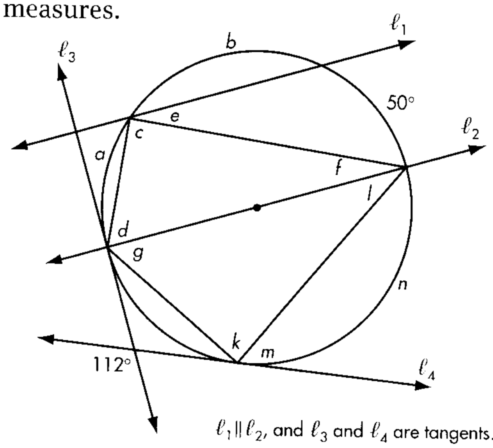
15.* $y = $ -?-



16. What's wrong with this picture?



17. Find the lettered angle measures and arc measures.

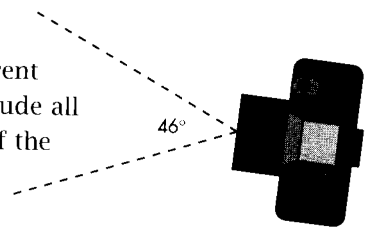


$\ell_1 \parallel \ell_2$, and ℓ_3 and ℓ_4 are tangents.

18. How can you find the center of a circle by using just the corner of a piece of paper?

19.• Chris Chisholm, while a high school student in Whitmore, California, used Conjecture 70 (Angles inscribed in a semicircle are . . . .) to discover a new and simpler way to find the orthocenter in a triangle. He noticed that if you construct a circle, using one of the sides of the triangle as the diameter of the circle, then you can immediately find an altitude to each of the other two sides! Try it. Use Chris's method to find the orthocenter of a triangle.

20.• The width of a view that can be captured in a photo depends on the camera's **picture angle**. Most 35 mm cameras have a 46° picture angle. Suppose you wanted to take a photo of your class standing in one straight row. Draw a line segment to represent the row. Draw a 46° angle on a piece of patty paper. Locate at least eight different points where a 35 mm camera could be positioned to include all the students standing along the segment, filling as much of the picture as possible. What is the locus of all such camera positions? What conjecture from this lesson does this activity illustrate?



21. **Computer Activity** Construct a circle and a diameter. Construct a point on one of the semicircles, and construct two chords to create a right triangle inscribed in the semicircle. Locate the midpoint of each of the two chords. What is the locus of the two midpoints as the vertex of the right angle is moved around the circle? Try visualizing this first. Sketch the locus by hand, then use your computer to animate the point on the circle and trace the locus of the two midpoints. What do you get?

Improving Reasoning Skills—*Think Dinosaur*

If the letter in the word *dinosaur* that is three letters after the word's second vowel is also found before the sixteenth letter of the alphabet, then print the word *dinosaur* horizontally. Otherwise print the word *dinosaur* vertically and cross out the second letter after the first vowel.

Investigation 7.5

For this investigation you will need the following special materials.

- Round objects you collected in Lesson 7.1 (the larger the objects the better)
- Meter stick or metric sewing tape
- Sewing thread or thin string to measure the circumference of each round object

Step 1 With the thread and the meter stick (or the sewing tape), measure the circumference and diameter of each round object to the nearest millimeter (tenth of a centimeter).

Step 2 Make a table similar to the one below and record the circumference (C) and diameter (D) measurements for each round object.

Name of object	-?-	-?-	-?-	-?-
Circumference (C)	-?-	-?-	-?-	-?-
Diameter (D)	-?-	-?-	-?-	-?-
C/D	-?-	-?-	-?-	-?-

Step 3 Calculate $\frac{C}{D}$ and record the answers in your table.

Step 4 Calculate the average of your $\frac{C}{D}$ results.

Compare the average of your $\frac{C}{D}$ results with the $\frac{C}{D}$ averages of other groups. Are the $\frac{C}{D}$ answers close? You should now be convinced that $\frac{C}{D}$ is very close to 3 for every circle. We define the ratio: $\frac{C}{D} = \pi$. If you solve this formula for C, you get a formula for finding the circumference of a circle in terms of the diameter. Because the diameter is twice the radius ($D = 2r$), you also can get a formula for finding the circumference in terms of the radius. State your conjecture.

C-73 If C is the circumference and D is the diameter of a circle, then there is a number π such that $C =$ —?—. Because $D = 2r$ where r is the radius, then $C =$ —?— (***Circumference Conjecture***).

The number π is an irrational number. Its decimal form never ends and no pattern in it ever repeats. The symbol π is a letter from the ancient Greek alphabet. Mathematicians began using it in the eighteenth century to represent the exact value of the circumference/diameter ratio.

Perhaps no other number has more fascinated and intrigued mathematicians throughout history. Mathematicians in ancient Egypt used $(4/3)^4$ as their approximation of π. Early Chinese and Hindu mathematicians used $\sqrt{10}$. By A.D. 408, Chinese mathematicians were using 355/113. Today, computers have calculated π to millions of decimal places.