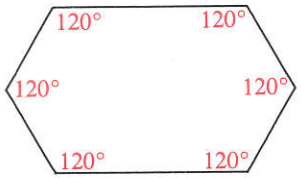
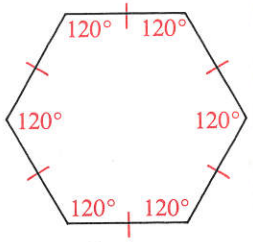
lygon has 22 sides. Find (a) the sum of the measures of the interior angles (b) the sum of the measures of the exterior angles, one angle at each x.

nterior angle sum = (22 − 2)180 = 3600 (Theorem 2-13)
Exterior angle sum = 360 (Theorem 2-14)

be equiangular or equilateral. If a polygon is both equi-ateral, it is called a **regular polygon.**



Equiangular hexagon



Regular hexagon

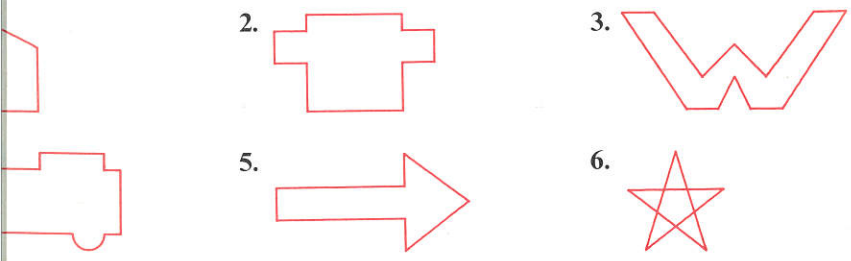
egular polygon has 12 sides. Find the measure of each interior angle.

rior angle sum = (12 − 2)180 = 1800
h of the 12 congruent angles has measure 1800 ÷ 12, or 150.

erior angle sum = 360
h of the 12 congruent exterior angles has measure 360 ÷ 12, or 30. Since n interior angle is a supplement of an exterior angle, each interior angle has asure 180 − 30, or 150.

xercises

of the figure a convex polygon? If not, is it a nonconvex



ching a rubber band around each of the figures in Exer-at is the relationship between the rubber band and the figure re is a convex polygon?

s 102 sides.
interior angle sum?
exterior angle sum?

9. Complete the table for regular polygons.

Number of sides	6	10	20	?	?	?	?
Measure of each ext. ∠	?	?	?	10	20	?	?
Measure of each int. ∠	?	?	?	?	?	179	90

Written Exercises

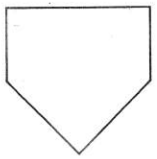
For each polygon, what is (a) the interior angle sum? (b) the exterior angle sum?

A **1.** Pentagon **2.** Hexagon **3.** Quadrilateral
4. Octagon **5.** Decagon **6.** *n*-gon

7. Complete the table for regular polygons.

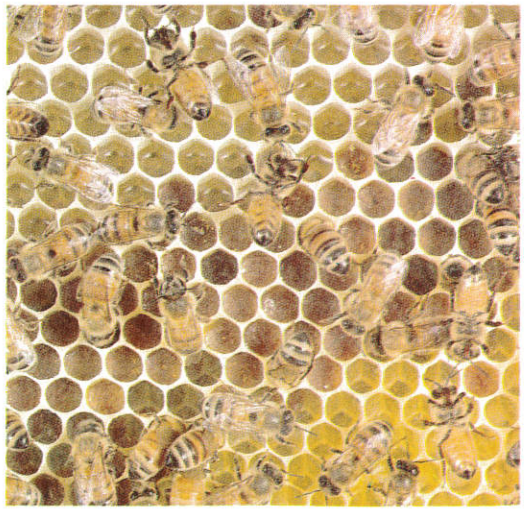
Number of sides	9	15	30	?	?	?	?
Measure of each ext. ∠	?	?	?	6	8	?	?
Measure of each int. ∠	?	?	?	?	?	165	178

8. A baseball diamond's home plate has three right angles. The other two angles are congruent. Find their measure.



Sketch the polygon described. If no such polygon exists, write *not possible.*

9. A quadrilateral that is equiangular but not equilateral.
10. A quadrilateral that is equilateral but not equiangular.
11. A pentagon that is equilateral but not equiangular.
12. A triangle that is equilateral but not equiangular.
13. A regular polygon, one of whose angles has measure 110.
14. The face of a honeycomb consists of interlocking regular hexagons. What is the measure of each angle of these hexagons?



B **15.** The sum of the measures of the interior angles of a polygon is four times the sum of the measures of its exterior angles, one angle at each vertex. How many sides does the polygon have?

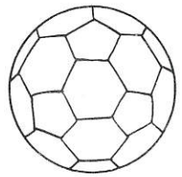
16. The measure of each interior angle of a regular polygon is eight times that of an exterior angle. How many sides does the polygon have?

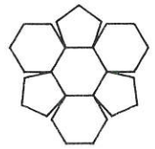
17. Make a sketch showing how to tile a floor using both squares and regular octagons.

18. **a.** What is the measure of each interior angle of a regular pentagon?
b. Can you tile a floor with tiles shaped like regular pentagons?

19. **a.** Is it possible to tile a floor with tiles shaped like equilateral triangles? (Ignore the difficulty in tiling along the edges of the room.)
b. Make a sketch showing how such tiles could be placed together to form a regular hexagon.

20. The cover of a soccer ball consists of interlocking regular pentagons and regular hexagons, as shown at the right. The second diagram shows that pentagons and hexagons cannot be interlocked in the same pattern to tile a floor. Why not?


Possible


Impossible

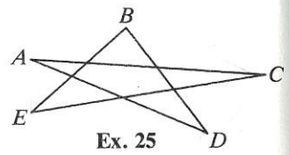
21. $ABCDEFGHIJ$ is a regular decagon. If sides $\overline{AB}$ and $\overline{CD}$ are extended to meet at K, find the measure of $\angle K$.

22. In quadrilateral $ABCD$, $m\angle A = x$, $m\angle B = 2x$, $m\angle C = 3x$, and $m\angle D = 4x$. Find the value of x and then state which pair of sides of $ABCD$ must be parallel.

23. In pentagon $PQRST$, $m\angle P = 90$ and $m\angle Q = 150$. $\angle S$ and $\angle T$ are each twice as large as $\angle R$.
a. Find the measures of $\angle R$, $\angle S$, and $\angle T$.
b. Which pair of sides of $PQRST$ must be parallel?

24. The sum of the measures of the interior angles in a polygon is known to be between 2500 and 2600. How many sides does the polygon have?

25. Find $m\angle A + m\angle B + m\angle C + m\angle D + m\angle E$.



Ex. 25

C **26.** The sum of the measures of the interior angles of a polygon with n sides is S. Not using n in your answer, express in terms of S the sum of the measures of the angles of a polygon with:
a. $n + 1$ sides **b.** $2n$ sides

27. The formula $S = (n - 2)180$ can apply to nonconvex polygons if you allow the measure of an interior angle to be more than 180.
a. Illustrate this with a diagram that shows interior angles with measures greater than 180.
b. Does the reasoning leading up to Theorem 2–13 apply to your figure?

COMPUTER KEY-IN

Theorem 2–13 gives a formula for the sum of the measures of the angle convex polygon. Using this formula you can compute the measure of an of a convex polygon if you know the measures of its other angles.

Computers are often used to generate random numbers, usually by of a built-in operation called RND. Since usage of RND varies with dif computers, check with the manual for your computer. In line 20 of the f ing BASIC program, the computer randomly selects a polygon of 3, 4 sides. After printing the measures of all but one of the angles, the com then asks the user to find the measure of the missing angle.

```
10   DIM A(5)
15   REM  N REPRESENTS THE NUMBER OF SIDES OF POLYGON
20   LET N = INT(RND(1) * 3) + 3
30   LET S = (N - 2) * 180
35   REM  T REPRESENTS SUM OF THE CHOSEN INTERIOR ANGLES
40   LET T = 0
50   FOR I = 1 TO N - 1
60   LET R = S - T
70   IF R > 180 THEN R = 180
75   REM  A(I) IS A RANDOM ANGLE BETWEEN 0 AND 180
80   LET A(I) = INT(RND(1) * R)
90   LET T = T + A(I)
100  NEXT I
105  REM  M REPRESENTS THE MISSING INTERIOR ANGLES
110  LET M = S - T
120  IF M >= 180 THEN 40
130  PRINT "HERE ARE THE MEASURES OF ALL BUT ONE OF THE
     ANGLES OF A POLYGON."
140  FOR J = 1 TO N - 1
150  PRINT A(J)
160  NEXT J
170  PRINT "------"
180  PRINT "WHAT IS THE MEASURE OF THE MISSING ANGLE";
190  INPUT X
200  IF X = M THEN 230
210  PRINT "SORRY, THE MISSING ANGLE HAS MEASURE"; M
220  END
230  PRINT "YOU ARE CORRECT"
240  END
```

Notice that lines 70 and 80 make it certain that A(I) will be between 0 The purpose of line 120 is to check whether the computer has gen convex polygon. If not, the computer is asked to generate a new set before printing the measures.

Type the program into your computer and RUN it several tim both correct and incorrect responses, checking the computer results.