Interior Angles of Polygons

Models and mappings

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

A convex polygon with n sides has interior-angle sum $S = (n-2)180^\circ$. If regular, each interior angle is $I = S/n = 180^\circ - 360^\circ/n$. One exterior angle at each vertex, taken consistently around a convex polygon, sums to 360°; a regular polygon has exterior angle $E = 360^\circ/n$. Interior and adjacent exterior angles sum to 180°. Check that a recovered side count is an integer at least 3.

Worked example

Find one interior angle of a regular nonagon (9 sides).

1. A convex 9-gon can be partitioned from one vertex into $9-2=7$ triangles without overlap.
2. The interior-angle sum is $(9-2)180^\circ = 7(180^\circ) = 1260^\circ$.
3. Because the polygon is regular, divide equally: $1260/9 = 140^\circ$ per interior angle. The sum and one-angle measure are different quantities.
Answer: 140°

Practice Problems

Show your thinking.

1. Find the interior-angle sum of a pentagon.

2. Find the interior-angle sum of a heptagon (7 sides).

3. Find one interior angle of a regular hexagon.

4. Find one interior angle of a regular decagon (10 sides).

5. Find one exterior angle of a regular octagon.

6. A quadrilateral has angles $82^\circ, 95^\circ, 103^\circ, x^\circ$. Find x.

7. A pentagon has four angles $100^\circ, 110^\circ, 120^\circ, 95^\circ$. Find its fifth.

8. Find the interior-angle sum of a 12-gon.

9. Find the difference between interior-angle sums of an octagon and a hexagon.

10. A regular pentagon has exterior angle 72°. Find its interior angle and verify the interior sum.

Answer Key

1. 540°
2. 900°
3. 120°
4. 144°
5. 45°
6. 80°
7. 115°
8. 1800°
9. 360°
10. 108°; sum 540°.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. A convex 5-gon can be partitioned from one vertex into $5 - 2 = 3$ triangles without overlap.

2. The interior-angle sum is $(5 - 2)180^\circ = 3(180^\circ) = 540^\circ$.

3. Thus the total is 540°. Regularity is unnecessary for the sum; unequal individual angles still add to this same total.

Problem 2

1. A convex 7-gon can be partitioned from one vertex into $7 - 2 = 5$ triangles without overlap.

2. The interior-angle sum is $(7 - 2)180^\circ = 5(180^\circ) = 900^\circ$.

3. Thus the total is 900°. Regularity is unnecessary for the sum; unequal individual angles still add to this same total.

Problem 3

1. A convex 6-gon can be partitioned from one vertex into $6 - 2 = 4$ triangles without overlap.

2. The interior-angle sum is $(6 - 2)180^\circ = 4(180^\circ) = 720^\circ$.

3. Because the polygon is regular, divide equally: $720/6 = 120^\circ$ per interior angle. The sum and one-angle measure are different quantities.

Problem 4

1. A convex 10-gon can be partitioned from one vertex into $10 - 2 = 8$ triangles without overlap.

2. The interior-angle sum is $(10 - 2)180^\circ = 8(180^\circ) = 1440^\circ$.

3. Because the polygon is regular, divide equally: $1440/10 = 144^\circ$ per interior angle. The sum and one-angle measure are different quantities.

Problem 5

1. The exterior angles total 360° and there are 8 equal ones.

2. Divide: $E = 360/8 = 45$ degrees.

3. The adjacent interior angle is $180 - 45 = 135^\circ$. The exterior measure 45° is not the octagon interior angle.

Problem 6

1. The quadrilateral sum is $(4 - 2)180 = 360$ degrees.

2. The known angles total $82 + 95 + 103 = 280$, so $x = 360 - 280 = 80$ degrees.

3. The check $82 + 95 + 103 + 80 = 360$ confirms all four interior angles, even though this quadrilateral is not regular.

Problem 7

1. The pentagon sum is $(5 - 2)180 = 540$ degrees.

2. The known sum is $100 + 110 + 120 + 95 = 425$, leaving $540 - 425 = 115$ degrees.

3. The final total $425 + 115 = 540$ verifies the missing interior angle. Dividing by 5 would incorrectly assume regularity.

Problem 8

1. A convex 12-gon can be partitioned from one vertex into $12 - 2 = 10$ triangles without overlap.

2. The interior-angle sum is $(12 - 2)180^\circ = 10(180^\circ) = 1800^\circ$.

3. Thus the total is 1800°. Regularity is unnecessary for the sum; unequal individual angles still add to this same total.

Problem 9

1. The octagon sum is $(8 - 2)180 = 1080$ degrees.

2. The hexagon sum is $(6 - 2)180 = 720$ degrees, so the difference is $1080 - 720 = 360$.

3. The two extra sides add two extra triangles, contributing $2(180) = 360^\circ$ to the interior-angle sum.

Problem 10

1. The interior and exterior form a linear pair: $I = 180 - 72 = 108$ degrees.

2. Five equal interiors total $5(108) = 540$ degrees.

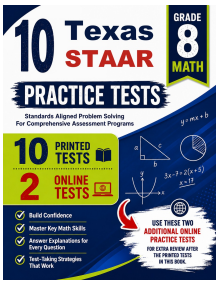
3. The formula check $(5 - 2)180 = 540$ agrees. The exterior sum is separately $5(72) = 360^\circ$.

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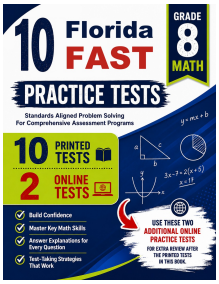
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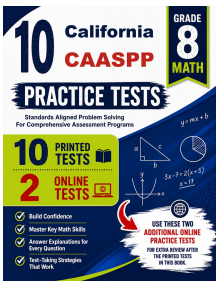
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