

Advanced High School Geometry Concepts

Geometry · Answer Key · 19 Questions

1. What is the locus of points equidistant from two intersecting lines?

- A) A single point
- B) A circle
- C) Two perpendicular lines bisecting the angles formed by the original lines**
- D) A hyperbola

2. In spherical geometry, what is the sum of the angles of a triangle?

- A) Exactly 180 degrees
- B) Less than 180 degrees
- C) More than 180 degrees**
- D) Always 360 degrees

3. What is the definition of an inversion with respect to a circle?

- A) A reflection across a line
- B) A rotation around a point
- C) A transformation that maps a point P to a point P' on the ray OP such that $OP \cdot OP' = r^2$, where O is the center and r is the radius**
- D) A dilation centered at a point

4. Which theorem states that if a line intersects two sides of a triangle and is parallel to the third side, it divides the two sides proportionally?

- A) Pythagorean Theorem
- B) Thales's Theorem (or Basic Proportionality Theorem)**
- C) Angle Bisector Theorem
- D) Ceva's Theorem

5. A regular tetrahedron has how many faces, edges, and vertices, respectively?

- A) 4, 6, 4**
- B) 6, 12, 8
- C) 8, 12, 6
- D) 4, 4, 4

6. What is the measure of a dihedral angle in a regular octahedron?

- A) 90 degrees
- B) 109.5 degrees
- C) 120 degrees
- D) $\arccos(-1/3) \approx 109.47$ degrees**

7. The sum of the interior angles of a polygon with n sides is given by which formula?

- A) $n * 180$ degrees
- B) $(n-2) * 180$ degrees**
- C) $n * 360$ degrees
- D) $(n-1) * 180$ degrees

8. What is the relationship between the radius of an inscribed circle (inradius) and the area of a triangle?

- A) Area = inradius * perimeter
- B) Area = $2 * \text{inradius} * \text{perimeter}$
- C) Area = inradius * semi-perimeter**
- D) Area = inradius / semi-perimeter

9. A curvilinear triangle is a triangle formed by arcs of great circles on a sphere. What is the maximum possible sum of the interior angles of a curvilinear triangle?

- A) 180 degrees
- B) 360 degrees
- C) 540 degrees**
- D) It can be arbitrarily large

10. What is the fundamental property of a parabola defined as a locus of points?

- A) Equidistant from a fixed point and a fixed circle
- B) Equidistant from a fixed line (directrix) and a fixed point (focus)**
- C) Equidistant from two fixed points
- D) Equidistant from two fixed parallel lines

11. Which of the following is NOT a type of Euclidean transformation?

- A) Translation
- B) Rotation
- C) Shear
- D) Inversion**

12. What does the term 'isometry' refer to in geometry?

- A) A transformation that preserves angles
- B) A transformation that preserves area
- C) A transformation that preserves distance**
- D) A transformation that preserves shape

13. In hyperbolic geometry, what is the sum of the angles of a triangle?

- A) Exactly 180 degrees
- B) Less than 180 degrees**
- C) More than 180 degrees
- D) Always 360 degrees

14. What is the measure of each interior angle of a regular dodecagon?

- A) 150 degrees
- B) 160 degrees
- C) 165 degrees**
- D) 180 degrees

15. The set of all points equidistant from a given point (the center) and a given circle is what geometric shape?

- A) A circle
- B) An ellipse
- C) A parabola**
- D) A hyperbola

16. What is the angle between two faces of a regular icosahedron?

- A) 90 degrees
- B) 116.565 degrees
- C) 138.19 degrees**
- D) 120 degrees

17. What is the condition for three points to be collinear?

- A) The area of the triangle formed by them is greater than zero
- B) The sum of the lengths of two segments formed by them is equal to the length of the third segment**
- C) The slope between any two pairs of points is different
- D) The distance between them is always zero

18. What is the definition of a point of inflection on a curve?

- A) A point where the tangent is horizontal
- B) A point where the curvature is zero
- C) A point where the concavity changes**
- D) A point where the curve intersects the x-axis

19. In Euclidean geometry, what is the sum of the exterior angles of any convex polygon, one at each vertex?

A) 180 degrees

B) 360 degrees

C) $n * 180$ degrees

D) Depends on the number of sides