

Advanced Geometry Facts

Geometry · Answer Key · 18 Questions

1. In which year did Leonhard Euler prove that the orthocenter, centroid, and circumcenter of a triangle are collinear on the Euler line?

- A) 1740
- B) 1750
- C) 1760**
- D) 1770

2. What is the numerical value of the golden ratio (ϕ) to five decimal places?

- A) 1.61803**
- B) 1.60803
- C) 1.61805
- D) 1.60805

3. Who is credited with the formal definition of a parabola in his work 'Conics' around 200 BC?

- A) Euclid
- B) Archimedes
- C) Apollonius of Perga**
- D) Ptolemy

4. The Koch snowflake, a fractal, has a dimension of approximately what value?

- A) 1.2618
- B) 1.4567
- C) 1.6094**
- D) 1.8928

5. What year did René Descartes publish 'La Géométrie', which introduced Cartesian coordinates?

- A) 1637**
- B) 1647
- C) 1627
- D) 1617

6. The area of a regular dodecagon (12-sided polygon) inscribed in a circle of radius 1 is equal to what numerical value?

- A) 2.983
- B) 3.106**
- C) 3.215
- D) 3.459

7. Who, in 1899, first proved that a regular 69-gon could be constructed using a compass and straightedge?

A) Carl Friedrich Gauss

B) Niels Henrik Abel

C) Évariste Galois

D) David Hilbert

8. What is the exact numerical value for the ratio of the circumference of a circle to its diameter, discovered by Archimedes using polygons?

A) 3.14159

B) $22/7$

C) 3.14

D) Approximation between $3 \frac{10}{71}$ and $3 \frac{1}{7}$

9. The E8 Lie group, which has a complex geometric structure, has a dimension of what number?

A) 18

B) 128

C) 248

D) 512

10. What year did Augustin-Louis Cauchy publish his foundational work on the geometry of surfaces and differential geometry?

A) 1815

B) 1827

C) 1835

D) 1842

11. The ratio of the volume of a sphere to the volume of a cylinder that circumscribes it (sharing the same radius and height) is exactly what fraction?

A) $1/2$

B) $2/3$

C) $3/4$

D) $3/5$

12. Who, in 1832, established the impossibility of constructing a regular 17-gon with compass and straightedge, a feat only possible for prime numbers of the form $2^{2^n} + 1$?

A) Pierre-Simon Laplace

B) Joseph-Louis Lagrange

C) Carl Friedrich Gauss

D) Siméon Denis Poisson

13. What is the minimum number of colors required to color any planar map such that no two adjacent regions have the same color?

- A) 3
- B) 4**
- C) 5
- D) 6

14. The concept of hyperbolic geometry, where parallel lines do not meet, was independently developed in the 1820s by which three mathematicians?

- A) Gauss, Lobachevsky, and Bolyai**
- B) Euclid, Riemann, and Klein
- C) Descartes, Fermat, and Pascal
- D) Euler, Lagrange, and Laplace

15. What is the exact value of the sum of the interior angles of a convex pentagon?

- A) 540 degrees**
- B) 720 degrees
- C) 900 degrees
- D) 1080 degrees

16. The discovery of the Platonic solids is traditionally attributed to which ancient Greek philosopher, who described them in his work 'Timaeus' around 360 BC?

- A) Aristotle
- B) Pythagoras
- C) Plato**
- D) Socrates

17. What is the numerical value of the angle (in degrees) of each interior angle of a regular octagon?

- A) 120
- B) 135**
- C) 144
- D) 150

18. In what year did Bernhard Riemann introduce his influential paper on the foundations of geometry, which generalized Euclidean geometry and laid groundwork for general relativity?

- A) 1854**
- B) 1864
- C) 1874
- D) 1884