

MCQ Differential Geometry

Choose the correct option:

1. The arc length parameter s of a curve satisfies

- A) $\left| \frac{d\vec{r}}{ds} \right| = 1$
- B) $\left| \frac{d\vec{r}}{ds} \right| = 0$
- C) $\frac{d\vec{r}}{ds} = 0$
- D) $\left| \frac{d\vec{r}}{ds} \right| = \infty$

Answer: A

2. The curvature of a circle of radius a is

- A) a
- B) $\frac{1}{a}$
- C) a^2
- D) 0

Answer: B

3. A curve with zero torsion is

- A) Helix
- B) Plane curve
- C) Twisted curve
- D) Spiral

Answer: B

4. The osculating plane is determined by

- A) \vec{T} and \vec{N}
- B) \vec{N} and \vec{B}
- C) \vec{T} and \vec{B}
- D) Only \vec{B}

Answer: A

5. The rectifying plane contains

- A) \vec{T} and \vec{B}
- B) \vec{T} and \vec{N}
- C) \vec{N} and \vec{B}
- D) Only \vec{N}

Answer: A

6. The tangent surface of a space curve is generated by

- A) Normal lines
- B) Binormal lines



- C) Tangent lines
- D) Circles

Answer: C

7. Involutes and evolutes are related through

- A) Tangent vectors
- B) Curvature centers
- C) Binormal vectors
- D) Surface normals

Answer: B

8. A circular helix has

- A) Variable curvature and torsion
- B) Constant curvature and torsion
- C) Zero curvature
- D) Zero torsion

Answer: B

9. A surface of revolution is generated by rotating a curve about

- A) A point
- B) A tangent
- C) An axis
- D) A plane

Answer: C

10. A helicoid is generated by

- A) Pure rotation
- B) Pure translation
- C) Simultaneous rotation and translation
- D) Reflection

Answer: C

11. The metric on a surface is used to measure

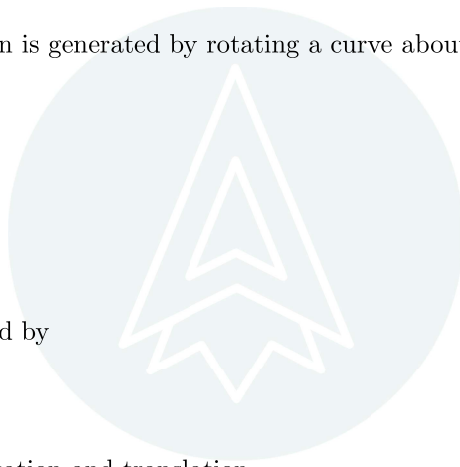
- A) Area only
- B) Distance and angle
- C) Volume only
- D) Curvature only

Answer: B

12. Two surfaces are isometric if they preserve

- A) Curvature only
- B) Distances
- C) Volume
- D) Torsion

Answer: B



13. Intrinsic properties remain unchanged under
- A) Stretching
 - B) Bending without stretching
 - C) Rotation only
 - D) Reflection only

Answer: B

14. The coefficients E, F, G are associated with
- A) Second fundamental form
 - B) Frenet frame
 - C) First fundamental form
 - D) Torsion

Answer: C

15. Curves on a surface are obtained by fixing
- A) One parameter
 - B) Two parameters
 - C) Three parameters
 - D) No parameter

Answer: A

16. A geodesic on a sphere is
- A) Ellipse
 - B) Great circle
 - C) Parabola
 - D) Hyperbola

Answer: B

17. Geodesic curvature of a geodesic is
- A) 1
 - B) Infinite
 - C) Zero
 - D) Negative

Answer: C

18. Gaussian curvature of a plane is
- A) 1
 - B) -1
 - C) 0
 - D) Infinite

Answer: C

19. A surface of constant positive curvature is
- A) Plane
 - B) Cylinder



- C) Sphere
- D) Cone

Answer: C

20. Gauss–Bonnet theorem relates

- A) Curvature and topology
- B) Area and volume
- C) Tangent and normal
- D) Curvature and torsion

Answer: A

21. The tangent vector is

- A) Zero
- B) Constant
- C) Normal to curve
- D) Derivative of position vector

Answer: D

22. The binormal vector is given by

- A) $\vec{T} + \vec{N}$
- B) $\vec{T} - \vec{N}$
- C) $\vec{T} \times \vec{N}$
- D) Zero

Answer: C

23. A surface is defined by

- A) One parameter
- B) Two parameters
- C) Three parameters
- D) No parameter

Answer: B

24. Intrinsic properties depend on

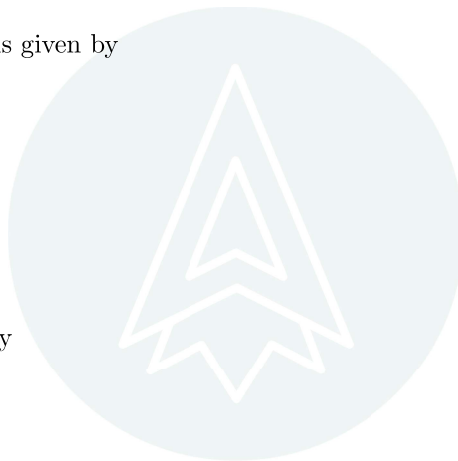
- A) Surface itself
- B) Embedding
- C) Coordinates
- D) Volume

Answer: A

25. Geodesic equation is derived from

- A) Energy minimization
- B) Volume
- C) Length minimization
- D) Area

Answer: C



26. Developable surfaces have
- A) Constant curvature
 - B) Infinite curvature
 - C) Non-zero Gaussian curvature
 - D) Zero Gaussian curvature

Answer: D

27. The principal normal vector is
- A) Tangent to the curve
 - B) Perpendicular to \vec{T}
 - C) Equal to \vec{B}
 - D) Zero

Answer: B

28. Curvature of a straight line is
- A) 1
 - B) Infinite
 - C) Zero
 - D) -1

Answer: C

29. Torsion measures
- A) Bending of curve
 - B) Twisting of curve
 - C) Length of curve
 - D) Area of surface

Answer: B

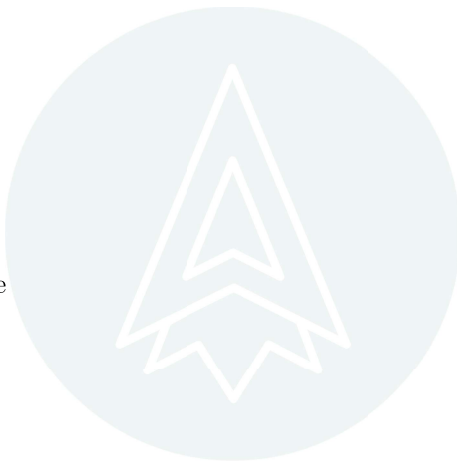
30. The first fundamental form is related to
- A) Distance on surface
 - B) Curvature only
 - C) Volume
 - D) Torsion

Answer: A

31. The second fundamental form is associated with
- A) Intrinsic geometry
 - B) Extrinsic curvature
 - C) Arc length
 - D) Coordinate axes

Answer: B

32. Gaussian curvature is the product of
- A) Principal curvatures
 - B) Tangent vectors



- C) Normal vectors
- D) Arc lengths

Answer: A

33. A geodesic on a plane is

- A) Circle
- B) Helix
- C) Straight line
- D) Parabola

Answer: C

34. The metric coefficients of a surface are denoted by

- A) E, F, G
- B) L, M, N
- C) T, N, B
- D) x, y, z

Answer: A

35. The coefficients L, M, N belong to

- A) First fundamental form
- B) Second fundamental form
- C) Frenet formulas
- D) Geodesic equations

Answer: B

