

I. Curve

1. How to describe a planar curve parametrically or by an equation in Cartesian coordinates.
2. Space curve given parametrically.
3. Determine whether a curve is piece-wise smooth.
4. Find the length of a smooth curve.
5. If a curve given parametrically represents a trajectory of a moving particle, find the velocity, speed and acceleration of the particle as a function of time.
6. Find the curvature of a trajectory at a point.
7. Find tangential, normal and binormal vectors for given trajectory.
8. Find the level curves of a function of two variables?
9. Find maximum and minimum values of a function along a curve. (Lagrange multipliers method).
- 10 Find an integral of a function along a curve. What is its physical interpretation?
- 11 Find an integral of a vector field along a curve. What is its physical interpretation?
12. Find an area of a region in xy-plane bounded by few planar curves.

II. Surface

1. How to describe a surface parametrically.
2. Surface as a graph of a function $z = f(x, y)$.
3. Find Area of a surface given parametrically.
4. Find equation of normal vector to a smooth surface at a given point.
5. Find equation of a tangent plane to a smooth surface at a point.
6. Find surface integral of a function. What is its physical interpretation?
7. Find surface integral of a vector field. What is its physical interpretation?
8. Find a volume bounded by a surface.
9. Find a mass of a solid with given density $f(x, y, z)$ bounded by a piece-wise smooth surface.

III Theorems.

1. Fundamental Theorem of line integral.
2. Green's Theorem.
3. Stokes' Theorem.
4. Divergence Theorem.

IV. Equations and formulas

1. Equations of line, circle, ellipse, helix.
2. Equations of plane, cone, cylinder, sphere, ellipsoid, elliptic paraboloid, hyperbolic paraboloid, hyperboloids.
- 3a. 2D-Cartesian and polar coordinates. Change of variables and integration.
- 3b. 3D-Cartesian, cylindrical and spherical coordinates. Change of variables and integration.
4. Curl and div of a vector field $\vec{F}(x, y, z)$.