
41. Evaluate
\[
\int_{(0,0)}^{(\pi,2)} (6xy - y^2) \, dx + (x^2y + 3) \, dy
\]
along the cycloid \( x = \theta - \sin \theta, \, y = 1 - \cos \theta \).

42. Evaluate
\[
\oint (3x^2 + 2y) \, dx - (x + 3 \cos y) \, dy
\]
around the parallelogram having vertices at \((0,0), (2,0), (3,1)\) and \((1,1)\).

62. Prove
\[
\iint_S \vec{R} \times d\vec{S} = \vec{0}
\]
for any closed surface \( S \).

63. Verify Stoke’s theorem for \( \vec{A} = (y - z + 2)\vec{i} + (yz + 4)\vec{j} - xz\vec{k} \), where \( S \) is the surface of the cube bounded by the planes \( x = 0, \, y = 0, \, z = 0, \, x = 2, \, y = 2, \, z = 2 \).

64. Verify Stoke’s theorem for \( \vec{F} = xz\vec{i} - y\vec{j} + x^2y\vec{k} \), where \( S \) is the surface of the region bounded by \( x = 0, \, y = 0, \, z = 0, , 2x + y + 2z = 8 \) which is not included in the \( XZ \)-plane.

65. Evaluate
\[
\iint_S (\nabla \times \vec{A}) \cdot \vec{n} \, dS,
\]
where \( \vec{A} = (x^2 + y - 4)\vec{i} + 3xy\vec{j} + (2xz + z^2)\vec{k} \), and \( S \) is the surface on
(a) the hemisphere \( x^2 + y^2 + z^2 = 16 \) above the \( XY \)-plane,
(b) the paraboloid \( z = 4 - (x^2 + y^2) \) above the \( XY \)-plane.

66. If \( \vec{A} = 2yz\vec{i} - (x + 3y - 2)\vec{j} + (x^2 + z)\vec{k} \), evaluate
\[
\iint_S (\nabla \times \vec{A}) \cdot \vec{n} \, dS,
\]
over the surface of intersection of the cylinders \( x^2 + y^2 = a^2, \, x^2 + z^2 = a^2 \) which is included in the first octant.