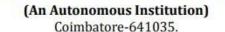


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UNIT-1 **VECTOR CALCULUS** STOKE'S THEOREM 2]. Vocity Stoke's theorem $\vec{F} = (x^2 - y^2)\vec{i} + 2xy\vec{j}$ so the sectangular legion bounded by x = 0, $x = q_g$ 9=0, y=b. Soln. <u>ST</u> $\int \vec{F} \cdot d\vec{r} = \int (\vec{r} \times \vec{F}) \cdot \hat{n} ds$ $\int \vec{F} \cdot d\vec{r} = (\chi^{2} - \chi^{2}) \vec{r} + 2\pi \chi \vec{J}$ $\int A(20) \vec{y} = 0$ $B [a, 0] \chi$ $\nabla X \overrightarrow{F} = \begin{vmatrix} \overrightarrow{r} & \overrightarrow{J} & \overrightarrow{K} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial x} \\ \frac{\partial}{x^2 - y^2} & \frac{\partial}{\partial x + y} & 0 \end{vmatrix}$ $= \overrightarrow{r} \begin{bmatrix} 0 - 0 \end{bmatrix} - \overrightarrow{r} \begin{bmatrix} 0 - 0 \end{bmatrix} + \overrightarrow{K} \begin{bmatrix} 3y + 3y \end{bmatrix}$ $\nabla \times \overrightarrow{F} = -4y \overrightarrow{K}$ RHS ∬ VxF. n ds = ∬ 4yk. K dre dy $= \int \int Ay \, dx \, dy$ $= 4 \int y [x]^{a} dy$ = 4a jy dy $= 4a \left[\frac{y^2}{2} \right]^b$ $\int [\nabla x \vec{F} \cdot \vec{n} \, dS = aab^2 \rightarrow (n)$ S Criven $\vec{F} = (x^2 - y^2)\vec{r} + axy\vec{J}$ $d\vec{r} = dx\vec{r} + dy\vec{J} + dx\vec{K}$ Scanned with $d\vec{r} = (x^2 - y^2) dx + axy dy$



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(An Autonomous Institution) Coimbatore-641035.



UNIT-1 VECTOR CALCULUS STOKE'S THEOREM LHS $\int \vec{F} \cdot d\vec{r} = \int + \int + \int + \int + \int \\ AB BC CD DA$ Along AB $[y=0 \Rightarrow dy=0]$ $\int (x^2 - y^2) dx + axy dy = \int x^2 dx$ $=\left(\frac{\pi^3}{3}\right)^{\alpha}$ $=\frac{a^{3}}{a}$ Along BC $[x=a \Rightarrow dx=o]$ $\int (x^2-y^2) dx + 2xy dy = \int 2ay dy$ BC $= 2\alpha \left(\frac{y^2}{2}\right)^{D}$ $= ab^2$ Along CD [9=b > dy=0] $\int (x^2 - y^2) dx + 2\pi y dy = \int (\pi^2 - b^2) dx$ $= \left[\frac{x^3}{3} - b^2 x\right]^0$ CD = 0 - (a3 - ab?) $= -\frac{a^3}{2} + ab^2$ Along DA [x=0 >> dx=0] $\int (x^2 - y^2) dx + 2xy dy = 0$ $\therefore \int \vec{F} \cdot d\vec{s} = \int + \int + \int + \int = \frac{a^3}{3} + ab^2 - \frac{a^3}{3} + ab^2 + \frac{a^3}{3} + ab$ From (1) & (2), LHS=RHS CamScannier Le Stoke's theorem is verified. Scanned with