Final Examination on Calculus 2 - 20222

Course code: MI1121E. Duration: 90 minutes

Caution: Unauthorized materials are not allowed

Q1. Find the curvature of the curve $y = x^2 - 1$ at $A(1, 0)$.

Q2. Find the directional derivative of the function $u(x, y, z) = x^2 + 2xy^2 - yz^3$ in the direction of $\vec{\ell} = (1, -2, 2)$ at the point $A(1, 1, 1)$.

Q3. Evaluate $\iint\limits_D (1 + x + y^2)dxdy$, where $D\colon x^2 + y^2 \le 1$.

Q4. Evaluate $\iiint\limits_V (3x + z)dxdydz$, where $V\colon x^2 + y^2 + z^2 \le 2z$.

Q5. Evaluate $\int\limits_0^{+\infty} \frac{\sqrt{x}}{(1 + x^2)^3}dx$.

Q6. Evaluate $\int\limits_C (x + 2y)ds$, where $C\colon y = \sqrt{2x - x^2}$.

Q7. Evaluate $\oint\limits_C (xy + 3x + 2y)dx + (xy - 2y)dy$, where C is the circle $x^2 + y^2 = 2x$ with counterclockwise orientation.

Q8. Evaluate $\iint\limits_S (2x - y + z^2)dS$, where S is the hemisphere

$$S\colon x^2 + y^2 + z^2 = 1, x \ge 0.$$

Q9. Find the flux of the vector field $\vec{F} = x\vec{i} + y\vec{j} + (z^2 - 1)\vec{k}$ across S, where S is the part of the ellipsoid $x^2 + \frac{y^2}{4} + z^2 = 1$, $z \ge 0$, with upward orientation.

Q10. Find the circulation of the vector field

$$\vec{F} = (2xze^{x^2} + y^2 - z)\vec{i} + (y - 3z)\vec{j} + (e^{x^2} + x + 2y)\vec{k}$$

around C. Here C is the curve of intersection of the plane $x + y + z = 1$ and the cylinder $x^2 + y^2 = 2y$, oriented counterclockwise as viewed from above.

——————*The end*——————-

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Q1. Find the curvature of the curve $y = x^2 + 1$ at $A(1, 2)$.

Q2. Find the directional derivative of the function $u(x, y, z) = x^2 + 2xy^2 - yz^3$ in the direction of $\vec{\ell} = (1, 2, -2)$ at the point $A(1, 1, 1)$.

Q3. Evaluate $\iint\limits_D (1 + x - y^2)dxdy$, where $D\colon x^2 + y^2 \le 1$.

Q4. Evaluate $\iiint\limits_V (2y + z)dxdydz$, where $V\colon x^2 + y^2 + z^2 \le 2z$.

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