"QUIZ" for Lecture 20

NAME: (print!) Fady Besada **Section:** 22

E-MAIL SCANNED .pdf OF COMPLETED QUIZ to DrZcalc3@gmail.com (Attachment: q20FirstLast.pdf) ASAP BUT NO LATER THAN Nov. 16, 8:00pm

1. Find an equation for the tangent plane to the parametric surface

$$x = v^2 \quad , \quad y = u + v \quad , \quad z = u^2 \quad ,$$

at the point $(1, 2, 1)$. Simplify as much as you can!

$r = xi + yj + zK \Rightarrow r = v^2 i + (u+v) j + u^2 K$

$r_u = x_u i + y_u j + z_u K \Rightarrow r_u = j + 2uK$

$r_v = x_v i + y_v j + z_v K \Rightarrow r_v = 2vi + j$

$r_u(1,1) = j + 2K, \quad r_v(1,1) = 2i + j$

$r_u \times r_v = \langle -2, 4, -2 \rangle$

$\boxed{x - 2y + z = -2}$

2. Evaluate the surface integral

$$\int\int_S z\, dS \quad ,$$

where S is the triangular region with vertices $(2,0,0), (0,2,0), (0,0,2)$.

$x + y + z = 2$

$z = 2 - x - y$

$\iint_S f(x,y,z)\, dS = \iint_D f(x, y, g(x,y)) \sqrt{1 + g_x^2 + g_y^2}\, dx\, dy$

$g(x,y) = 2 - x - y \Rightarrow g_x = -1, \; g_y = -1$

$\iint_S z\, dS = \iint_D (2 - x - y)\sqrt{3}\, dy\, dx$

$D = \{(x,y) \mid x \geq 0, \; y \geq 0, \; x + y \leq 2\}$

$D = \{(x,y) \mid 0 \leq x \leq 2, \; 0 \leq y \leq 2 - x\}$

$\int_0^2 \int_0^{2-x} \sqrt{3}\, dy\, dx = \boxed{2\sqrt{3}}$

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Evaluate the surface integral $\int\int_S \mathbf{F} \cdot d\mathbf{S}$ for the given vector field $\mathbf{F}$ and oriented surface S.

$$\mathbf{F}(x, y, z) = \langle xy\,,\, yz\,,\, zx \rangle \quad ,$$

and S is the part of the paraboloid $z = 1 - x^2 - y^2$ that lies above the square $0 \le x \le 1\,,\, 0 \le y \le 1$ and has upward orientation.

$F = \langle P, Q, R \rangle$

$\iint_S F \cdot ds = \iint_D \left(-P\frac{dg}{dx} - Q\frac{dg}{dy} + R\right) dA$

$P = xy, \quad Q = yz, \quad R = zx$

$\iint_D \left(-xy(-2x) - yz(-2y) + xz\right) dA$

$\iint_D \left(2x^2y + 2y^2z + xz\right) dA$

$\int_0^1\int_0^1 \left(2x^2y + 2y^2(1 - x^2 - y^2) + x(1 - x^2 - y^2)\right) dA = \boxed{\frac{83}{180}}$