Math 10B - Calculus of Several Variables II
Quiz 5
May 27, 2011

Name: Key

1a	1b	Total
/4	/6	/10

Problem 1. *Consider the surface* $x^2 + y^2 = 1$ *where* $-3 \leq z \leq 5$.

(*a*) (4 Points) *Parametrize the surface.*

(*b*) (6 Points) *Find the tangent plane to the surface at the point* $\left(\frac{1}{2}, \frac{\sqrt{3}}{2}, 0\right)$.

(a) $X(s,t) = (\cos s, \sin s, t)$, $0 \leq s \leq 2\pi$, $-3 \leq t \leq 5$

(b) $T_s = (-\sin s, \cos s, 0)$ $T_t = (0,0,1)$

$$N = T_s \times T_t = \begin{vmatrix} i & j & k \\ -\sin s & \cos s & 0 \\ 0 & 0 & 1 \end{vmatrix} = (\cos s, \sin s, 0)$$

$X\left(\frac{\pi}{3}, 0\right) = \left(\cos\frac{\pi}{3}, \sin\frac{\pi}{3}, 0\right) = \left(\frac{1}{2}, \frac{\sqrt{3}}{2}, 0\right) = P$

$N\left(\frac{\pi}{3}, 0\right) = \left(\frac{1}{2}, \frac{\sqrt{3}}{2}, 0\right)$

$\Rightarrow N \cdot ((x,y,z) - P) = \left(\frac{1}{2}, \frac{\sqrt{3}}{2}, 0\right) \cdot \left(x - \frac{1}{2}, y - \frac{\sqrt{3}}{2}, z - 0\right)$

$= \frac{1}{2}x - \frac{1}{4} + \frac{\sqrt{3}}{2}y - \frac{3}{4} + 0 = \boxed{\frac{1}{2}x + \frac{\sqrt{3}}{2}y - 1 = 0}$

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/4	/6	/10

Problem 1. *Consider the surface $x^2 + y^2 = 4$ where $-3 \leq z \leq 5$.*

(*a*) (4 Points) *Parametrize the surface.*

(*b*) (6 Points) *Find the surface area of this surface.*

(a) $X(s,t) = (2\cos s, 2\sin s, t)$, $0 \leq s \leq 2\pi$, $-3 \leq t \leq 5$

(b) $T_s = (-2\sin s, 2\cos s, 0)$, $T_t = (0,0,1)$

$$\Rightarrow N = T_s \times T_t = \begin{vmatrix} i & j & k \\ -2\sin s & 2\cos s & 0 \\ 0 & 0 & 1 \end{vmatrix} = (2\cos s, 2\sin s, 0)$$

$$\Rightarrow \|N\| = \sqrt{(2\cos s)^2 + (2\sin s)^2 + 0^2} = \sqrt{4(\cos^2 s + \sin^2 s)} = 2$$

$$\Rightarrow SA = \iint_D \|N\| dA = \int_0^{2\pi} \int_{-3}^{5} 2 \, dt \, ds = \boxed{32\pi}$$