620-231 Exam Semester 1 (2005)

Q 1 (a) $Df = \begin{bmatrix} -4 & 16 \\ -5 & 0 \end{bmatrix}$

(b) $f(x,y) \approx 1 - \frac{1}{8}(x-\pi)^2 - \frac{\pi}{2}(x-\pi)(y-\frac{1}{2}) - \frac{\pi^2}{2}(y-\frac{1}{2})^2$

Q 2 $(0,0)$ is absolute minimum ($f=-2$)

$(\frac{1}{\sqrt{2}}, -1), (\frac{-1}{\sqrt{2}}, 1)$ are absolute maximums ($f=\sqrt{2}$)

Q3 (a)(i) $\underset{\sim}{c}_1'(t) \cdot \underset{\sim}{c}_1(t) = 0$

(ii) $\underset{\sim}{N} = -(\cos\omega t, \sin\omega t, 0)$

$\underset{\sim}{B} = (0,0,1) = \underset{\sim}{k}$

(iii) —

(b) $\underset{\sim}{c}(t) = (\cos t - 1, \sin t)$ [Answer not unique]

(c) Proof.

Q4 : $\pi(e^{b^2} - e^{a^2})$

Q5(a) 0

(b)(i) $p=1$

(b)(ii) $\sqrt{3}$

Q6 $z_{cm} = 9/8$

Q7(a) $\underset{\sim}{\hat{n}} = \frac{1}{\sqrt{v^2+1}}(v\cos\phi, v\sin\phi, 1)$

(b) $\frac{32\pi M}{3}(2\sqrt{2}-1)$

(c) $(s, t, 2 - (\frac{s^2+t^2}{8}))$

Q8 (a) 64π

(b) Proof

Q9 (a) -16π

(b) See lecture notes

Q10 18π