1/31/20.

Multivariable Calculus Midterm 1

1 9 2 1 1 2 4 5 7 1 1 replaced

1 2 3 4 5 6 7 8 9

1) $x^1 + y^9 + z^2 + 1 + xyz^2 = 4$

$9y^8 + 2z \cdot \frac{dz}{dy} + 2xyz \cdot \frac{dz}{dy} + xz^2 = 0$

$-\left(\frac{9y^8 + xz^2}{2z + 2xyz}\right) = \frac{dz}{dy}$

At $(1,1,1)$, $\frac{dz}{dy} = \frac{-9-1}{2+2} = -\frac{10}{4} = -2.5$

2) $\nabla f_p = \langle 1, -1, 6 \rangle$

Direction $\langle 1, 2, -1 \rangle$

3) $x^3 \cdot 2 + y^3 \cdot 2 + z^3 \cdot 5$

$2x^3 + 2y^3 + 5z^3$

$\nabla f = \langle 6x^2 + 6y^2 + 15z^2 \rangle$

$PQ = \langle 1, -1, 3 \rangle - \langle 1, -1, 1 \rangle = \langle 0, 0, 2 \rangle$

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$$\frac{1 \quad 9 \quad 2 \quad 1 \quad 1 \quad 2\,4\,5\,7}{1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7\,8\,9}$$

Unit direction: $\langle 0, 0, 2 \rangle = \langle 0, 0, 1 \rangle$

$\langle 6, 6, 15 \rangle$

$\langle 6, 6, 15 \rangle \cdot \langle 0, 0, 1 \rangle$

$= 15$

4) $e^{x-1} - (x-1)(e^{y-2})$

→ Find saddle point.

$f_x = e^{x-1} - e^{y-2}$ $\qquad f_{1,2} = e^0 - e^0 = 1 - 1 = 0.$

$f_y = -(x-1)e^{y-2}$ $\qquad f_{y(1,2)} = -(1-1)e^{y-2} = 0$

$f_{xy} = -e^{y-2}$ $\qquad F_{xy} = -e^0 = \boxed{-1}.$

$e^{x-1} - e^{y-2} = 0.$ $\qquad -(x-1)e^{y-2} = 0$

Critical point at $(1, 2)$.

5) $\frac{x^2(1) - y^2(1)}{x-y}$

$\frac{0}{0}$, let $y = cx$.

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$$\frac{x^2 - c^2x^2}{x - cx} = \frac{\cancel{x}(x - c^2x)}{x\cancel{x}(1-c)} = \frac{x(x-c)}{1-c}$$

Depends on x.

let $x = r\cos\theta$, $y = r\sin\theta$.

$$\lim_{r\to 0} \frac{r^2\cos^2\theta - r^2\sin^2\theta}{r\cos\theta - r\sin\theta} = \lim_{r\to 0} \frac{r(\cos^2\theta - \sin^2\theta)}{\cos\theta - \sin\theta} = \frac{0}{0}$$

8) $\langle 0, 9, 4t \rangle$ $\quad$ $\langle 0, 9, 0 \rangle$

$\langle 0, 0, 4 \rangle$. $\quad$ $\langle 0, 0, 4 \rangle$ X

$= \langle 36, 0, 0 \rangle$.

$$k(t) = \frac{(36)}{9^3} =$$

$v = \cos t \quad -9\sin t + C$.

$\langle \cos t, -9\sin t \rangle + c = \langle 1, 0 \rangle$.

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