Subject: Exam 2
Year. Month. Date. ( )

Problem 1

a) $\nabla f = \langle 2xy^2-1, 2x^2y \rangle$

$\nabla f \big|_{(2,1)} = \langle 3, 8 \rangle$

b) $3x + 8y = 1\cancel{4}2$

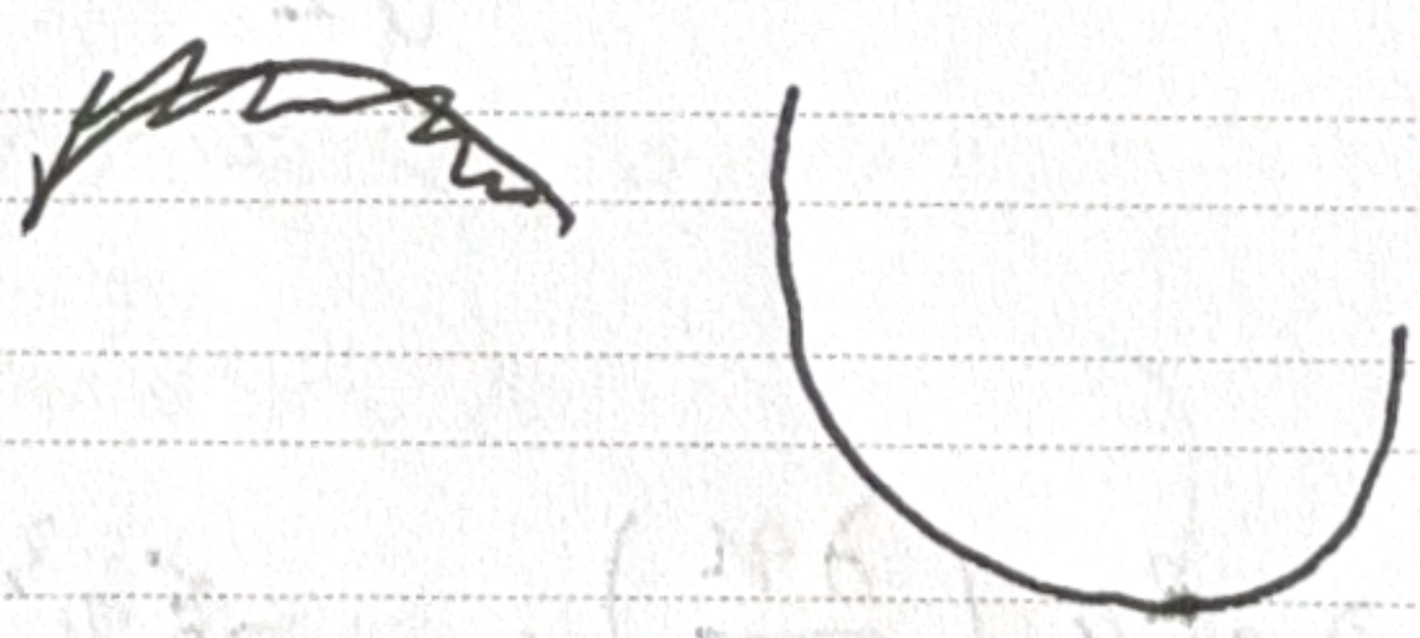
c) $\Delta f \approx (2xy^2-1)\Delta x + (2x^2y)\Delta y$

$\underset{\text{at }(2,1)}{\approx} \quad 3\Delta x + 8\Delta y$

$\Rightarrow \; -.3 + .8 = .5 \to \overset{2}{\cancel{13}}.5$

d) $\nabla f \cdot \langle -\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \rangle = \frac{2}{\sqrt{2}} xy^2 - \frac{1}{\sqrt{2}} + \frac{2}{\sqrt{2}} x^2 y$

Problem 2



Problem 3

a) $\left.\begin{aligned} w_x &= -6x - 4y + 16 \\ w_y &= -4x - 2y - 12 \end{aligned}\right\} \overbrace{(20, 46)}^{\text{saddle}}$

$w_{xx} = -6 \quad w_{yy} = -2 \quad w_{xy} = -4$

b) it has to be on boundaries

$x=0 \to f_{y\to\infty} \downarrow \quad y=0 \to f_{x\to\infty} \downarrow \Rightarrow (0,0)$

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Problem 4

a) $w_x = w_u \cdot \frac{-y}{x^2} + w_v \cdot 2x$

$w_y = w_u \cdot \frac{1}{x} + w_v \cdot 2y$

b) $w_u \cdot \frac{-y}{x} + w_v \cdot 2x^2 + w_u \cdot \frac{y}{x} + w_v \cdot 2y^2$

$= -w_u \cdot u + w_v \cdot 2 \cdot v + w_u \cdot u = w_v \cdot 2v$

c) $10v^5$

Problem 5

$\nabla g = \langle 4x^3 + y + z, 4y^3 + x + z, 4z^3 + y + x \rangle$

$f = x$

$\nabla f = \langle 1, 0, 0 \rangle$

$$\left.\begin{array}{l} 4x^3 + y + z = \lambda \\ 4y^3 + x + z = 0 \\ 4z^3 + y + x = 0 \\ x^4 + y^4 + z^4 + xy + yz + zx = 6 \end{array}\right\}$$

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Problem 6

a) $0 = dw = 2x\,dx + 3y^2\,dy \cancel{+} - 4z^3\,dz$

$0 = dw = (z+y)\,dx + x\,dy + (3z^2 + z)\,dz$ ✓

b) $\cancel{0 = (z+y)\,dx + \frac{x - (2x^2)}{3y^2}\,dx + (3z^2 + z)\,dz}$

$3 \quad x^2 + 3y^3 - 3z^4 = z^3 + zx + xy = 3$

$$6x\,dx + 9y^2\,dy - 12z^3\,dz = (z+y)\,dx + x\,dy + (3z^2 + x)\,dz = 0$$

$$(6x - z - y)\,dx + (9y^2 + x)\,dy + (3z^2 + x - 12)\,\overset{0}{dz} = 0$$

$$\Rightarrow \frac{dy}{dx} = \frac{6x - z - y}{9y^2 + x}$$

$$\Rightarrow \left.\frac{dy}{dx}\right|_{(1,1,1)} = \frac{4}{10}$$ ✗

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