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1. (i)

$$f(x,y) = 2x^2y^2 - 3xy + 4x + 2$$

$$f_x = 4xy^2 - 3y + 4 \qquad f_y = 4x^2y - 3x$$

(ii)

$$f(x,y) = cos(x^2y) \cdot e^{xy}$$

$$f_x = -sin(x^2y) \cdot 2xy \cdot e^{xy} + cos(x^2y) \cdot y \cdot e^{xy}$$

$$f_y = -sin(x^2y) \cdot x^2 \cdot e^{xy} + cos(x^2y) \cdot x \cdot e^{yx}$$

(iii)

$$f(x,y) = \frac{sin\ x + cos\ y}{x^2 + y^2}$$

$$f_x = \frac{cos\ x \cdot x^2y^2 - (sin\ x + cos\ y) \cdot 2x}{(x^2 + y^2)^2}$$

$$f_y = \frac{-sin \cdot x^2y^2 - (sin\ x + cos\ y) \cdot 2y}{(x^2 + y^2)^2}$$

(iv)

$$f(x,y) = \sqrt{1 - x^2 - y^2}$$

$$f_x = \frac{1}{2}(1 - 2x)^{-\frac{1}{2}} \qquad f_y = \frac{1}{2}(1 - 2y)^{-\frac{1}{2}}$$

2. **TODO**

3. **TODO**

4. **TODO**