Please answer the following questions completely and clearly. An unsupported answer is worth few points.

(1) Find and sketch the domain of $f(x, y) = \sqrt{1-x} + \sqrt{4-x^2-y^2}$:

(2) Show that the following limit does not exist:
$$\lim_{{(x, y) \to (0, 0)}} \frac{x^5-6y}{y+3x}$$

(3) Calculate the partial derivatives of $f(x, y) = x^2y \cos(xy)$: