1. True. $f_y(a,b) = \lim_{h\to 0} \dfrac{f(a,b+h) - f(a,b)}{h}$ from Equation 11.3.3. Let $h = y - b$. As $h \to 0$, $y \to b$. Then by substituting, we get $f_y(a,b) = \lim_{y\to b} \dfrac{f(a,y) - f(a,b)}{y-b}$.

2. False. If there were such a function, then $f_{xy} = 2y$ and $f_{yx} = 1$. So $f_{xy} \neq f_{yx}$, which contradicts Clairaut's Theorem.

3. False. $f_{xy} = \dfrac{\partial^2 f}{\partial y\, \partial x}$.

4. True. From Equation we get $D_{\mathbf{k}}\, f(x,y,z) = \nabla f(x,y,z) \cdot \langle 0,0,1\rangle = f_z(x,y,z)$.

5. False. See Example 11.2.3.

6. False. See Exercise 11.4.38(a).

7. True. If f has a local minimum and f is differentiable at (a,b) then by Theorem 11.7.2, $f_x(a,b) = 0$ and $f_y(a,b) = 0$, so $\nabla f(a,b) = \langle f_x(a,b), f_y(a,b)\rangle = \langle 0,0\rangle = \mathbf{0}$.

8. False. If f is not continuous at $(2,5)$, then we can have $\lim_{(x,y)\to(2,5)} f(x,y) \neq f(2,5)$. (See Example 11.2.7)

9. False. $\nabla f(x,y) = \langle 0, 1/y\rangle$.

10. True. This is part (c) of the Second Derivatives Test (11.7.3).

11. True. $\nabla f = \langle \cos x, \cos y\rangle$, so $|\nabla f| = \sqrt{\cos^2 x + \cos^2 y}$. But $|\cos\theta| \leq 1$, so $|\nabla f| \leq \sqrt{2}$. Now $D_{\mathbf{u}}\, f(x,y) = \nabla f \cdot \mathbf{u} = |\nabla f|\, |\mathbf{u}| \cos\theta$, but $\mathbf{u}$ is a unit vector, so $|D_{\mathbf{u}}\, f(x,y)| \leq \sqrt{2} \cdot 1 \cdot 1 = \sqrt{2}$.

12. False. See Exercise 11.7.29.