

Quiz 5 (Feb 27, 2025) KEY

Let  $f(x,y) = x^2y + xy^3$  and let  $x_0 = 3, y_0 = -2$ .

- ① Find the slope of the tangent line at  $(x_0, y_0, f(x_0, y_0))$  in the direction of  $(1, 1)$ .  
 (4 pts)  $\nabla f = \langle 2xy + y^3, x^2 + 3xy^2 \rangle, \vec{v} = \langle -2, 3 \rangle \left( \frac{1}{\sqrt{13}} \right)$  }  $D_{\vec{v}} f = \langle -20, 45 \rangle \cdot \left\langle \frac{-2}{\sqrt{13}}, \frac{3}{\sqrt{13}} \right\rangle$   
 $\nabla f(3, -2) = \langle -20, 45 \rangle$  }  $= \frac{175}{\sqrt{13}} \approx 48.54$

- ② Find the direction at this point of steepest ascent.  
 (3 pts)  $\langle -20, 45 \rangle$

- ③ Find the slope of steepest ascent.  
 (3 pts)  $\sqrt{(-20)^2 + (45)^2} = \sqrt{400 + 2025} = \sqrt{2425} \approx 49.24$

Note: the  $(1, 1)$  in problem 1 is NOT a vector! It is a coordinate, so the vector must be inferred from the initial point  $(3, -2)$  to  $(1, 1)$ , which is  $\langle -2, 3 \rangle$ .