

Name: \_\_\_\_\_

**Math 2030, Winter 2016, Quiz 5**  
**17 February 2016**  
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*No calculators needed or allowed.*

Let  $f(x, y, z) = x^3y + y^2z$ .

1. Compute the gradient  $\nabla f$ .
2. Compute the directional derivative  $D_{\vec{u}}f$  if  $\vec{u} = (1, 1, 0)$ .
3. Observe that  $f(1, 3, 4) = 39$ . Compute the tangent plane to  $f(x, y, z) = 39$  at the point  $(1, 3, 4)$ .
4. Use this tangent plane to estimate the value of  $z$  for which  $f(1.1, 3.1, z) = 39$ .
5. Find  $\partial z / \partial x$  if  $z(x, y)$  is implicitly defined by the condition  $f(x, y, z) = 39$ .