Multiple Choice: (5 points each)

1. For the function \( f(x,y) = y^2 \cos(xy) \) which partial derivative is incorrect?
   
   a. \( \frac{\partial f}{\partial x} = -y^3 \sin(xy) \)
   
   b. \( \frac{\partial f}{\partial y} = 2y \cos(xy) - xy^2 \sin(xy) \)
   
   c. \( \frac{\partial^2 f}{\partial x^2} = -y^4 \cos(xy) \)
   
   d. \( \frac{\partial^2 f}{\partial y \partial x} = -3y^2 \sin(xy) - xy^3 \cos(xy) \)
   
   e. \( \frac{\partial^2 f}{\partial x \partial y} = -y^2 \sin(xy) - xy^3 \cos(xy) \)

2. Find the equation of the plane tangent to \( z = x^2y^3 \) at the point \( (2,1,4) \).
   Its \( z \)-intercept is:
   
   a. 0
   
   b. −24
   
   c. −16
   
   d. 24
   
   e. 4
3. Consider a function \( p(x, y) \). If \( p(2, 3) = 3 \), \( \frac{\partial p}{\partial x}(2, 3) = 4 \), and \( \frac{\partial p}{\partial y}(2, 3) = 5 \), estimate \( p(2.1, 2.8) \).

   a. 2.4  
   b. 2.6  
   c. 2.8  
   d. 3.2  
   e. 3.4

4. If the temperature in a room is given by \( T = 75 + xyz \) and a fly is located at \( (2, 1, 4) \), in what unit vector direction should the fly fly in order to decrease the temperature as fast as possible?

   a. \( \frac{1}{\sqrt{2T}} \langle 2, 4, 1 \rangle \)
   b. \( \frac{1}{\sqrt{2T}} \langle -2, -4, -1 \rangle \)
   c. \( \langle 4, 8, 2 \rangle \)
   d. \( \langle -4, -8, -2 \rangle \)
   e. \( \frac{1}{\sqrt{2T}} \langle 2, -4, 1 \rangle \)

5. Find the equation of the plane tangent to the surface \( x^2z^3 + xy^3 = 31 \) at the point \( (1, 3, 2) \). Its \( z \)-intercept is:

   a. -31  
   b. 124  
   c. 120  
   d. 31  
   e. 4