Multiple Choice & Work Out: (5 points each)

1. For the function $f(x,y) = x \cos(xy)$ which partial derivative is incorrect?

   a. $\frac{\partial f}{\partial x} = \cos(xy) - xy \sin(xy)$

   b. $\frac{\partial f}{\partial y} = -x^2 \sin(xy)$

   c. $\frac{\partial^2 f}{\partial x^2} = -y \sin(xy) - x^2 y \cos(xy)$

   d. $\frac{\partial^2 f}{\partial x \partial y} = -2x \sin(xy) - x^2 y \cos(xy)$

   e. $\frac{\partial^2 f}{\partial y \partial x} = -2x \sin(xy) - x^2 y \cos(xy)$

2. Find the equation of the plane tangent to $z = x^2 y^3$ at the point $(2, 1, 4)$.

   a. $z = -4x - 12y + 24$

   b. $z = -4x - 12y + 4$

   c. $z = 4x + 12y + 4$

   d. $z = 4x + 12y - 8$

   e. $z = 4x + 12y - 16$
3. The plane tangent to \( z = f(x, y) = xy^2 - x^2 \) at the point \((1, 2, -3)\) is
\[
z = f_{\text{tan}}(x, y) = 3 + 2(x - 1) + 4(y - 2).
\]
Use this information to approximate \( f(1.1, 1.8) \).

a. 2  
b. 2.4  
c. 3.6  
d. 4  
e. 12.4

4. Consider a function \( g(x, y) \). If \( g(2, 3) = 4, \ \frac{\partial g}{\partial x} = 5, \) and \( \frac{\partial g}{\partial y} = 1, \) estimate \( g(1.9, 3.3) \).

a. 3.8  
b. 4.2  
c. 4.8  
d. 10  
e. 16.8

5. The mass of a body is \( M = \rho V \) where \( \rho \) is its density and \( V \) is its volume.

If the density is measured to be \( \rho = 1.2 \frac{g}{cm^3} \) with an uncertainty of \( \Delta \rho = \pm 0.01 \frac{g}{cm^3} \)
and the volume is measured to be \( V = 2 \text{ cm}^3 \) with an uncertainty of \( \Delta V = \pm 0.02 \text{ cm}^3 \),
then the mass is \( M = 2.4 \text{ g} \). Use differentials to estimate the uncertainty in the mass.

NOTE: The uncertainty in a quantity is its differential.