

$$\begin{aligned}
 &= \left(\frac{\partial}{\partial z} \right) \left(\frac{\partial}{\partial y} \right) (3x^2 y^2 z + y^6 z) \\
 &= \left(\frac{\partial}{\partial z} \right) (3x^2 2y z + 6y^5 z) \\
 &= \left(\frac{\partial}{\partial z} \right) (6x^2 y z + 6y^5 z) \\
 &= \boxed{6x^2 y + 6y^5}
 \end{aligned}$$

$$3) \quad \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} = 0$$

$$f(x, y) = e^{-x} \cos(y) - e^{-y} \cos(x)$$

$$\begin{aligned}
 \left[\frac{\partial^2 f}{\partial x^2} \right] &= \frac{\partial}{\partial x} \left(\frac{\partial}{\partial x} (e^{-x} \cos(y) - e^{-y} \cos(x)) \right) \\
 &= \frac{\partial}{\partial x} (-e^{-x} \cos(y) + e^{-y} \sin(x)) \\
 &= \boxed{e^{-x} \cos(y) + e^{-y} \cos(x)}
 \end{aligned}$$

$$\begin{aligned}
 \left[\frac{\partial^2 f}{\partial y^2} \right] &= \frac{\partial}{\partial y} \left(\frac{\partial}{\partial y} (e^{-x} \cos(y) - e^{-y} \cos(x)) \right) \\
 &= \frac{\partial}{\partial y} (-e^{-x} \sin(y) + e^{-y} \cos(x)) \\
 &= \boxed{-e^{-x} \cos(y) - e^{-y} \cos(x)}
 \end{aligned}$$