1. find the partial derivative with respect to each variable, for $f(x,y) = e^{xy^2}$:

$$\frac{\partial f}{\partial x} = e^{xy^2} \cdot \frac{\partial}{\partial x} xy^2 = e^{xy^2} \cdot y^2 = y^2 e^{xy^2}$$

$$\frac{\partial f}{\partial y} = e^{xy^2} \cdot \frac{\partial}{\partial y} xy^2 = e^{xy^2} \cdot x \cdot 2y = 2xy\, e^{xy^2}$$

2. find the partial derivative with respect to each variable, for $f(x,y,z) = y\sin(xz) - z\ln(xy)$:

$$\frac{\partial f}{\partial x} = y \cdot \cos(xz) \cdot \frac{\partial}{\partial x}(xz) - z \cdot \frac{1}{xy} \cdot \frac{\partial}{\partial x}(xy) =$$

$$y\cos(xz) \cdot z - z \cdot \frac{1}{xy} \cdot y = yz\cos(xz) - \frac{z}{x}$$

$$\frac{\partial f}{\partial y} = \sin(xz) - z \cdot \frac{1}{xy} \cdot \frac{\partial}{\partial y}(xy) = \sin(xz) - \frac{z}{xy} \cdot x =$$

$$\sin(xz) - \frac{z}{y}$$

$$\frac{\partial f}{\partial z} = y \cdot \cos(xz) \cdot \frac{\partial}{\partial z}(xz) - \ln(xy) = y \cdot \cos(xz) \cdot x - \ln(xy) =$$

$$xy\cos(xz) - \ln(xy)$$

3. integrate:

$$\int_{\phi}^{2}\int_{\phi}^{4-2y} x+y \; dx\,dy = \int_{\phi}^{2} \left[\frac{x^2}{2} + xy\right]_{x=\phi}^{x=4-2y} dy =$$

$$\int_{\phi}^{2}\left[\frac{1}{2}(4-2y)^2 + y(4-2y)\right] - \left[\frac{1}{2}\cdot\phi + \phi\cdot y\right] dy = \int_{\phi}^{2} \frac{1}{2}\cdot(16-16y+4y^2) + 4y - 2y^2 d$$

$$= \int_{\phi}^{2} 8 - 8y + 2y^2 + 4y - 2y^2 \, dy = \int_{\phi}^{2} 8 - 4y \, dy = 8y - 4\cdot\frac{1}{2}y^2\Big]_{\phi}^{2} =$$

$$8y - 2y^2\Big]_{\phi}^{2} = 8\cdot 2 - 2\cdot 2^2 - (8\cdot\phi - 2\cdot\phi^2) = 16 - 8 = 8$$