12. $\vec{F}(x,y) = \underbrace{x^3}_{M}\vec{i} + \underbrace{4e^y}_{N}\vec{j}$

$\operatorname{div}\vec{F}(x,y) = \frac{\partial M}{\partial x} + \frac{\partial N}{\partial y}$

$= \boxed{3x^2 + 4e^y}$

13. $\vec{F}(x,y,z) = \underbrace{\ln(x^2+y)}_{M}\vec{i} + \underbrace{x^2y^3}_{N}\vec{j} + \underbrace{\ln(2y^2-z^2)}_{P}\vec{k}$

$\operatorname{div}\vec{F}(x,y,z) = \frac{\partial M}{\partial x} + \frac{\partial N}{\partial y} + \frac{\partial P}{\partial z}$

$= \frac{1}{x^2+y}\cdot 2x + 3x^2y^2 + \frac{1}{2y^2-z^2}\cdot -2z$

$= \boxed{\frac{2x}{x^2+y} + 3x^2y^2 - \frac{2z}{2y^2-z^2}}$