The following statements are equivalent.

1. $\vec{\mathbf{F}} = \langle F_1,\ F_2 \rangle$ is a conservative vector field.

2. Line integrals of $\vec{\mathbf{F}}$ are *path independent.* If **A** and **B** are any two points and C_1 and C_2 are two different paths connecting **A** to **B** then $\int_{C_1} \vec{\mathbf{F}} \bullet d\vec{\mathbf{r}} = \int_{C_2} \vec{\mathbf{F}} \bullet d\vec{\mathbf{r}}$

3. $\oint_C \vec{\mathbf{F}} \bullet d\vec{\mathbf{r}} = 0$ for every closed loop C

4. $\frac{\partial F_2}{\partial x} - \frac{\partial F_1}{\partial y} = 0$ at all points

5. $\vec{\mathbf{F}} = \nabla \phi$ for some scalar valued function $\phi = \phi(x, y)$

The following statements are equivalent.

1. $\vec{\mathbf{F}} = \langle F_1,\ F_2,\ F_3 \rangle$ is a conservative vector field.

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3. $\oint_C \vec{\mathbf{F}} \bullet d\vec{\mathbf{r}} = 0$ for every closed loop C

4. $\nabla \times \vec{\mathbf{F}} = \vec{\mathbf{0}}$ at all points

5. $\vec{\mathbf{F}} = \nabla\phi$ for some scalar valued function $\phi = \phi(x, y, z)$