# 1. Equations Reducible to Exact Form

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## Equations Reducible To Exact Form

### Integrating Factor

non exact DE × IF = exact DE

### Ways to find integrating factor

#### Case ①, ②

Given $M\,dx + N\,dy = 0$

$$\frac{\partial M}{\partial y} \neq \frac{\partial N}{\partial x}$$

If:

$$\frac{\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}}{N} = \phi(x), \quad IF = e^{\int \phi(x)\,dx}$$

If:

$$\frac{\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}}{M} = \phi(y), \quad IF = e^{-\int \phi(y)\,dy}$$

#### Case ③

If M and N are homogeneous functions of same degree:

$$IF = \frac{1}{Mx + Ny}$$

#### Case ④

Given,

$$M(x,y)\,dx + N(x,y)\,dy = 0$$

If it can be written as

If it can be written as

$$\underbrace{y \cdot f_1(xy)}_{M}\,dx + \underbrace{x \cdot f_2(xy)}_{N}\,dy = 0$$

Then

$$IF = \frac{1}{Mx - Ny}$$