

First-Order Partial Differential Equations > Nonlinear Equations > Section 3.1

2.
$$\frac{\partial w}{\partial x} + a\left(\frac{\partial w}{\partial y}\right)^2 + by^2 = 0$$
.

This equation governs free oscillations of a point body of mass m = 1/(2a) in an elastic field with elastic coefficient k = 2b (x is time and y is the displacement from the equilibrium).

Complete integral:

$$w = -C_1 x + C_2 \pm \int \sqrt{\frac{C_1 - by^2}{a}} dx + C_2,$$

where C_1 and C_2 are arbitrary constants.

References

Gantmakher, F. R., Lectures on Analytical Mechanics [in Russian], Fizmatlit, Moscow, 1966.

Polyanin, A. D., Zaitsev, V. F., and Moussiaux, A., Handbook of First Order Partial Differential Equations, Taylor & Francis, London, 2002.

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