

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

1.
$$\frac{\partial w}{\partial x} + a \left(\frac{\partial w}{\partial y}\right)^2 = by$$
.

This equation governs the free vertical drop of a point body near the Earth's surface (y is the vertical coordinate measured downward, x time, m = 1/(2a) the mass of the body, and g = 2ab the gravitational acceleration).

Complete integral:

$$w = -C_1 x \pm \frac{2a}{3b} \left(\frac{by + C_1}{a}\right)^{3/2} + C_2,$$

where C_1 and C_2 are arbitrary constants.

References

Markeev, A. P., Theoretical Mechanics [in Russian], Nauka, Moscow, 1990.

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

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