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3.
$$\frac{\partial w}{\partial t} = \frac{\partial^2 w}{\partial x^2} - w(1-w)(a-w)$$
.

FitzHugh–Nagumo equation. This equation arises in genetics, biology, and heat and mass transfer. Solutions:

$$\begin{split} w(x,t) &= \frac{A \exp(z_1) + aB \exp(z_2)}{A \exp(z_1) + B \exp(z_2) + C}, \\ z_1 &= \pm \frac{\sqrt{2}}{2} \, x + \left(\frac{1}{2} - a\right)t, \quad z_2 = \pm \frac{\sqrt{2}}{2} \, ax + a\left(\frac{1}{2}a - 1\right)t, \end{split}$$

where A, B, and C are arbitrary constants.

See also: Newell-Whitehead equation (a special case of the Fitzhugh-Nagumo equation).

References

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FitzHugh-Nagumo Equation

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