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$$7. \quad \frac{\partial w}{\partial t} = a \frac{\partial}{\partial x} \bigg(e^{\lambda w} \frac{\partial w}{\partial x} \bigg).$$

Heat equation with a exponential nonlinearity.

1°. Solutions:

$$w(x,t) = \frac{2}{\lambda} \ln \left(\frac{\pm x + A}{\sqrt{B - 2at}} \right),$$

$$w(x,t) = \frac{1}{\lambda} \ln \frac{A + Bx - Cx^2}{D + 2aCt},$$

where A, B, C, and D are arbitrary constants.

 2° . There are solutions of the following forms:

$$\begin{split} w(x,t) &= F(z), \quad z = kx + \beta t & \text{traveling-wave solution;} \\ w(x,t) &= G(\xi), \quad \xi = xt^{-1/2} & \text{self-similar solution;} \\ w(x,t) &= H(\eta) + 2kt, \quad \eta = xe^{-k\lambda t}; \\ w(x,t) &= U(\zeta) - \lambda^{-1} \ln t, \quad \zeta = x + k \ln t, \end{split}$$

where k and β are arbitrary constants.

References

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