

# Picone-type identities in comparison theory of nonlinear equations

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Let  $x(t)$ ,  $G(x, t)$  and  $P(x, t)$  be of the class  $C^1$  with  $P(x, t) > 0$ . Then

$$(\alpha + 1) \frac{d}{dt} \left\{ G(x(t), t) \right\} = P|x'|^{\alpha+1} + \alpha P^{-\frac{1}{\alpha}} \left| \frac{\partial G}{\partial x} \right|^{1+\frac{1}{\alpha}} + (\alpha + 1) \frac{\partial G}{\partial t} -$$
$$P \left[ |x'|^{\alpha+1} - (\alpha + 1) P^{-1} x' \frac{\partial G}{\partial x} + \alpha P^{-\frac{\alpha+1}{\alpha}} \left| \frac{\partial G}{\partial x} \right|^{1+\frac{1}{\alpha}} \right]$$

It is shown how this general Picone-type formula can be used for various particular choices of  $P$  and  $G$  to obtain comparison results for various classes of nonlinear differential equations, including half-linear differential equations of the second order and the first-order nonlinear equation governing the motion of a braked cart rolling down an inclined plane.

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