

$$\begin{aligned} \frac{d}{dt} \left(\frac{1}{2} m v^2 \right) &= m v \frac{dv}{dt} \\ &= m v \cdot a \\ &= m v \cdot \frac{dv}{dt} \end{aligned}$$

$$\begin{aligned} \frac{d}{dt} \left(\frac{1}{2} m v^2 \right) &= m v \cdot a \\ &= m v \cdot \frac{dv}{dt} \\ &= m \cdot \frac{1}{2} \frac{d}{dt} (v^2) \\ &= \frac{1}{2} m \frac{d}{dt} (v^2) \end{aligned}$$

$$\begin{aligned} \frac{d}{dt} \left(\frac{1}{2} m v^2 \right) &= \frac{1}{2} m \frac{d}{dt} (v^2) \\ &= \frac{1}{2} m \cdot 2v \cdot \frac{dv}{dt} \\ &= m v \cdot \frac{dv}{dt} \end{aligned}$$

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