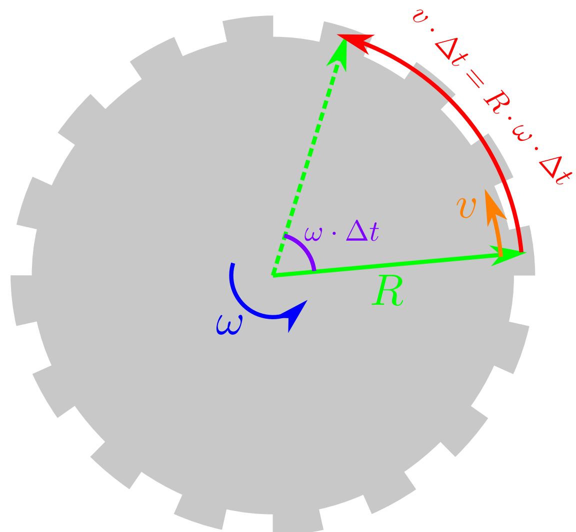
In the image on the right, a gear of radius R is rotating counterclockwise at an angular speed of ω. After a time interval of Δt, the gear has turned by $\omega\Delta t$. The rim of the gear is moving at a speed of v. After the same time interval of Δt, the rim of the gear has moved a distance of $v\Delta t$. The distance that the gear rim has moved can also be computed from the rotated angle of $\omega\Delta t$ and the gear's radius R: $R \cdot \omega\Delta t$. This gives the relationship $v\Delta t = R\omega\Delta t$ which is equivalent to:

$$v = R\omega$$



If a gear has a radius of $R = 7\text{cm} = 0.07\text{m}$, and rotates once every $T = 2\text{s}$, then with a full rotation of 2π every time interval of T, the angular speed is $\omega = \frac{2\pi}{T} \approx 3.142\text{s}^{-1}$. The speed of the rim is $v = R\omega = 0.2199\text{m/s} = 21.99\text{cm/s}$.

Reasoning in the other direction, if the rim speed is now $v = 30\text{cm/s} = 0.3000\text{m/s}$ and the radius is unchanged, then the angular speed satisfies $v = R\omega \iff \omega = \frac{v}{R} \approx 4.286\text{s}^{-1}$. The time T required for a full revolution is: $T = \frac{2\pi}{\omega} \approx 1.466\text{s}$