Acceleration of a car with air and rolling resistance

$P := 73600$ The power of the motor in Watt

$A := 2.13$ Frontarea of the car

$cw := 0.29$ A cofficient of the resistance of air

$\rho := 1.2$ The density of air at 20 degrees

$m := 1440$ The mass of the car in kg

$\mu := 0.03$ The friction coeff of rolling resistance

$g := 9.81$ Gravity constant

Describing differetialequation
Use the rule that F*v=effect.
The second derivate is the acceleration, and the first speed

$$m \cdot s'' \cdot s' = P - \frac{\rho \cdot A \cdot cw \cdot s'^{3}}{2} - \mu \cdot m \cdot g \cdot s'$$

$$k := \frac{A \cdot cw \cdot \rho}{2}$$

Given

$$\frac{d^2}{dt^2} s(t) = \frac{P - k \cdot \left(\frac{d}{dt} s(t)\right)^3 - \mu \cdot m \cdot g \cdot \frac{d}{dt} s(t)}{m \cdot \frac{d}{dt} s(t)}$$

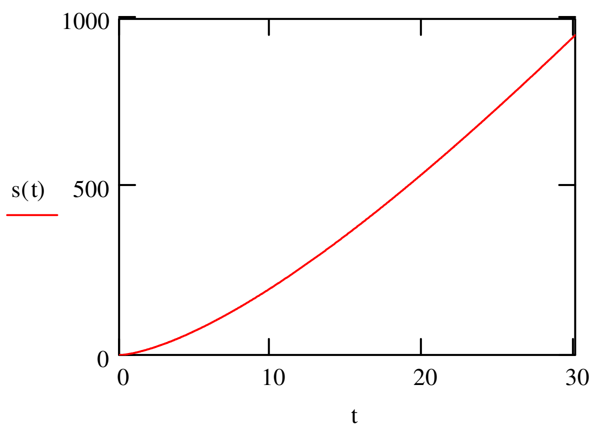
$s(0) = 0$ $s'(0) = 0.005$

On the left side is the describing differential-equation for a accelerating car. P is the effect who you put into the wheels. The second term is the resistance of air and the third is the rolling resistance. All those parts of the equation is divided by the mass and speed and you got the acceleration of the car.

$s := \text{odesolve}(t, 200)$

$$v(t) := \frac{d}{dt} s(t)$$

$\text{root}(s(t) - 404, t, 0, 200) = 16.26$ The time to reach 404 m



$v(199) \cdot 3.6 = 186.609$ Max speed in km/h