Calculation of the theoretical turning radius

This document details the calculation of the theoretical turning radius of our bus

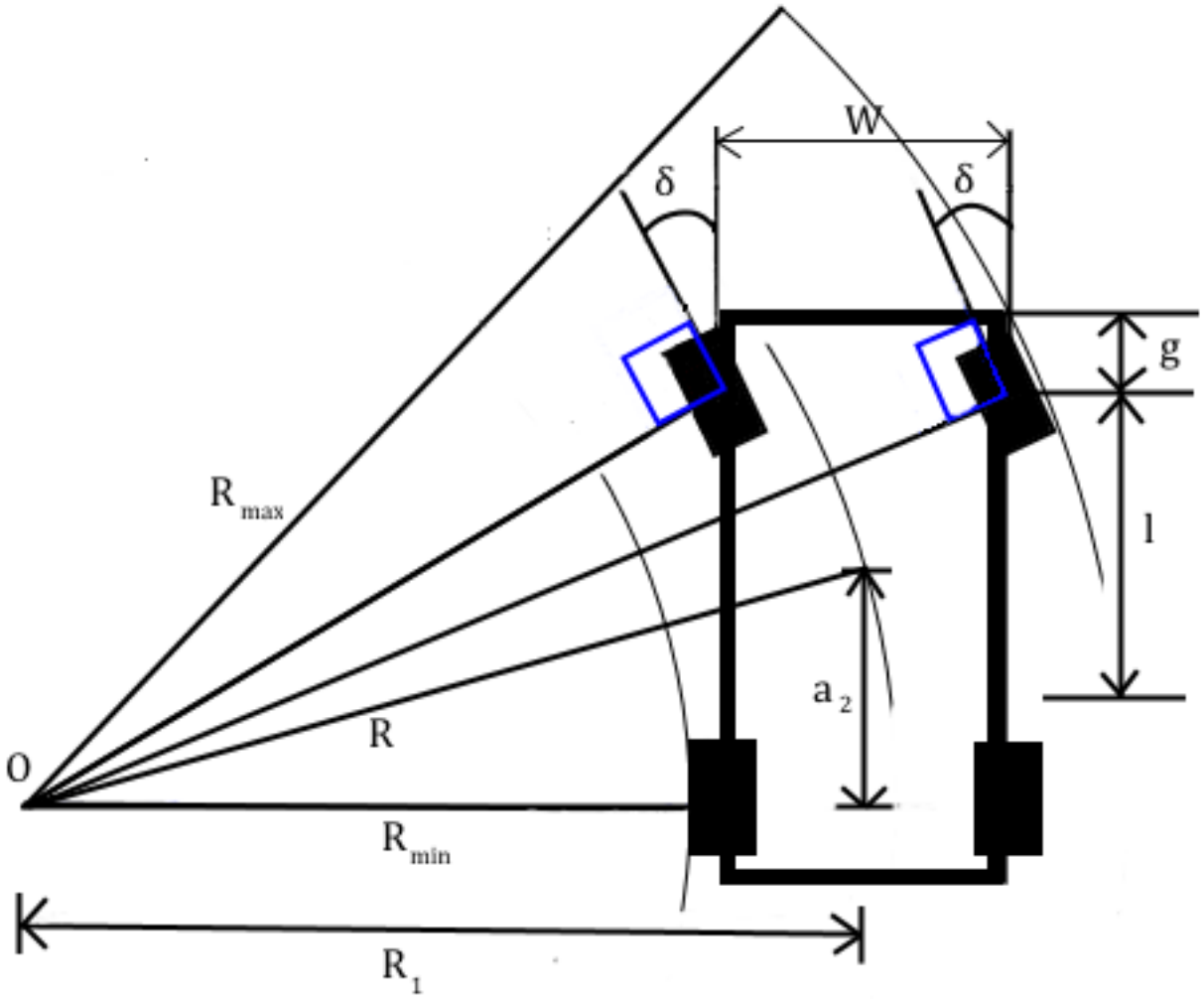
The distance between the centre of front wheels and back wheels
$l := 21\,\text{cm}$:

The degrees the front wheels are turning, converted into radians
$\delta := 35 \cdot 0.0174532925$:

The distance between the centre of the front wheels to the front of the vehicle
$g := 9\,\text{cm}$:

The distance between the back wheels and the centre of the vehicle
$a_2 := 10.5\,\text{cm}$:

The width of the vehicle
$W := 15.35\,\text{cm}$:



Calculation of the radius to the centre using the cotangent function and the Pythagorean theorem

$$R := \sqrt{a_2^{\,2} + l^2 \cdot \cot(\delta)^2} = 31.77603769 \text{ cm}$$

Using the calculated radius we calculate the distance from the centre of rotation to the centre of the vehicle again using the Pythagorean theorem

$$R_1 := \sqrt{R^2 - a_2^{\,2}}$$

$$R_1 := 29.99110820 \text{ cm} \quad \textbf{(1.1)}$$

Calculating the minimal radius, subtracting half of the width of the vehicle from the radius to the center of the vehicle

$$R_{\min} := R_1 - \left(\frac{W}{2}\right) = 22.31610820 \text{ cm}$$

Calculating the maximum radius again by using the Pythagorean theorem

$$R_{\max} := \sqrt{(R_{\min} + W)^2 + (l + g)^2} = 48.15325230 \text{ cm}$$

Difference between the radius's

$$R_\Delta := R_{\max} - R_{\min} = 25.83714410 \text{ cm}$$

Diameters

$$D_{\max} := R_{\max} \cdot 2 = 96.30650460 \text{ cm}$$

$$D_{\min} := R_{\min} \cdot 2 = 44.63221640 \text{ cm}$$

$$R_{\min}\ 22.31610820 \text{ cm} \xrightarrow{\text{remove units}} 0.2231610820 \xrightarrow{\text{assign to a name}} R_{mi}$$

$$R_{\max} = 48.15325230 \text{ cm} \xrightarrow{\text{remove units}} 0.4815325230 \xrightarrow{\text{assign to a name}} R_{mx}$$

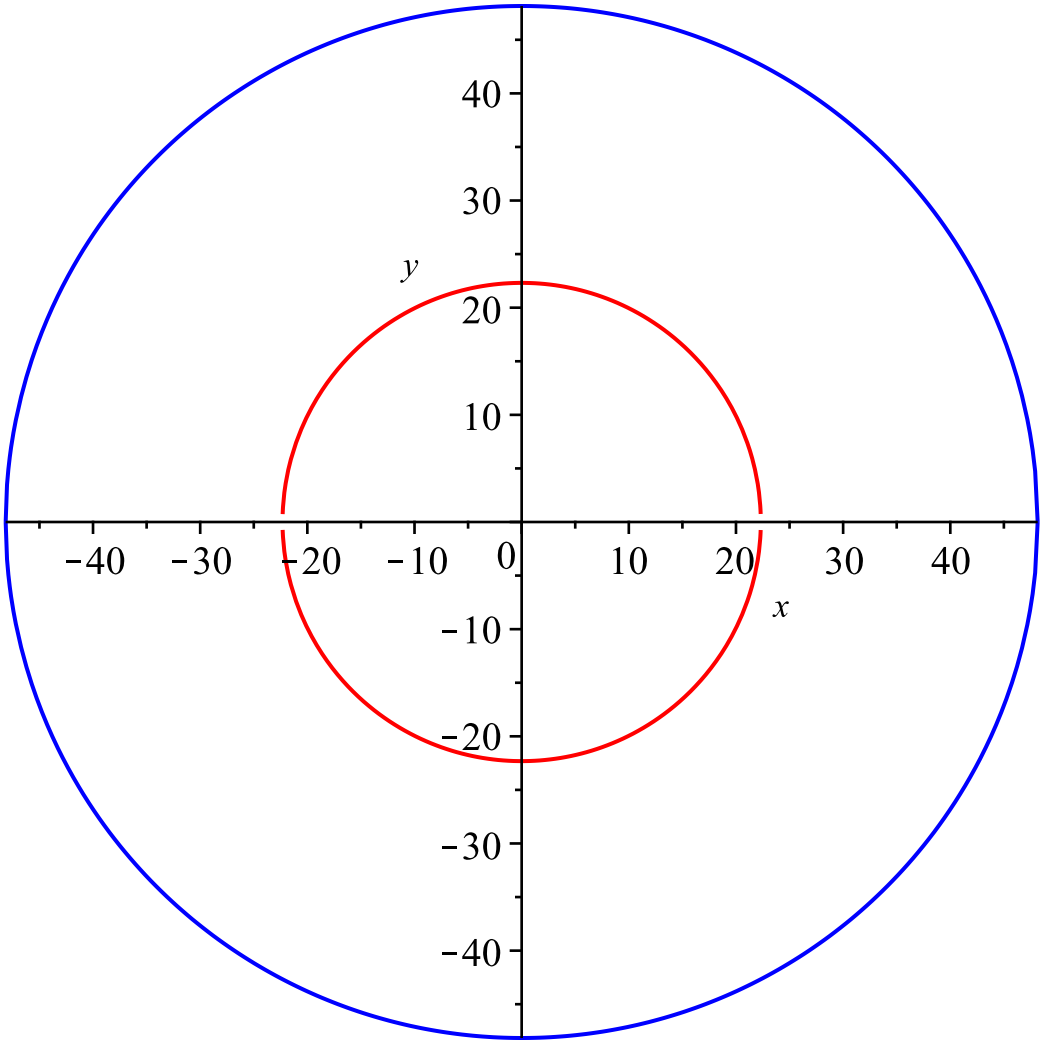
$$c_{\min} := x\text{^}2 + y\text{^}2 = (100 \cdot R_{mi})^2 :$$

$$cplot_{\min} := solve(c_{\min}, y) :$$

$$c_{\max} := x\text{^}2 + y\text{^}2 = (100 \cdot R_{mx})^2 :$$

$$cplot_{\max} := solve(c_{\max}, y) :$$

$$plot([cplot_{\min}, cplot_{\max}], x = -(100 \cdot R_{mx}) .. (100 \cdot R_{mx}), y = -(100 \cdot R_{mx}) .. (100 \cdot R_{mx}), scaling = constrained);$$



restart