Problems

1) A motor car has a wheel base of 2.743 m and pivot center of 1.065 m. The front and rear wheel track is 1.217 m. Calculate the correct angle of outside lock and turning circle radius of the outer front and inner rear wheel when the angle of inside lock is 40°

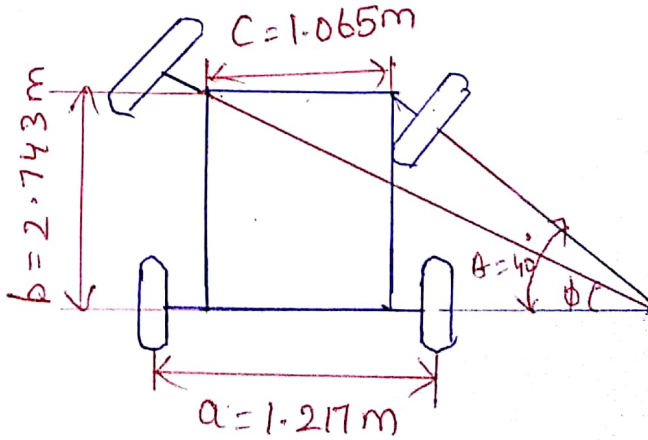
Given data:

$a = 1.217\ m$

$b = 2.743\ m$

$c = 1.065\ m$

$\theta = 40°$



To find:

(i) ϕ

(ii) R_{of}

(iii) R_{ir}

Solution

$$\cot\phi - \cot\theta = \frac{c}{b}$$

$$\cot\phi - \cot 40 = \frac{1.065}{2.743}$$

$$\boxed{\phi = 32.33^\circ}$$

$$R_{of} = \frac{b}{\sin\phi} + \frac{a-c}{2}$$

$$= \frac{2.743}{\sin 32.33} + \frac{1.217 - 1.065}{2}$$

$$\boxed{R_{of} = 5.2\text{m}}$$

$$R_{ir} = b \cot\theta - \frac{a-c}{2}$$

$$= 2.743 \cot 40 - \frac{1.217 - 1.065}{2}$$

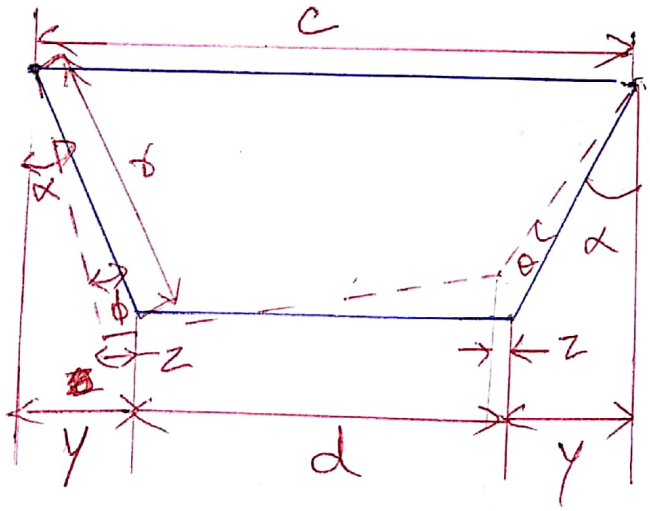
$$\boxed{R_{ir} = 3.193\ m}$$

Result:

$$\phi = 32.33^{\circ}$$

$$R_{of} = 5.2\ m$$

$$R_{ir} = 3.193\ m$$



$$\sin(\alpha+\theta) = \frac{y+z}{r} \quad , \quad \sin(\alpha-\phi) = \frac{y-z}{r}$$

$$\sin[(\alpha+\theta)+(\alpha-\phi)] = \frac{2y}{r} = 2\sin\alpha.$$

1. A track has pivot pins 1.37m apart. The length of each track arm is 0.17m and the track road is behind front axle and 1.17m long. Determine the wheel base which will give true rolling for all wheels when the car is turning. So that the inner wheel Stub axle is 60° to the Central line of the car. A geometrical Construction may be used.

Given data :

$$C = 1.37\ m$$

$$r = 0.17\ m$$

$$d = 1.17\ m$$

$$\theta = 60^\circ$$

To find :

$$\sin\alpha = \frac{b}{R}$$

(i) Wheel base (b)

Solution

$$2 \sin \alpha = \frac{2Y}{r}$$

$$2Y = c - d$$

$$2Y = 1.37 - 1.17$$

$$\boxed{Y = 0.1 \text{ m}}$$

$$2 \sin\alpha = \frac{2 \times 0.1}{0.17}$$

$$\sin \alpha = 0.588$$

$$\boxed{\alpha = 36.03^\circ}$$

$$\sin [(\alpha + \theta) + (\alpha - \phi)] = 2 \sin \alpha$$

$$\sin [(36.03 + 30) + (36.03 - \phi)] = 2 \sin 36.23$$

$$\boxed{\phi = 25.5^\circ}$$

$$\cot\phi - \cot\theta = \frac{c}{b}$$

$$\cot 25.5 - \cot 30 = \frac{1.37}{b}$$

$$\boxed{b = 3.76\,m}$$

Result:

$$\alpha = 36.03^\circ$$
$$\phi = 25.5^\circ$$
$$b = 3.76\,m$$

Problem

1) The distance between kingpins of a car is 1.3 m. The track arm is 0.1525 m long and length of the track rod is 1.2m. For a track of 1.42 m and wheel base of 2.85 m. Find the radius of curvature of the path follow by the near side of front wheel at which correcting Steering Obtained when the car is turning to right

Given data:

$c = 1.3\,m$

$r = 0.1525\,m$

$d = 1.2\,m$

$a = 1.42$

$b = 2.85\,m$

To find:

R_{if}

Solution:

$$R_{if} = \frac{b}{\sin\theta} - \frac{a-c}{2}$$

$$\cot\phi - \cot\theta = \frac{c}{b}$$

$$\cot\phi - \cot\theta = \frac{1.3}{2.85}$$

$$\cot\phi - \cot\theta = 0.456 \rightarrow (1)$$

W.K.T

$$\sin(\alpha+\theta) + \sin(\alpha-\phi) = 2\sin\alpha = \frac{2y}{r}$$

$$2\sin\alpha = \frac{2y}{r}$$

$$C = 2Y + d$$

$$1.3 = 2Y + 1.2$$

$$\boxed{Y = 0.05\,m}$$

$$2 \sin\alpha = \frac{2Y}{r}$$

$$2 \sin\alpha = \frac{2(0.05)}{0.1525}$$

$$\boxed{\alpha = 19.13^\circ}$$

By trail and error method

(i) $\theta = 30^\circ$

$$\sin(\alpha + \theta) + \sin(\alpha - \phi) = 2\sin d$$

$$\sin(19.13 + 30) + \sin(19.13 - \phi) = 2\sin 19.13$$

$$\boxed{\phi = 24.9^\circ}$$

Sub $\theta = 30^\circ$ & $\phi = 24.9$ in (1)

$$\cot 24.9 - \cot 30 = 0.456$$

$$0.422 \neq 0.456$$

(ii) $\theta = 35^\circ$

$$\sin(19.13 + 35) + \sin(19.13 - \phi) = 2\sin 19.13$$

$$\boxed{\phi = 28.02}$$

Sub $\theta = 35$, $\phi = 28.02$

$$\cot 28.02 - \cot 35 = 0.456$$

$$0.4509 \neq 0.456$$

(iii) $\theta = 36^\circ$

$$\sin(19.13 + 36) + \sin(19.13 - \phi) = 2\sin 19.13$$

$$\boxed{\phi = 28.63}$$

$$\cot 28.63 - \cot 36 = 0.456$$

$$0.455 = 0.456$$ ✓

$$R_{if} = \frac{b}{\sin\theta} - \frac{a-c}{2}$$

$$= \frac{2.85}{\sin 36} - \frac{(1.42 - 1.3)}{2}$$

$$\boxed{R_{if} = 4.78 \text{ m}}$$

Result:

$R_{if} = 4.78$ m