

Important Turning Dynamics Formulas PDF



Formulas Examples with Units

List of 17 Important Turning Dynamics Formulas

1) Pivot Centre given Turning Radius of Inner Front Wheel Formula

Formula

$$c = a_{tw} - 2 \cdot \left(\frac{b}{\sin(\theta)} - R_{if} \right)$$

Evaluate Formula 

Example with Units

$$1300.0913 \text{ mm} = 1999 \text{ mm} - 2 \cdot \left(\frac{2700 \text{ mm}}{\sin(40^\circ)} - 3851 \text{ mm} \right)$$

2) Pivot Centre given Turning Radius of Inner Rear Wheel Formula

Formula

$$c = a_{tw} - 2 \cdot \left(\frac{b}{\tan(\theta)} - R_{ir} \right)$$

Evaluate Formula 

Example with Units

$$1363.5306 \text{ mm} = 1999 \text{ mm} - 2 \cdot \left(\frac{2700 \text{ mm}}{\tan(40^\circ)} - 2900 \text{ mm} \right)$$

3) Pivot Centre given Turning Radius of Outer Front Wheel Formula

Formula

$$c = a_{tw} - 2 \cdot \left(-\frac{b}{\sin(\varphi)} + R_{of} \right)$$

Evaluate Formula 

Example with Units

$$2579 \text{ mm} = 1999 \text{ mm} - 2 \cdot \left(-\frac{2700 \text{ mm}}{\sin(30^\circ)} + 5110 \text{ mm} \right)$$



4) Pivot Centre given Turning Radius of Outer Rear Wheel Formula

Formula

$$c = a_{tw} - 2 \cdot \left(-\frac{b}{\tan(\varphi)} + R_{or} \right)$$

Evaluate Formula 

Example with Units

$$1352.0744_{mm} = 1999_{mm} - 2 \cdot \left(-\frac{2700_{mm}}{\tan(30^\circ)} + 5000_{mm} \right)$$

5) Turning radius of car when taking turn Formula

Formula

$$R_t = \frac{b}{2 \cdot \sin(\delta)}$$

Example with Units

$$1558.8457_{mm} = \frac{2700_{mm}}{2 \cdot \sin(60^\circ)}$$

Evaluate Formula 

6) Turning radius of front inner wheel while cornering Formula

Formula

$$R_i = \left(\frac{b}{\sin(\theta)} \right) - \left(\frac{a_{tw} - c}{2} \right)$$

Evaluate Formula 

Example with Units

$$3850.9543_{mm} = \left(\frac{2700_{mm}}{\sin(40^\circ)} \right) - \left(\frac{1999_{mm} - 1300_{mm}}{2} \right)$$

7) Turning radius of outer front wheel while cornering Formula

Formula

$$R_{of} = \left(\frac{b}{\sin(\varphi)} \right) + \left(\frac{a_{tw} - c}{2} \right)$$

Evaluate Formula 

Example with Units

$$5749.5_{mm} = \left(\frac{2700_{mm}}{\sin(30^\circ)} \right) + \left(\frac{1999_{mm} - 1300_{mm}}{2} \right)$$



8) Turning radius of outer rear wheel while cornering Formula

Formula

$$R_{or} = \left(\frac{b}{\tan(\varphi)} \right) + \left(\frac{a_{tw} - c}{2} \right)$$

Example with Units

$$5026.0372 \text{ mm} = \left(\frac{2700 \text{ mm}}{\tan(30^\circ)} \right) + \left(\frac{1999 \text{ mm} - 1300 \text{ mm}}{2} \right)$$

Evaluate Formula 

9) Turning radius of rear inner wheel while cornering Formula

Formula

$$R_{ir} = \left(\frac{b}{\tan(\theta)} \right) - \left(\frac{a_{tw} - c}{2} \right)$$

Example with Units

$$2868.2347 \text{ mm} = \left(\frac{2700 \text{ mm}}{\tan(40^\circ)} \right) - \left(\frac{1999 \text{ mm} - 1300 \text{ mm}}{2} \right)$$

Evaluate Formula 

10) Wheel Base given Turning Radius of Inner Front Wheel Formula

Formula

$$b = \left(R_{if} + \frac{a_{tw} - c}{2} \right) \cdot \sin(\theta)$$

Example with Units

$$2700.0294 \text{ mm} = \left(3851 \text{ mm} + \frac{1999 \text{ mm} - 1300 \text{ mm}}{2} \right) \cdot \sin(40^\circ)$$

Evaluate Formula 

11) Wheel Base given Turning Radius of Inner Rear Wheel Formula

Formula

$$b = \left(R_{ir} + \frac{a_{tw} - c}{2} \right) \cdot \tan(\theta)$$

Example with Units

$$2726.6543 \text{ mm} = \left(2900 \text{ mm} + \frac{1999 \text{ mm} - 1300 \text{ mm}}{2} \right) \cdot \tan(40^\circ)$$

Evaluate Formula 



12) Wheel Base given Turning Radius of Outer Front Wheel Formula

Formula

$$b = \left(R_{of} - \frac{a_{tw} - c}{2} \right) \cdot \sin(\varphi)$$

Evaluate Formula 

Example with Units

$$2380.25 \text{ mm} = \left(5110 \text{ mm} - \frac{1999 \text{ mm} - 1300 \text{ mm}}{2} \right) \cdot \sin(30^\circ)$$

13) Wheel Base given Turning Radius of Outer Rear Wheel Formula

Formula

$$b = \left(R_{or} - \frac{a_{tw} - c}{2} \right) \cdot \tan(\varphi)$$

Evaluate Formula 

Example with Units

$$2684.9674 \text{ mm} = \left(5000 \text{ mm} - \frac{1999 \text{ mm} - 1300 \text{ mm}}{2} \right) \cdot \tan(30^\circ)$$

14) Wheel Track given Turning Radius of Inner Front Wheel Formula

Formula

$$a_{tw} = 2 \cdot \left(\frac{b}{\sin(\theta)} - R_{if} \right) + c$$

Evaluate Formula 

Example with Units

$$1998.9087 \text{ mm} = 2 \cdot \left(\frac{2700 \text{ mm}}{\sin(40^\circ)} - 3851 \text{ mm} \right) + 1300 \text{ mm}$$

15) Wheel Track given Turning Radius of Inner Rear Wheel Formula

Formula

$$a_{tw} = 2 \cdot \left(\frac{b}{\tan(\theta)} - R_{ir} \right) + c$$

Evaluate Formula 

Example with Units

$$1935.4694 \text{ mm} = 2 \cdot \left(\frac{2700 \text{ mm}}{\tan(40^\circ)} - 2900 \text{ mm} \right) + 1300 \text{ mm}$$



16) Wheel Track given Turning Radius of Outer Front Wheel Formula

Formula

Evaluate Formula 

$$a_{tw} = 2 \cdot \left(- \frac{b}{\sin(\varphi)} + R_{of} \right) + c$$

Example with Units

$$720_{mm} = 2 \cdot \left(- \frac{2700_{mm}}{\sin(30^\circ)} + 5110_{mm} \right) + 1300_{mm}$$

17) Wheel Track given Turning Radius of Outer Rear Wheel Formula

Formula

Evaluate Formula 

$$a_{tw} = 2 \cdot \left(- \frac{b}{\tan(\varphi)} + R_{or} \right) + c$$

Example with Units

$$1946.9256_{mm} = 2 \cdot \left(- \frac{2700_{mm}}{\tan(30^\circ)} + 5000_{mm} \right) + 1300_{mm}$$



Variables used in list of Turning Dynamics Formulas above

- a_{tw} Track Width of Vehicle (Millimeter)
- b Wheelbase of Vehicle (Millimeter)
- c Distance between Front Wheel Pivot Center (Millimeter)
- R_i Turning Radius of Inner Wheel (Millimeter)
- R_{if} Turning Radius of Inner Front Wheel (Millimeter)
- R_{ir} Turning Radius of Inner Rear Wheel (Millimeter)
- R_{of} Turning Radius of Outer Front Wheel (Millimeter)
- R_{or} Turning Radius of Outer Rear Wheel (Millimeter)
- R_t Turning Radius of Car (Millimeter)
- δ Steer Angle (Degree)
- θ Angle of Inside Wheel Lock (Degree)
- φ Angle of Outside Wheel Lock (Degree)

Constants, Functions, Measurements used in list of Turning Dynamics Formulas above

- **Functions:** $\sin$, $\sin(\text{Angle})$
Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- **Functions:** $\tan$, $\tan(\text{Angle})$
The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- **Measurement:** **Length** in Millimeter (mm)
Length Unit Conversion 
- **Measurement:** **Angle** in Degree ($^{\circ}$)
Angle Unit Conversion 



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