



calculatoratoz.com



unitsconverters.com

Moments, Loads, Angles acting on Steering system and Axles Formulas

Calculators!

Examples!

Conversions!

Bookmark calculatoratoz.com, unitsconverters.com

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**
Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**
Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

[Please leave your feedback here...](#)



List of 21 Moments, Loads, Angles acting on Steering system and Axles Formulas

Moments, Loads, Angles acting on Steering system and Axles

1) Centripetal Acceleration during Cornering

$$fx \quad a_c = \frac{v_t \cdot v_t}{R}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$ex \quad 400m/s^2 = \frac{60m/s \cdot 60m/s}{9m}$$

2) Characteristic Speed for Understeer Vehicles

$$fx \quad v_u = \sqrt{\frac{57.3 \cdot L \cdot g}{K}}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$ex \quad 913.9383m/s = \sqrt{\frac{57.3 \cdot 2.7m \cdot 9.8m/s^2}{0.104^\circ}}$$

3) Critical Speed for Oversteer Vehicle

$$fx \quad v_o = -\sqrt{\frac{57.3 \cdot L \cdot g}{K}}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$ex \quad -913.9383m/s = -\sqrt{\frac{57.3 \cdot 2.7m \cdot 9.8m/s^2}{0.104^\circ}}$$

4) Driveline Torque

$$fx \quad T_d = F_x \cdot R_e$$

[Open Calculator !\[\]\(83bbbd261710c59db0214aa27b2edc0d_img.jpg\)](#)

$$ex \quad 157.5N \cdot m = 450N \cdot 0.35m$$


5) Front Slip Angle at High Cornering Speed

$$fx \quad \alpha_f = \beta + \left(\left(\frac{a \cdot r}{v_t} \right) - \delta \right)$$

[Open Calculator !\[\]\(f507db636256ac11a5525ef93ec6b8d7_img.jpg\)](#)

$$ex \quad 0.77^\circ = 0.34^\circ + \left(\left(\frac{1.8m \cdot 25degree/s}{60m/s} \right) - 0.32^\circ \right)$$



6) Lateral Acceleration during Cornering of Car 

$$fx \quad A_{\alpha} = \frac{a_c}{g}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad 40.91837m/s^2 = \frac{401m/s^2}{9.8m/s^2}$$

7) Load on Front Axle at High Speed Cornering 

$$fx \quad W_{fl} = \frac{W \cdot b}{L}$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$ex \quad 1481.481N = \frac{20000N \cdot 0.2m}{2.7m}$$

8) Load on Rear Axle at High Speed Cornering 

$$fx \quad W_r = \frac{W \cdot a}{L}$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)


$$ex \quad 13333.33N = \frac{20000N \cdot 1.8m}{2.7m}$$

9) Rear Slip Angle due to High Speed Cornering 

$$fx \quad \alpha_r = \beta - \left(\frac{b \cdot r}{v_t} \right)$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754_img.jpg\)](#)

$$ex \quad 0.256667^{\circ} = 0.34^{\circ} - \left(\frac{0.2m \cdot 25\text{degree/s}}{60m/s} \right)$$

10) Self Aligning Moment or Torque on Wheels 

$$fx \quad M_{at} = (M_{zl} + M_{zr}) \cdot \cos(\lambda_l) \cdot \cos(v)$$

[Open Calculator !\[\]\(aff7c69c44a5e015f18c35867ef3f5c3_img.jpg\)](#)

$$ex \quad 100.1407N \cdot m = (27N \cdot m + 75N \cdot m) \cdot \cos(10^{\circ}) \cdot \cos(4.5^{\circ})$$

11) Track Width of Vehicle using Ackermann Condition 

$$fx \quad a_{tw} = (\cot(\delta_o) - \cot(\delta_i)) \cdot L$$

[Open Calculator !\[\]\(a25a22d88c5882f4a20f36103df86562_img.jpg\)](#)

$$ex \quad 1.99783m = (\cot(16^{\circ}) - \cot(20^{\circ})) \cdot 2.7m$$



Angles Acting on Steering System and Axles

12) Angle of Inside Lock given Turning Radius of Inner Front Wheel

$$\text{fx } \theta = a \sin \left(\frac{L}{R_{IF} + \frac{a_{tw}-c}{2}} \right)$$

[Open Calculator !\[\]\(23d9fc146e83b5c3013cfa32c784f8d5_img.jpg\)](#)

$$\text{ex } 43.33298^\circ = a \sin \left(\frac{2.7\text{m}}{3\text{m} + \frac{1.999\text{m}-0.13\text{m}}{2}} \right)$$

13) Angle of Inside Lock given Turning Radius of Inner Rear Wheel

$$\text{fx } \theta = a \tan \left(\frac{L}{R_{IR} + \frac{a_{tw}-c}{2}} \right)$$

[Open Calculator !\[\]\(aa53ad6fea213b8b2226d3077e30533a_img.jpg\)](#)

$$\text{ex } 43.00884^\circ = a \tan \left(\frac{2.7\text{m}}{1.96\text{m} + \frac{1.999\text{m}-0.13\text{m}}{2}} \right)$$

14) Angle of Inside Wheel Lock Satisfying Correct Steering Condition

$$\text{fx } \theta = a \cot \left(\cot(\varphi) - \frac{c}{L} \right)$$

[Open Calculator !\[\]\(626ce8ac21792b9405bfddfea8e0c96a_img.jpg\)](#)

$$\text{ex } 42.99248^\circ = a \cot \left(\cot(41.74^\circ) - \frac{0.13\text{m}}{2.7\text{m}} \right)$$

15) Angle of Outside Lock given Turning Radius of Outer Front Wheel

$$\text{fx } \varphi = a \sin \left(\frac{L}{R_{OF} - \frac{a_{tw}-c}{2}} \right)$$

[Open Calculator !\[\]\(c1168d6a8b365d11e842ece304635fa7_img.jpg\)](#)

$$\text{ex } 41.74085^\circ = a \sin \left(\frac{2.7\text{m}}{4.99\text{m} - \frac{1.999\text{m}-0.13\text{m}}{2}} \right)$$


16) Angle of Outside Lock given Turning Radius of Outer Rear Wheel

$$\text{fx } \varphi = a \tan \left(\frac{L}{R_{OR} - \frac{a_{tw}-c}{2}} \right)$$

[Open Calculator !\[\]\(ccd39a0dc6d5afcc151e1371f9462f58_img.jpg\)](#)

$$\text{ex } 41.74618^\circ = a \tan \left(\frac{2.7\text{m}}{3.96\text{m} - \frac{1.999\text{m}-0.13\text{m}}{2}} \right)$$




17) Angle of Outside Wheel Lock Satisfying Correct Steering Condition 

$$\text{fx } \varphi = a \cot\left(\cot(\theta) + \frac{c}{L}\right)$$

Open Calculator 

$$\text{ex } 41.74717^\circ = a \cot\left(\cot(43^\circ) + \frac{0.13\text{m}}{2.7\text{m}}\right)$$

Moments Acting on Steering System and Axles 18) Moment about Steeraxis due to Driveline Torque 

$$\text{fx } M_{sa} = F_x \cdot ((d \cdot \cos(v) \cdot \cos(\lambda_1)) + (R_e \cdot \sin(\lambda_1 + \zeta)))$$

Open Calculator 

$$\text{ex } 170.3342\text{N}\cdot\text{m} = 450\text{N} \cdot ((0.21\text{m} \cdot \cos(4.5^\circ) \cdot \cos(10^\circ)) + (0.35\text{m} \cdot \sin(10^\circ + 19.5^\circ)))$$

19) Moment Arising due to Lateral Forces on Wheels during Steering 

$$\text{fx } M_l = (F_{yl} + F_{yr}) \cdot R_e \cdot \tan(v)$$

Open Calculator 


$$\text{ex } 28.37197\text{N}\cdot\text{m} = (510\text{N} + 520\text{N}) \cdot 0.35\text{m} \cdot \tan(4.5^\circ)$$

20) Moment Arising from Traction Force on Wheels during Steering 

$$\text{fx } M_t = (F_{xl} - F_{xr}) \cdot d_L$$

Open Calculator 

$$\text{ex } 4\text{N}\cdot\text{m} = (500\text{N} - 400\text{N}) \cdot 0.04\text{m}$$

21) Moment due to Vertical Force on Wheels during Steering 

$$\text{fx } M_v = ((F_{zl} - F_{zr}) \cdot d_L \cdot \sin(v) \cdot \cos(\delta)) - ((F_{zl} + F_{zr}) \cdot d_L \cdot \sin(\lambda_1) \cdot \sin(\delta))$$

Open Calculator 

$$\text{ex } 0.108424\text{N}\cdot\text{m} = ((650\text{N} - 600\text{N}) \cdot 0.04\text{m} \cdot \sin(4.5^\circ) \cdot \cos(0.32^\circ)) - ((650\text{N} + 600\text{N}) \cdot 0.04\text{m} \cdot \sin(10^\circ) \cdot \sin(0.32^\circ))$$



Variables Used








- **a** Distance of c.g from Front Axle (Meter)
- **a_c** Centripetal Acceleration during Cornering (Meter per Square Second)
- **a_{tw}** Track Width of Vehicle (Meter)
- **A_q** Horizontal Lateral Acceleration (Meter per Square Second)
- **b** Distance of c.g from Rear Axle (Meter)
- **c** Distance between Front Wheel Pivot Center (Meter)
- **d** Distance between Steeraxis and Tire center (Meter)
- **d_L** Lateral Offset at Ground (Meter)
- **F_x** Tractive Force (Newton)
- **F_{xl}** Tractive Force on Left Wheels (Newton)
- **F_{xr}** Tractive Force on Right Wheels (Newton)
- **F_{yl}** Lateral Force on Left Wheels (Newton)
- **F_{yr}** Lateral Force on Right Wheels (Newton)
- **F_{zl}** Vertical Load on Left Wheels (Newton)
- **F_{zr}** Vertical Load on Right Wheels (Newton)
- **g** Acceleration due to Gravity (Meter per Square Second)
- **K** Understeer Gradient (Degree)
- **L** Wheelbase of Vehicle (Meter)
- **M_{at}** Self Aligning Moment (Newton Meter)
- **M_l** Moment on Wheels Arising from Lateral Force (Newton Meter)
- **M_{sa}** Moment about Steeraxis due to Driveline Torque (Newton Meter)
- **M_t** Moment Arising from Traction Force (Newton Meter)
- **M_v** Moment arising from Vertical Forces on Wheels (Newton Meter)
- **M_{zl}** Aligning Moment Acting on Left Tires (Newton Meter)
- **M_{zr}** Aligning Moment on Right Tires (Newton Meter)
- **r** Yaw Velocity (Degree per Second)
- **R** Radius of Turn (Meter)
- **R_e** Radius of Tire (Meter)
- **R_{IF}** Turning Radius of Inner Front Wheel (Meter)
- **R_{IR}** Turning Radius of Rear Inner Wheel (Meter)
- **R_{OF}** Turning Radius of Outer Front Wheel (Meter)
- **R_{OR}** Turning Radius of Outer Rear Wheel (Meter)
- **T_d** Driveline Torque (Newton Meter)



- V_o Critical Speed for Oversteer Vehicles (Meter per Second)
- V_t Total Velocity (Meter per Second)
- V_u Characteristic Speed for Understeer Vehicles (Meter per Second)
- W Total Load of Vehicle (Newton)
- W_{fl} Load on Front Axle at High Speed Cornering (Newton)
- W_r Load on Rear Axle at High Speed Cornering (Newton)
- α_f Slip Angle of Front Wheel (Degree)
- α_r Slip Angle of Rear Wheel (Degree)
- β Vehicle Body Slip Angle (Degree)
- δ Steer Angle (Degree)
- δ_i Steering Angle Inner Wheel (Degree)
- δ_o Steering Angle Outer Wheel (Degree)
- ζ Angle made by Front Axle with Horizontal (Degree)
- θ Angle of Inside Wheel Lock (Degree)
- λ_l Lateral Inclination Angle (Degree)
- ν Caster Angle (Degree)
- φ Angle of Outside Wheel Lock (Degree)




Constants, Functions, Measurements used

- **Function: acot** , $\text{acot}(\text{Number})$
Inverse trigonometric cotangent function
- **Function: asin** , $\text{asin}(\text{Number})$
Inverse trigonometric sine function
- **Function: atan** , $\text{atan}(\text{Number})$
Inverse trigonometric tangent function
- **Function: cos** , $\text{cos}(\text{Angle})$
Trigonometric cosine function
- **Function: cot** , $\text{cot}(\text{Angle})$
Trigonometric cotangent function
- **Function: sin** , $\text{sin}(\text{Angle})$
Trigonometric sine function
- **Function: sqrt** , $\text{sqrt}(\text{Number})$
Square root function
- **Function: tan** , $\text{tan}(\text{Angle})$
Trigonometric tangent function
- **Measurement: Length** in Meter (m)
Length Unit Conversion 
- **Measurement: Speed** in Meter per Second (m/s)
Speed Unit Conversion 
- **Measurement: Acceleration** in Meter per Square Second (m/s^2)
Acceleration Unit Conversion 
- **Measurement: Force** in Newton (N)
Force Unit Conversion 
- **Measurement: Angle** in Degree ($^\circ$)
Angle Unit Conversion 
- **Measurement: Angular Velocity** in Degree per Second (degree/s)
Angular Velocity Unit Conversion 
- **Measurement: Torque** in Newton Meter ($\text{N}\cdot\text{m}$)
Torque Unit Conversion 



Check other formula lists

- [Moments, Loads, Angles acting on Steering system and Axles Formulas](#) 
- [Movement Ratio Formulas](#) 
- [Pivot Centre, Wheel Base and Track Formulas](#) 
- [Steering System Formulas](#) 
- [Turning Radius Formulas](#) 

Feel free to SHARE this document with your friends!

PDF Available in

[English](#) [Spanish](#) [French](#) [German](#) [Russian](#) [Italian](#) [Portuguese](#) [Polish](#) [Dutch](#)

11/22/2023 | 11:25:05 PM UTC

[Please leave your feedback here...](#)

