Important Rates for Axle Suspension in Race Car Formulas PDF

Formulas
Examples
with Units

List of 10
Important Rates for Axle Suspension in Race Car Formulas

1) Rear Track Width given Roll Rate Formula

Evaluate Formula

Formula

$$t_R = \sqrt{\frac{K_\Phi \cdot K_w \cdot T_s^2}{\left(K_w \cdot \frac{T_s^2}{2} - K_\Phi\right) \cdot K_t}}$$

Example with Units

$$0.6277\,\text{m} = \sqrt{\frac{10297.43\,\text{Nm/rad} \cdot 30366.46\,\text{N/m} \cdot 0.9\,\text{m}^2}{\left(30366.46\,\text{N/m} \cdot \frac{0.9\,\text{m}^2}{2} - 10297.43\,\text{Nm/rad}\right) \cdot 321300\,\text{N/m}}}$$

2) Rear Track Width given Roll Rate of Suspension with Anti-Roll Bar Formula

Evaluate Formula

Formula

$$t_R = \sqrt{2 \cdot \frac{K_\Phi \cdot \left(R_{arb} + K_w \cdot \frac{\left(T_s\right)^2}{2}\right)}{\left(R_{arb} + K_w \cdot \frac{T_s^2}{2} - K_\Phi\right) \cdot K_t}}$$

Example with Units

$$0.4\,\text{m} = \sqrt{2 \cdot \frac{10297.43\,\text{Nm/rad} \cdot \left(4881.6\,\text{Nm/rad} + 30366.46\,\text{N/m} \cdot \frac{\left(0.9\,\text{m}\right)^2}{2}\right)}{\left(4881.6\,\text{Nm/rad} + 30366.46\,\text{N/m} \cdot \frac{0.9\,\text{m}^2}{2} - 10297.43\,\text{Nm/rad}\right) \cdot 321300\,\text{N/m}}}$$

3) Roll Rate Formula

Evaluate Formula

Formula

$$K_{\Phi} = \frac{K_t \cdot \frac{t_R^2}{2} \cdot K_w \cdot \frac{T_s^2}{2}}{K_t \cdot \frac{t_R^2}{2} + K_w \cdot \frac{T_s^2}{2}}$$

Example with Units

$$8318.3788\,\text{Nm/rad} = \frac{321300\,\text{N/m} \cdot \frac{0.4\,\text{m}^2}{2} \cdot 30366.46\,\text{N/m} \cdot \frac{0.9\,\text{m}^2}{2}}{321300\,\text{N/m} \cdot \frac{0.4\,\text{m}^2}{2} + 30366.46\,\text{N/m} \cdot \frac{0.9\,\text{m}^2}{2}}$$

4) Roll Rate with Anti-Roll Bar Formula

Evaluate Formula

Formula

$$K_{\Phi} = \frac{K_t \cdot \frac{t_R^2}{2} \cdot \left(R_{arb} + K_w \cdot \frac{T_s^2}{2} \right)}{K_t \cdot \frac{t_R^2}{2} + R_{arb} + K_w \cdot \frac{T_s^2}{2}}$$

Example with Units

$$10297.4296\,\text{Nm/rad} = \frac{321300\,\text{N/m} \cdot \frac{0.4\,\text{m}^2}{2} \cdot \left(4881.6\,\text{Nm/rad} + 30366.46\,\text{N/m} \cdot \frac{0.9\,\text{m}^2}{2} \right)}{321300\,\text{N/m} \cdot \frac{0.4\,\text{m}^2}{2} + 4881.6\,\text{Nm/rad} + 30366.46\,\text{N/m} \cdot \frac{0.9\,\text{m}^2}{2}}$$

5) Spring Track Width given Roll Rate Formula

Evaluate Formula

Formula

$$T_s = \sqrt{\frac{K_{\Phi} \cdot K_t \cdot t_R^2}{\left(K_t \cdot \frac{t_R^2}{2} - K_{\Phi} \right) \cdot K_w}}$$

Example with Units

$$1.0637\,\text{m} = \sqrt{\frac{10297.43\,\text{Nm/rad} \cdot 321300\,\text{N/m} \cdot 0.4\,\text{m}^2}{\left(321300\,\text{N/m} \cdot \frac{0.4\,\text{m}^2}{2} - 10297.43\,\text{Nm/rad} \right) \cdot 30366.46\,\text{N/m}}}$$

6) Spring Track Width given Roll Rate of Suspension with Anti-Roll Bar Formula

Evaluate Formula

Formula

$$T_s = \sqrt{2 \cdot \left(\frac{\frac{K_\Phi \cdot K_t \cdot \frac{t_R^2}{2}}{\left(K_t \cdot \frac{t_R^2}{2} - K_\Phi \right)} - R_{arb}}{K_w} \right)}$$

Example with Units

$$0.9\,\text{m} = \sqrt{2 \cdot \left(\frac{\frac{10297.43\,\text{Nm/rad} \cdot 321300\,\text{N/m} \cdot \frac{0.4\,\text{m}^2}{2}}{\left(321300\,\text{N/m} \cdot \frac{0.4\,\text{m}^2}{2} - 10297.43\,\text{Nm/rad} \right)} - 4881.6\,\text{Nm/rad}}{30366.46\,\text{N/m}} \right)}$$

7) Tyre Rate given Roll Rate Formula

Evaluate Formula

Formula

$$K_t = \frac{K_\Phi \cdot \left(K_w \cdot \frac{T_s^2}{2} \right)}{\left(K_w \cdot \frac{T_s^2}{2} - K_\Phi \right) \cdot \frac{t_R^2}{2}}$$

Example with Units

$$791122.8638\,\text{N/m} = \frac{10297.43\,\text{Nm/rad} \cdot \left(30366.46\,\text{N/m} \cdot \frac{0.9\,\text{m}^2}{2} \right)}{\left(30366.46\,\text{N/m} \cdot \frac{0.9\,\text{m}^2}{2} - 10297.43\,\text{Nm/rad} \right) \cdot \frac{0.4\,\text{m}^2}{2}}$$

8) Tyre Rate given Roll Rate of Suspension with Anti-Roll Bar Formula

Evaluate Formula

Formula

$$K_t = \frac{K_\Phi \cdot \left(R_{arb} + K_w \cdot \frac{T_s^2}{2} \right)}{\left(R_{arb} + K_w \cdot \frac{T_s^2}{2} - K_\Phi \right) \cdot \frac{t_R^2}{2}}$$

Example with Units

$$321300.0309\,\text{N/m} = \frac{10297.43\,\text{Nm/rad} \cdot \left(4881.6\,\text{Nm/rad} + 30366.46\,\text{N/m} \cdot \frac{0.9\,\text{m}^2}{2} \right)}{\left(4881.6\,\text{Nm/rad} + 30366.46\,\text{N/m} \cdot \frac{0.9\,\text{m}^2}{2} - 10297.43\,\text{Nm/rad} \right) \cdot \frac{0.4\,\text{m}^2}{2}}$$

9) Vertical Tyre Axle Rate given Roll Rate Formula

Evaluate Formula

Formula

$$K_w = \frac{K_\Phi \cdot K_t \cdot \frac{t_R^2}{2}}{K_t \cdot \frac{t_R^2}{2} - K_\Phi \cdot \frac{T_s^2}{2}}$$

Example with Units

$$12291.7611\,\text{N/m} = \frac{10297.43\,\text{Nm/rad} \cdot 321300\,\text{N/m} \cdot \frac{0.4\,\text{m}^2}{2}}{321300\,\text{N/m} \cdot \frac{0.4\,\text{m}^2}{2} - 10297.43\,\text{Nm/rad} \cdot \frac{0.9\,\text{m}^2}{2}}$$

10) Vertical Tyre Axle Rate given Roll Rate of Suspension with Anti-Roll Bar Formula

Evaluate Formula

Formula

$$K_w = \frac{\frac{K_\Phi \cdot K_t \cdot \frac{t_R^2}{2}}{K_t \cdot \frac{t_R^2}{2} - K_\Phi} - R_{arb}}{\frac{T_s^2}{2}}$$

Example with Units

$$30366.4627\,\text{N/m} = \frac{\frac{10297.43\,\text{Nm/rad} \cdot 321300\,\text{N/m} \cdot \frac{0.4\,\text{m}^2}{2}}{321300\,\text{N/m} \cdot \frac{0.4\,\text{m}^2}{2} - 10297.43\,\text{Nm/rad}} - 4881.6\,\text{Nm/rad}}{\frac{0.9\,\text{m}^2}{2}}$$

Variables used in list of Rates for Axle Suspension in Race Car Formulas above

- K_t Tyre Vertical Rate *(Newton per Meter)*
- K_w Wheel Centre Rate *(Newton per Meter)*
- K_Φ Roll Rate *(Newton Meter per Radian)*
- R_{arb} Roll Rate of Anti-Roll Bar *(Newton Meter per Radian)*
- t_R Rear Track Width *(Meter)*
- T_s Spring Track Width *(Meter)*

Constants, Functions, Measurements used in list of Rates for Axle Suspension in Race Car Formulas above

- Functions: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Surface Tension** in Newton per Meter (N/m)
  Surface Tension Unit Conversion
- Measurement: **Torsion Constant** in Newton Meter per Radian (Nm/rad)
  Torsion Constant Unit Conversion

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