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Rates for Axle Suspension in Race Car Formulas

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List of 10 Rates for Axle Suspension in Race Car Formulas

Rates for Axle Suspension in Race Car

1) Rear Track Width given Roll Rate

Open Calculator

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

$$0.484635\text{m} = \sqrt{\frac{11805\text{Nm/rad} \cdot 42419.8\text{N/m} \cdot (0.9\text{m})^2}{\left(42419.8\text{N/m} \cdot \frac{(0.9\text{m})^2}{2} - 11805\text{Nm/rad}\right) \cdot 321300\text{N/m}}}$$

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

Open Calculator

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

$$0.397566\text{m} = \sqrt{2 \cdot \frac{11805\text{Nm/rad} \cdot \left(4881.6\text{Nm/rad} + 42419.8\text{N/m} \cdot \frac{(0.9\text{m})^2}{2}\right)}{\left(4881.6\text{Nm/rad} + 42419.8\text{N/m} \cdot \frac{(0.9\text{m})^2}{2} - 11805\text{Nm/rad}\right) \cdot 321300\text{N/m}}}$$

3) Roll Rate

Open Calculator

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

$$16400.52\text{Nm/rad} = \frac{321300\text{N/m} \cdot \frac{(1.5\text{m})^2}{2} \cdot 42419.8\text{N/m} \cdot \frac{(0.9\text{m})^2}{2}}{321300\text{N/m} \cdot \frac{(1.5\text{m})^2}{2} + 42419.8\text{N/m} \cdot \frac{(0.9\text{m})^2}{2}}$$

4) Roll Rate with Anti-Roll Bar

Open Calculator

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

$$20792.56\text{Nm/rad} = \frac{321300\text{N/m} \cdot \frac{(1.5\text{m})^2}{2} \cdot \left(4881.6\text{Nm/rad} + 42419.8\text{N/m} \cdot \frac{(0.9\text{m})^2}{2}\right)}{321300\text{N/m} \cdot \frac{(1.5\text{m})^2}{2} + 4881.6\text{Nm/rad} + 42419.8\text{N/m} \cdot \frac{(0.9\text{m})^2}{2}}$$

5) Spring Track Width given Roll Rate

Open Calculator

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

$$0.758532\text{m} = \sqrt{\frac{11805\text{Nm/rad} \cdot 321300\text{N/m} \cdot (1.5\text{m})^2}{\left(321300\text{N/m} \cdot \frac{(1.5\text{m})^2}{2} - 11805\text{Nm/rad}\right) \cdot 42419.8\text{N/m}}}$$

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

Open Calculator

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

$$0.587549\text{m} = \sqrt{2 \cdot \left(\frac{\frac{11805\text{Nm/rad} \cdot 321300\text{N/m} \cdot \frac{(1.5\text{m})^2}{2}}{\left(321300\text{N/m} \cdot \frac{(1.5\text{m})^2}{2} - 11805\text{Nm/rad}\right)} - 4881.6\text{Nm/rad}}{42419.8\text{N/m}}\right)}$$

7) Tyre Rate given Roll Rate

Open Calculator

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

ex $$33539.54\text{N/m} = \frac{11805\text{Nm/rad} \cdot \left(42419.8\text{N/m} \cdot \frac{(0.9\text{m})^2}{2}\right)}{\left(42419.8\text{N/m} \cdot \frac{(0.9\text{m})^2}{2} - 11805\text{Nm/rad}\right) \cdot \frac{(1.5\text{m})^2}{2}}$$

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

Open Calculator

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

ex $$22570.78\text{N/m} = \frac{11805\text{Nm/rad} \cdot \left(4881.6\text{Nm/rad} + 42419.8\text{N/m} \cdot \frac{(0.9\text{m})^2}{2}\right)}{\left(4881.6\text{Nm/rad} + 42419.8\text{N/m} \cdot \frac{(0.9\text{m})^2}{2} - 11805\text{Nm/rad}\right) \cdot \frac{(1.5\text{m})^2}{2}}$$

9) Vertical Tyre Axle Rate given Roll Rate

Open Calculator

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

ex $$11963.24\text{N/m} = \frac{11805\text{Nm/rad} \cdot 321300\text{N/m} \cdot \frac{(1.5\text{m})^2}{2}}{321300\text{N/m} \cdot \frac{(1.5\text{m})^2}{2} - 11805\text{Nm/rad} \cdot \frac{(0.9\text{m})^2}{2}}$$

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

Open Calculator

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

ex $$18078.9\text{N/m} = \frac{\frac{11805\text{Nm/rad} \cdot 321300\text{N/m} \cdot \frac{(1.5\text{m})^2}{2}}{321300\text{N/m} \cdot \frac{(1.5\text{m})^2}{2} - 11805\text{Nm/rad}} - 4881.6\text{Nm/rad}}{\frac{(0.9\text{m})^2}{2}}$$

Variables Used

- 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

- Function: **sqrt**, sqrt(Number)
  Square root function
- 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

Check other formula lists

- **Rates for Axle Suspension in Race Car Formulas**
- **Ride Rate and Ride Frequency for Race Cars Formulas**
- **Vehicle Cornering in Race Cars Formulas**
- **Weight Transfer during Braking Formulas**
- **Wheel Centre Rates for Independent Suspension Formulas**

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