Important Suspension Geometry Formulas PDF

Formulas
Examples
with Units

List of 24
Important Suspension Geometry Formulas

1) Anti Geometry of Independent Suspension Formulas

1.1) Angle between IC and Ground Formula

Evaluate Formula

Formula

$$\Phi R = atan\left(\frac{SVSA_h}{SVSA_l}\right)$$

Example with Units

$$18.4349° = atan\left(\frac{200\,mm}{600\,mm}\right)$$

1.2) Camber Change Rate Formula

Evaluate Formula

Formula

$$\theta = atan\left(\frac{1}{fvsa}\right)$$

Example with Units

$$36.8974° = atan\left(\frac{1}{1332\,mm}\right)$$

1.3) Front View Swing Arm Formula

Evaluate Formula

Formula

$$fvsa = \frac{\frac{a_{tw}}{2}}{1 - RC}$$

Example with Units

$$1332.6667\,mm = \frac{\frac{1999\,mm}{2}}{1 - 0.25}$$

1.4) Height of Centre of Gravity from Road Surface from Percentage Anti Dive Formula

Evaluate Formula

Formula

$$h = \frac{\left(\%B_f\right) \cdot \left(\frac{SVSA_h}{SVSA_l}\right) \cdot b_{ind}}{\%AD_f}$$

Example with Units

$$10000\,mm = \frac{\left(60\right) \cdot \left(\frac{200\,mm}{600\,mm}\right) \cdot 1350\,mm}{2.7}$$

1.5) Height of Centre of Gravity from Road Surface from Percentage Anti Lift Formula

Evaluate Formula

Formula

$$h = \frac{\left(\%B_r\right) \cdot \left(\frac{SVSA_h}{SVSA_l}\right) \cdot b_{ind}}{\%AL_r}$$

Example with Units

$$10000.0002\,mm = \frac{\left(60.88889\right) \cdot \left(\frac{200\,mm}{600\,mm}\right) \cdot 1350\,mm}{2.74}$$

1.6) Percent Anti Squat Formula

Evaluate Formula

Formula

$$\%AS = \left(\frac{\tan(\Phi R)}{\frac{h}{b_{ind}}} \right) \cdot 100$$

Example with Units

$$4.4987 = \left(\frac{\tan(18.43°)}{\frac{10000\,mm}{1350\,mm}} \right) \cdot 100$$

1.7) Percentage Anti Dive on Front Formula

Evaluate Formula

Formula

$$\%AD_f = \left(\%B_f \right) \cdot \frac{\frac{SVSA_h}{SVSA_l}}{\frac{h}{b_{ind}}}$$

Example with Units

$$2.7 = \left(60 \right) \cdot \frac{\frac{200\,mm}{600\,mm}}{\frac{10000\,mm}{1350\,mm}}$$

1.8) Percentage Anti Lift Formula

Evaluate Formula

Formula

$$\%AL_r = \left(\%B_f \right) \cdot \frac{\frac{SVSA_h}{SVSA_l}}{\frac{h}{b_{ind}}}$$

Example with Units

$$2.7 = \left(60 \right) \cdot \frac{\frac{200\,mm}{600\,mm}}{\frac{10000\,mm}{1350\,mm}}$$

1.9) Percentage Front Braking given Percentage Anti Dive Formula

Evaluate Formula

Formula

$$\%B_f = \frac{\%AD_f}{\frac{\frac{SVSA_h}{SVSA_l}}{\frac{h}{b_{ind}}}}$$

Example with Units

$$60 = \frac{2.7}{\frac{\frac{200\,mm}{600\,mm}}{\frac{10000\,mm}{1350\,mm}}}$$

1.10) Percentage Rear Braking given Percentage Anti Lift Formula

Evaluate Formula

Formula

$$\%B_r = \frac{\%AL_r}{\frac{\frac{SVSA_h}{SVSA_l}}{\frac{h}{b_{ind}}}}$$

Example with Units

$$60.8889 = \frac{2.74}{\frac{\frac{200\,mm}{600\,mm}}{\frac{10000\,mm}{1350\,mm}}}$$

1.11) Roll Camber Formula

Evaluate Formula

Formula

$$RC = \frac{\theta c}{RA}$$

Example with Units

$$0.25 = \frac{2°}{8°}$$

1.12) Side View Swing Arm Height given Percentage Anti Dive Formula

Evaluate Formula

Formula

$$SVSA_h = \frac{\%AD_f}{\left(\%B_f\right) \cdot \frac{\frac{1}{SVSA_l}}{\frac{h}{b_{ind}}}}$$

Example with Units

$$200\,\text{mm} = \frac{2.7}{\left(60\right) \cdot \frac{\frac{1}{600\,\text{mm}}}{\frac{10000\,\text{mm}}{1350\,\text{mm}}}}$$

1.13) Side View Swing Arm Height given Percentage Anti Lift Formula

Evaluate Formula

Formula

$$SVSA_h = \frac{\%AL_r}{\left(\%B_r\right) \cdot \frac{\frac{1}{SVSA_l}}{\frac{h}{b_{ind}}}}$$

Example with Units

$$200\,\text{mm} = \frac{2.74}{\left(60.88889\right) \cdot \frac{\frac{1}{600\,\text{mm}}}{\frac{10000\,\text{mm}}{1350\,\text{mm}}}}$$

1.14) Side View Swing Arm Length given Percentage Anti Dive Formula

Evaluate Formula

Formula

$$SVSA_l = \frac{\left(\%B_f\right) \cdot \frac{SVSA_h}{\frac{h}{b_{ind}}}}{\%AD_f}$$

Example with Units

$$600\,\text{mm} = \frac{\left(60\right) \cdot \frac{200\,\text{mm}}{\frac{10000\,\text{mm}}{1350\,\text{mm}}}}{2.7}$$

1.15) Side View Swing Arm Length given Percentage Anti Lift Formula

Evaluate Formula

Formula

$$SVSA_l = \frac{\left(\%B_r\right) \cdot \frac{SVSA_h}{\frac{h}{b_{ind}}}}{\%AL_r}$$

Example with Units

$$600\,\text{mm} = \frac{\left(60.88889\right) \cdot \frac{200\,\text{mm}}{\frac{10000\,\text{mm}}{1350\,\text{mm}}}}{2.74}$$

1.16) Wheelbase of Vehicle from Percentage Anti Dive Formula

Evaluate Formula

Formula

$$b_{ind} = \frac{\%AD_f}{\left(\%B_f\right) \cdot \frac{\frac{SVSA_h}{SVSA_l}}{h}}$$

Example with Units

$$1350\,\text{mm} = \frac{2.7}{\left(60\right) \cdot \frac{\frac{200\,\text{mm}}{600\,\text{mm}}}{10000\,\text{mm}}}$$

1.17) Wheelbase of Vehicle from Percentage Anti Lift Formula

Evaluate Formula

Formula

$$b_{ind} = \frac{\%AL_r}{\left(\%B_f\right) \cdot \frac{\frac{SVSA_h}{SVSA_l}}{h}}$$

Example with Units

$$1370\,\text{mm} = \frac{2.74}{\left(60\right) \cdot \frac{\frac{200\,\text{mm}}{600\,\text{mm}}}{10000\,\text{mm}}}$$

2) Forces on Suspension Formulas

2.1) Centre of Gravity Position Distance from Front Wheels Formula

Evaluate Formula

Formula

$$a = \frac{W_r \cdot b}{m}$$

Example with Units

$$3570\,\text{mm} = \frac{210\,\text{kg} \cdot 1955\,\text{mm}}{115\,\text{kg}}$$

2.2) Centre of Gravity Position Distance from Rear Wheels Formula

Evaluate Formula

Formula

$$c = \frac{W_f \cdot b}{m}$$

Example with Units

$$2210\,\text{mm} = \frac{130\,\text{kg} \cdot 1955\,\text{mm}}{115\,\text{kg}}$$

2.3) Force Applied by Coil Spring Formula

Evaluate Formula

Formula

$$F_{coil} = k \cdot x$$

Example with Units

$$15\,\text{N} = 100\,\text{N/m} \cdot 150\,\text{mm}$$

2.4) Installation Ratio given Motion Ratio Formula

Evaluate Formula

Formula

$$IR = \sqrt{M.R.}$$

Example

$$0.6 = \sqrt{0.36}$$

2.5) Mass on front axle given position of COG Formula

Evaluate Formula

Formula

$$W_f = \frac{c}{\frac{b}{m}}$$

Example with Units

$$130\,\text{kg} = \frac{2210\,\text{mm}}{\frac{1955\,\text{mm}}{115\,\text{kg}}}$$

2.6) Motion Ratio given Installation Ratio Formula

Evaluate Formula

Formula

$$M.R. = IR^2$$

Example

$$0.36 = 0.6^2$$

2.7) Wheel Base of Vehicle given COG Position from Rear Axle Formula

Evaluate Formula

Formula

$$b = \frac{c}{\frac{W_f}{m}}$$

Example with Units

$$1955\,\text{mm} = \frac{2210\,\text{mm}}{\frac{130\,\text{kg}}{115\,\text{kg}}}$$

Variables used in list of Suspension Geometry Formulas above

- **%AD$_f$** Percentage Anti Dive Front
- **%AL$_r$** Percentage Anti Lift
- **%AS** Percentage Anti Squat
- **%B$_f$** Percentage Front Braking
- **%B$_r$** Percentage Rear Braking
- **a** Horizontal Distance of C.G. from Front Axle *(Millimeter)*
- **a$_{tw}$** Track Width of Vehicle *(Millimeter)*
- **b** Wheelbase of Vehicle *(Millimeter)*
- **b$_{ind}$** Independent Wheelbase of Vehicle *(Millimeter)*
- **c** Horizontal Distance of C.G. from Rear Axle *(Millimeter)*
- **F$_{coil}$** Force Coil Spring *(Newton)*
- **fvsa** Front View Swing Arm *(Millimeter)*
- **h** Height of CG above Road *(Millimeter)*
- **IR** Installation Ratio
- **k** Coil Spring Stiffness *(Newton per Meter)*
- **m** Mass of Vehicle *(Kilogram)*
- **M.R.** Motion Ratio in Suspension
- **RA** Roll Angle *(Degree)*
- **RC** Roll Camber
- **SVSA$_h$** Side View Swing Arm Height *(Millimeter)*
- **SVSA$_l$** Side View Swing Arm Length *(Millimeter)*
- **W$_f$** Mass on Front Axle *(Kilogram)*
- **W$_r$** Mass on Rear Axle *(Kilogram)*
- **x** Maximum Compression in Spring *(Millimeter)*
- **θ** Camber Change Rate *(Degree)*
- **θc** Camber Angle *(Degree)*
- **ΦR** Angle between IC and Ground *(Degree)*

Constants, Functions, Measurements used in list of Suspension Geometry Formulas above

- Functions: **atan**, atan(Number)
  Inverse tan is used to calculate the angle by applying the tangent ratio of the angle, which is the opposite side divided by the adjacent side of the right triangle.
- 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.
- Functions: **tan**, tan(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: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Surface Tension** in Newton per Meter (N/m)
  Surface Tension Unit Conversion

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