Important All Wheel Braking for Racing Car Formulas **PDF**

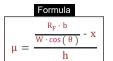


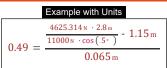
List of 25

Important All Wheel Braking for Racing Car **Formulas**

1) Effects on Front Wheel Formulas (7)

1.1) Friction Coefficient between Wheel and Road Surface with Front Wheel Brake Formula 🕝





1.2) Front Wheel Reaction with All Wheel Braking Formula C

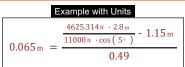
$$R_{F} = W \cdot (x + \mu \cdot h) \cdot \frac{\cos(\theta)}{b}$$

Example with Units

$$4625.3142 \,\text{M} \,=\, 11000 \,\text{N} \,\cdot\, \left(\, 1.15 \,\text{m} \,+\, 0.49 \cdot 0.065 \,\text{m}\,\,\right) \cdot \frac{\cos\left(\,5^{\circ}\,\,\right)}{2.8 \,\text{m}}$$

1.3) Height of C.G. from Road Surface with Front Wheel Brake Formula [7]

Formula



Evaluate Formula C

Evaluate Formula

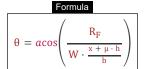
Evaluate Formula

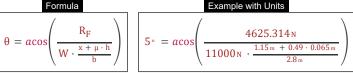
1.4) Horizontal Distance of C.G from Rear Axle with Front Wheel Brake Formula 🕝 Evaluate Formula 🕝

$$x = \frac{R_F \cdot b}{W \cdot \cos\left(\theta\right)} - \mu \cdot h$$

$$1.15 \text{ m} = \frac{4625.314 \text{ N} \cdot 2.8 \text{ m}}{11000 \text{ N} \cdot \cos\left(5^{\circ}\right)} - 0.49 \cdot 0.065 \text{ m}$$

1.5) Slope of Road from Braking with Front Wheel Reaction Formula 🕝





Evaluate Formula (

Evaluate Formula

Evaluate Formula

Evaluate Formula 🕝

1.6) Vehicle Weight with All Wheel Brake on Front Wheel Formula [

Formula $W = \frac{R_F}{\left(x + \mu \cdot h\right) \cdot \frac{\cos(\theta)}{h}}$

Example with Units
$$10999.9995 \,\text{N} \,=\, \frac{4625.314 \,\text{N}}{\left(\,1.15 \,\text{m} \,+\, 0.49 \cdot 0.065 \,\text{m}\,\,\right) \cdot \frac{\cos\left(\,5^{\circ}\,\,\right)}{2.8 \,\text{m}}}$$

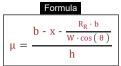
1.7) Wheel Base with All Wheel Braking on Front Wheel Formula

$$b = W \cdot (x + \mu \cdot h) \cdot \frac{\cos(\theta)}{R_F}$$

Example with Units
$$2.8\,\text{m} \,=\, 11000\,\text{N} \,\cdot\, \left(\,\, 1.15\,\text{m} \,+\, 0.49\,\cdot\, 0.065\,\text{m}\,\,\right) \,\cdot\, \frac{\cos\left(\,5^{\circ}\,\,\right)}{4625.314\,\text{N}}$$

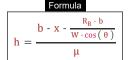
2) Effects on Rear Wheel Formulas (

2.1) Friction Coefficient between Wheel and Road Surface with Rear Wheel Brake Formula 🕝 Evaluate Formula





2.2) Height of C.G. from Road Surface with Rear Wheel Brake Formula C



$$h = \frac{b - x - \frac{R_R \cdot b}{W \cdot \cos{(\theta)}}}{\mu} \quad 0.065 \, \text{m} = \frac{2.8 \, \text{m} - 1.15 \, \text{m} - \frac{6332.83 \, \text{N} \cdot 2.8 \, \text{m}}{11000 \, \text{N} \cdot \cos{(5^{\circ})}}}{0.49}$$

Evaluate Formula C

2.3) Horizontal Distance of C.G from Rear Axle with Rear Wheel Brake Formula 🕝

Formula

Formula Example with Units
$$x = b - \mu \cdot h - \frac{R_R \cdot b}{W \cdot \cos(\theta)}$$

$$1.15_m = 2.8_m - 0.49 \cdot 0.065_m - \frac{6332.83_N \cdot 2.8_m}{11000_N \cdot \cos(5_\circ)}$$

2.4) Rear Wheel Reaction with All Wheel Braking Formula [

$$R_{R} = W \cdot (b - x - \mu \cdot h) \cdot \frac{\cos(\theta)}{b}$$

Evaluate Formula (

Example with Units

$$6332.8275 \,\text{N} \,=\, 11000 \,\text{N} \,\cdot\, \left(\, 2.8 \,\text{m} \,\,-\, 1.15 \,\text{m} \,\,-\, 0.49 \,\cdot\, 0.065 \,\text{m}\,\, \right) \,\cdot\, \frac{\cos\left(\, 5\,^{\circ}\,\,\right)}{2.8 \,\text{m}}$$

2.5) Slope of Road from Braking with Rear Wheel Reaction Formula C



Formula

Formula Example with Units
$$\theta = a\cos\left(\frac{R_R}{W \cdot \frac{b \cdot x \cdot \mu \cdot h}{b}}\right) \qquad 4.9997^{\circ} = a\cos\left(\frac{6332.83 \, \text{N}}{11000 \, \text{N} \cdot \frac{2.8 \, \text{m} \cdot 1.15 \, \text{m} \cdot 0.49 \cdot 0.065 \, \text{m}}{2.8 \, \text{m}}}\right)$$

2.6) Vehicle Weight with All Wheel Brake on Rear Wheel Formula C



Evaluate Formula

$$W = \frac{R_R}{\left(b - x - \mu \cdot h\right) \cdot \frac{\cos(\theta)}{b}}$$

Example with Units

$$11000.0044_{N} = \frac{6332.83_{N}}{\left(2.8_{m} - 1.15_{m} - 0.49 \cdot 0.065_{m}\right) \cdot \frac{\cos(5^{\circ})}{2.8_{m}}}$$

2.7) Wheel Base with All Wheel Braking on Rear Wheel Formula 🗂



 $b = \frac{W \cdot \cos(\theta) \cdot (x + \mu \cdot h)}{W \cdot \cos(\theta) \cdot R_{P}}$

Example with Units

$$2.8_{m} = \frac{11000_{N} \cdot \cos(5^{\circ}) \cdot (1.15_{m} + 0.49 \cdot 0.065_{m})}{11000_{N} \cdot \cos(5^{\circ}) - 6332.83_{N}}$$

3) Vehicle Braking Dynamics Formulas (

3.1) All Wheel Braking Retardation Formula 🕝

Formula

$$a = [g] \cdot (\mu \cdot \cos(\theta) - \sin(\theta))$$

Evaluate Formula

$$3.9323 \,\mathrm{m/s^2} = 9.8066 \,\mathrm{m/s^2} \cdot (0.49 \cdot \cos(5^\circ) - \sin(5^\circ))$$

3.2) Braking Force on Brake Drum on Level Road Formula 🕝



Formula Example with Units
$$F = \frac{W}{g} \cdot f \qquad 7801.0204 \, \text{N} = \frac{11000 \, \text{N}}{9.8 \, \text{m/s}^2} \cdot 6.95 \, \text{m/s}^2$$

Evaluate Formula [

3.3) Braking Torque of Disc Brake Formula

Formula



$$T_{s} = 2 \cdot p \cdot a_{p} \cdot \mu_{p} \cdot R_{m} \cdot n$$

$$0.0547 \,\mathrm{N^*m} = 2 \cdot 8 \,\mathrm{N/m^2} \cdot 0.02 \,\mathrm{m^2} \cdot 0.34 \cdot 0.25 \,\mathrm{m} \cdot 2.01$$

3.4) Braking Torque of Leading Shoe Formula Example with Units

$$T_{l} = \frac{W_{l} \cdot m \cdot \mu f \cdot k}{n_{t} + (\mu f \cdot k)} \qquad 1.2436 \, N^{*}m = \frac{105 \, N \cdot 0.26 \, m \cdot 0.35 \cdot 0.3 \, m}{2.2 \, m + (0.35 \cdot 0.3 \, m)}$$

Evaluate Formula [

3.5) Braking Torque of Trailing Shoe Formula

$$T_{t} = \frac{W_{t} \cdot n_{t} \cdot \mu_{0} \cdot k}{n_{t} \cdot \mu_{0} \cdot k}$$

Example with Units

$$T_{t} = \frac{W_{t} \cdot n_{t} \cdot \mu_{0} \cdot k}{n_{t} \cdot \mu_{0} \cdot k} \qquad 4.4287 \,_{N^{*}m} = \frac{80 \,_{N} \cdot 2.2 \,_{m} \cdot 0.18 \cdot 0.3 \,_{m}}{2.2 \,_{m} \cdot 0.18 \cdot 0.3 \,_{m}}$$

Evaluate Formula 🕝

3.6) Friction Coefficient between Wheel and Road Surface with Retardation Formula 🗂



$$\frac{a}{[g]} + \sin(\theta)$$

Example with Units

$$\mu = \frac{\frac{a}{[g]} + \sin(\theta)}{\cos(\theta)}$$

$$0.4898 = \frac{\frac{3.93 \text{ m/s}^2}{9.8066 \text{m/s}^2} + \sin(5^\circ)}{\cos(5^\circ)}$$

Evaluate Formula [

3.7) Gradient Descend Brake Drum Force Formula 🕝

Formula

$$F = \frac{W}{g} \cdot f + W \cdot \sin(\alpha_{inc})$$

Evaluate Formula (

Example with Units

$$7802.9403\,\text{N} \,=\, \frac{11000\,\text{N}}{9.8\,\text{m/s}^2} \cdot 6.95\,\text{m/s}^2 \,+\, 11000\,\text{N} \,\cdot \text{sin} \, \big(\, 0.01^\circ \, \big)$$

3.8) Ground Speed of Track Laying Vehicle Formula C

Formula
$$V_{g} = \frac{E_{\text{rpm}} \cdot C}{16660 \cdot P}$$

$$V_g = \frac{E_{rpm} \cdot C}{16660 \cdot R_g} \qquad 0.0263 \, \text{m/s} = \frac{5100 \, \text{rev/min} \, \cdot 8.2 \, \text{m}}{16660 \cdot 10}$$

3.9) Mean Lining Pressure of Brake Lining Formula 🕝

Formula

$$mlp = \left(\frac{180}{8 \cdot \pi}\right) \cdot \frac{F \cdot r}{\mu f \cdot r_{BD}^{2} \cdot w \cdot \alpha}$$

Evaluate Formula

Evaluate Formula [

Example with Units

$$2143.1742\,\text{N/m}^2 = \left(\frac{180}{8 \cdot 3.1416}\right) \cdot \frac{7800\,\text{N} \cdot 0.1\,\text{m}}{0.35 \cdot 5.01\,\text{m}^2 \cdot 0.68\,\text{m} \cdot 25^\circ}$$

3.10) Normal Force at Brake Shoe Contact Point Formula C

$$P = \frac{F \cdot r}{8 \cdot \mu f \cdot \alpha}$$

Example with Units

$$P = \frac{F \cdot r}{8 \cdot \mu f \cdot \alpha} \qquad \boxed{638.4387_{N} = \frac{7800_{N} \cdot 0.1_{m}}{8 \cdot 0.35 \cdot 25_{\circ}}}$$

Evaluate Formula C

3.11) Wheel Heat Generation Rate Formula C

Formula

$$H = \frac{F \cdot V}{4}$$

Example with Units $H = \frac{F \cdot V}{4} \mid 87750_{J/s} = \frac{7800 \,\text{N} \cdot 45 \,\text{m/s}}{4}$ Evaluate Formula C

Variables used in list of All Wheel Braking for Racing Car Formulas above

- a Retardation Produced by Braking (Meter per Square Second)
- a_p Area of One Piston per Caliper (Square Meter)
- b Vehicle Wheelbase (Meter)
- C Driving Sprocket Circumference (Meter)
- Erpm Engine RPM (Revolution per Minute)
- f Vehicle Deceleration (Meter per Square Second)
- F Brake Drum Braking Force (Newton)
- g Acceleration due to Gravity (Meter per Square Second)
- h Height of Center of Gravity (C.G.) of Vehicle (Meter)
- H Heat Generated per Second at Each Wheel (Joule per Second)
- **k** Effective Radius of Normal Force (Meter)
- m Distance of Actuating Force from Horizontal (Meter)
- mlp Mean Lining Pressure (Newton per Square Meter)
- n Number of Caliper Units
- n_t Force of Trailing Shoe Distance from Horizontal (Meter)
- **p** Line Pressure (Newton per Square Meter)
- P Normal Force between Shoe and Drum (Newton)
- r Effective Wheel Radius (Meter)
- r_{BD} Brake Drum Radius (Meter)
- R_F Normal Reaction at the Front Wheel (Newton)
- R_q Overall Gear Reduction
- R_m Mean Radius of Caliper Unit to Disc Axis (Meter)
- R_R Normal Reaction at Rear Wheel (Newton)
- T_I Leading Shoe Braking Torque (Newton Meter)
- T_s Disc Brake Braking Torque (Newton Meter)
- T_t Trailing Shoe Braking Torque (Newton Meter)

Constants, Functions, Measurements used in list of All Wheel Braking for Racing Car Formulas above

- constant(s): pi,
 3.14159265358979323846264338327950288
 Archimedes' constant
- constant(s): [g], 9.80665
 Gravitational acceleration on Earth
- Functions: acos, acos(Number)
 The inverse cosine function, is the inverse function of the cosine function. It is the function that takes a ratio as an input and returns the angle whose cosine is equal to that ratio.
- Functions: cos, cos(Angle)
 Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Functions: sin, sin(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.
- Measurement: Length in Meter (m)
 Length Unit Conversion
- Measurement: Area in Square Meter (m²)
 Area Unit Conversion
- Measurement: Pressure in Newton per Square Meter (N/m²)

 Pressure Unit Conversion
- Measurement: Speed in Meter per Second (m/s)
 Speed Unit Conversion
- Measurement: Acceleration in Meter per Square Second (m/s²)

Acceleration Unit Conversion

- Measurement: Power in Joule per Second (J/s)

 Power Unit Conversion
- Measurement: Force in Newton (N)
 Force Unit Conversion
- Measurement: Angle in Degree (°)
 Angle Unit Conversion
- Measurement: Angular Velocity in Revolution per Minute (rev/min)
 Angular Velocity Unit Conversion

- V Vehicle Speed (Meter per Second)
- V_g Ground Speed of Track Laying Vehicle (Meter per Second)
- W Brake Lining Width (Meter)
- W Vehicle Weight (Newton)
- W_I Leading Shoe Actuating Force (Newton)
- W_t Trailing Shoe Actuating Force (Newton)
- X Horizontal Distance of C.G. from Rear Axle (Meter)
- α Angle between Linings of Brake Shoes (Degree)
- α_{inc} Angle of Inclination of Plane to Horizontal (Degree)
- θ Inclination Angle of Road (Degree)
- µ Friction Coefficient Between Wheels and Ground
- μ₀ Friction Coefficient for Smooth Road
- μ_p Friction Coefficient of Pad Material
- µf Friction Coefficient between Drum and Shoe

Measurement: Torque in Newton Meter (N*m)
 Torque Unit Conversion

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Try our Unique Visual Calculators

- M Percentage decrease
- HCF of three numbers

Multiply fraction

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