

# Important Rear Wheel Braking for Racing Car Formulas PDF



## Formulas Examples with Units

## List of 19 Important Rear Wheel Braking for Racing Car Formulas

### 1) Effects on Front Wheel (FW) Formulas

#### 1.1) Friction Coefficient between Wheel and Road Surface on Front Wheel Formula

Formula

Evaluate Formula

$$\mu_{FW} = \frac{W \cdot (b - x) \cdot \frac{\cos(\theta)}{R_F} - b}{h}$$

Example with Units

$$0.456 = \frac{13000 \text{ N} \cdot (2.7 \text{ m} - 1.2 \text{ m}) \cdot \frac{\cos(10^\circ)}{7103 \text{ N}} - 2.7 \text{ m}}{0.007919 \text{ m}}$$

#### 1.2) Height of C.G. from Road Surface on Front Wheel Formula

Formula

Evaluate Formula

$$h = \frac{W \cdot (b - x) \cdot \frac{\cos(\theta)}{R_F} - b}{\mu_{FW}}$$

Example with Units

$$0.0079 \text{ m} = \frac{13000 \text{ N} \cdot (2.7 \text{ m} - 1.2 \text{ m}) \cdot \frac{\cos(10^\circ)}{7103 \text{ N}} - 2.7 \text{ m}}{0.456032}$$

#### 1.3) Horizontal Distance of C.G from Rear Axle on Front Wheel Formula

Formula

Evaluate Formula

$$x = (b - \mu_{FW} \cdot h) - R_F \cdot \frac{b - \mu_{FW} \cdot h}{W \cdot \cos(\theta)}$$

Example with Units

$$1.2004 \text{ m} = (2.7 \text{ m} - 0.456032 \cdot 0.007919 \text{ m}) - 7103 \text{ N} \cdot \frac{2.7 \text{ m} - 0.456032 \cdot 0.007919 \text{ m}}{13000 \text{ N} \cdot \cos(10^\circ)}$$



## 1.4) Normal Reaction Force at Front Wheel Formula

Formula

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

Evaluate Formula 

Example with Units

$$7103\text{ N} = 13000\text{ N} \cdot (2.7\text{ m} - 1.2\text{ m}) \cdot \frac{\cos(10^\circ)}{2.7\text{ m} + 0.456032 \cdot 0.007919\text{ m}}$$

## 1.5) Slope of Road on Front Wheel Formula

Formula

$$\theta = \arccos\left(\frac{R_F}{W \cdot \frac{b - x}{b + \mu_{FW} \cdot h}}\right)$$

Example with Units

$$10^\circ = \arccos\left(\frac{7103\text{ N}}{13000\text{ N} \cdot \frac{2.7\text{ m} - 1.2\text{ m}}{2.7\text{ m} + 0.456032 \cdot 0.007919\text{ m}}}\right)$$

Evaluate Formula 

## 1.6) Weight of Vehicle on Front Wheel Formula

Formula

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

Example with Units

$$13000\text{ N} = \frac{7103\text{ N}}{(2.7\text{ m} - 1.2\text{ m}) \cdot \frac{\cos(10^\circ)}{2.7\text{ m} + 0.456032 \cdot 0.007919\text{ m}}}$$

Evaluate Formula 

## 1.7) Wheel Base on Front Wheel Formula

Formula

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

Evaluate Formula 

Example with Units

$$2.7\text{ m} = \frac{7103\text{ N} \cdot 0.456032 \cdot 0.007919\text{ m} + 13000\text{ N} \cdot 1.2\text{ m} \cdot \cos(10^\circ)}{13000\text{ N} \cdot \cos(10^\circ) - 7103\text{ N}}$$

## 2) Effects on Rear Wheel (RW) Formulas

### 2.1) Breaking Retardation on Rear Wheel Formula

Formula

$$a = [g] \cdot \left( \frac{\mu_{RW} \cdot (b - x) \cdot \cos(\theta)}{b + \mu_{RW} \cdot h} - \sin(\theta) \right)$$

Evaluate Formula 

Example with Units

$$0.8688\text{ m/s}^2 = 9.8066\text{ m/s}^2 \cdot \left( \frac{0.48 \cdot (2.7\text{ m} - 1.2\text{ m}) \cdot \cos(10^\circ)}{2.7\text{ m} + 0.48 \cdot 0.007919\text{ m}} - \sin(10^\circ) \right)$$



## 2.2) Friction Coefficient between Wheel and Road Surface on Rear Wheel Formula

Formula

$$\mu_{RW} = \frac{R_R \cdot b - W \cdot x \cdot \cos(\theta)}{h \cdot (W \cdot \cos(\theta) - R_R)}$$

Example with Units

$$0.48 = \frac{5700\text{ N} \cdot 2.7\text{ m} - 13000\text{ N} \cdot 1.2\text{ m} \cdot \cos(10^\circ)}{0.007919\text{ m} \cdot (13000\text{ N} \cdot \cos(10^\circ) - 5700\text{ N})}$$

## 2.3) Friction Coefficient using Retardation on Rear Wheel Formula

Formula

$$\mu_{RW} = \frac{\left(\frac{a}{|g|} + \sin(\theta)\right) \cdot b}{(b - x) \cdot \cos(\theta) - \left(\left(\frac{a}{|g|} + \sin(\theta)\right) \cdot h\right)}$$

Example with Units

$$0.48 = \frac{\left(\frac{0.86885\text{ m/s}^2}{9.8066\text{ m/s}^2} + \sin(10^\circ)\right) \cdot 2.7\text{ m}}{(2.7\text{ m} - 1.2\text{ m}) \cdot \cos(10^\circ) - \left(\left(\frac{0.86885\text{ m/s}^2}{9.8066\text{ m/s}^2} + \sin(10^\circ)\right) \cdot 0.007919\text{ m}\right)}$$

## 2.4) Height of C.G. from Road Surface on Rear Wheel Formula

Formula

$$h = \frac{R_R \cdot b - W \cdot x \cdot \cos(\theta)}{\mu_{RW} \cdot (W \cdot \cos(\theta) - R_R)}$$

Example with Units

$$0.0079\text{ m} = \frac{5700\text{ N} \cdot 2.7\text{ m} - 13000\text{ N} \cdot 1.2\text{ m} \cdot \cos(10^\circ)}{0.48 \cdot (13000\text{ N} \cdot \cos(10^\circ) - 5700\text{ N})}$$

## 2.5) Height of C.G. using Retardation on Rear Wheel Formula

Formula

$$h = \frac{\mu_{RW} \cdot (b - x) \cdot \cos(\theta)}{\left(\frac{a}{|g|} + \sin(\theta)\right) - b} \cdot \mu_{RW}$$

Example with Units

$$0.0079\text{ m} = \frac{0.48 \cdot (2.7\text{ m} - 1.2\text{ m}) \cdot \cos(10^\circ)}{\left(\frac{0.86885\text{ m/s}^2}{9.8066\text{ m/s}^2} + \sin(10^\circ)\right) - 0.48} \cdot 2.7\text{ m}$$



## 2.6) Horizontal Distance of C.G. from Rear Axle on Rear Wheel Formula

Formula

$$x = R_R \cdot \frac{b + \mu_{RW} \cdot h}{W \cdot \cos(\theta)} - \mu_{RW} \cdot h$$

Evaluate Formula 

Example with Units

$$1.2 \text{ m} = 5700 \text{ N} \cdot \frac{2.7 \text{ m} + 0.48 \cdot 0.007919 \text{ m}}{13000 \text{ N} \cdot \cos(10^\circ)} - 0.48 \cdot 0.007919 \text{ m}$$

## 2.7) Horizontal Distance of C.G. using Retardation on Rear Wheel Formula

Formula

$$x = b - \left( \left( \frac{a}{[g]} + \sin(\theta) \right) \cdot \frac{b + \mu_{RW} \cdot h}{\mu_{RW} \cdot \cos(\theta)} \right)$$

Evaluate Formula 

Example with Units

$$1.2 \text{ m} = 2.7 \text{ m} - \left( \left( \frac{0.86885 \text{ m/s}^2}{9.8066 \text{ m/s}^2} + \sin(10^\circ) \right) \cdot \frac{2.7 \text{ m} + 0.48 \cdot 0.007919 \text{ m}}{0.48 \cdot \cos(10^\circ)} \right)$$

## 2.8) Normal Reaction Force at Rear Wheel Formula

Formula

$$R_R = W \cdot \left( x + \mu_{RW} \cdot h \right) \cdot \frac{\cos(\theta)}{b + \mu_{RW} \cdot h}$$

Evaluate Formula 

Example with Units

$$5699.9994 \text{ N} = 13000 \text{ N} \cdot \left( 1.2 \text{ m} + 0.48 \cdot 0.007919 \text{ m} \right) \cdot \frac{\cos(10^\circ)}{2.7 \text{ m} + 0.48 \cdot 0.007919 \text{ m}}$$

## 2.9) Slope of Road on Rear Wheel Formula

Formula

$$\theta = \arccos \left( \frac{R_R}{W \cdot \frac{x + \mu_{RW} \cdot h}{b + \mu_{RW} \cdot h}} \right)$$

Example with Units

$$10^\circ = \arccos \left( \frac{5700 \text{ N}}{13000 \text{ N} \cdot \frac{1.2 \text{ m} + 0.48 \cdot 0.007919 \text{ m}}{2.7 \text{ m} + 0.48 \cdot 0.007919 \text{ m}}} \right)$$

Evaluate Formula 



## 2.10) Weight of Vehicle on Rear Wheel Formula

Formula

$$W = \frac{R_R}{\left( x + \mu_{RW} \cdot h \right) \cdot \frac{\cos(\theta)}{b + \mu_{RW} \cdot h}}$$

Evaluate Formula 

Example with Units

$$13000.0013_N = \frac{5700_N}{\left( 1.2_m + 0.48 \cdot 0.007919_m \right) \cdot \frac{\cos(10^\circ)}{2.7_m + 0.48 \cdot 0.007919_m}}$$

## 2.11) Wheel Base of Vehicle using Retardation on Rear Wheel Formula

Formula

$$b = \frac{\left( \frac{a}{|g|} + \sin(\theta) \right) \cdot \mu_{RW} \cdot h + \mu_{RW} \cdot x \cdot \cos(\theta)}{\mu_{RW} \cdot \cos(\theta) - \left( \frac{a}{|g|} + \sin(\theta) \right)}$$

Evaluate Formula 

Example with Units

$$2.7_m = \frac{\left( \frac{0.86885_{m/s^2}}{9.8066_{m/s^2}} + \sin(10^\circ) \right) \cdot 0.48 \cdot 0.007919_m + 0.48 \cdot 1.2_m \cdot \cos(10^\circ)}{0.48 \cdot \cos(10^\circ) - \left( \frac{0.86885_{m/s^2}}{9.8066_{m/s^2}} + \sin(10^\circ) \right)}$$

## 2.12) Wheel Base on Rear Wheel Formula

Formula

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

Evaluate Formula 

Example with Units





$$2.7_m = \left( 13000_N \cdot \left( 1.2_m + 0.48 \cdot 0.007919_m \right) \cdot \frac{\cos(10^\circ)}{5700_N} \right) - 0.48 \cdot 0.007919_m$$



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




- **a** Braking Retardation (Meter per Square Second)
- **b** Vehicle Wheelbase (Meter)
- **h** Height of C.G. of Vehicle (Meter)
- **R<sub>F</sub>** Normal Reaction at Front Wheel (Newton)
- **R<sub>R</sub>** Normal Reaction at Rear Wheel (Newton)
- **W** Vehicle Weight (Newton)
- **x** Horizontal Distance of C.G. from Rear Axle (Meter)
- **θ** Road Inclination Angle (Degree)
- **μ<sub>FW</sub>** Friction Coefficient on Front Wheel
- **μ<sub>RW</sub>** Friction Coefficient on Rear Wheel

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

- **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:** **Acceleration** in Meter per Square Second (m/s<sup>2</sup>)  
Acceleration Unit Conversion 
- **Measurement:** **Force** in Newton (N)  
Force Unit Conversion 
- **Measurement:** **Angle** in Degree (°)  
Angle Unit Conversion 



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