



# Rear Wheel Braking for Racing Car Formulas

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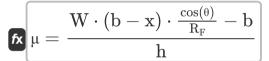


## List of 19 Rear Wheel Braking for Racing Car Formulas

## Rear Wheel Braking for Racing Car

## Effects on Front Wheel (FW)

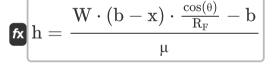
1) Friction Coefficient between Wheel and Road Surface on Front Wheel



Open Calculator

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

2) Height of C.G. from Road Surface on Front Wheel



Open Calculator 🗗

3) Horizontal Distance of C.G from Rear Axle on Front Wheel

$$\mathbf{x} = (\mathbf{b} - \mathbf{\mu} \cdot \mathbf{h}) - \mathbf{R}_{\mathrm{F}} \cdot \frac{\mathbf{b} - \mathbf{\mu} \cdot \mathbf{h}}{\mathbf{W} \cdot \cos(\theta)}$$

Open Calculator 🗗

ex

$$1.200311 \mathrm{m} = (2.7 \mathrm{m} - 0.48 \cdot 0.007919 \mathrm{m}) - 7103 \mathrm{N} \cdot rac{2.7 \mathrm{m} - 0.48 \cdot 0.007919 \mathrm{m}}{13000 \mathrm{N} \cdot \cos(10^\circ)}$$





#### 4) Normal Reaction Force at Front Wheel



Open Calculator

$$R_{\mathrm{F}} = W \cdot (b-x) \cdot rac{\cos( heta)}{b+\mu \cdot h}$$

## 5) Slope of Road on Front Wheel

$$heta = a \cos\!\left(rac{
m R_F}{
m W \cdot rac{b-x}{b+\mu \cdot h}}
ight)$$

Open Calculator

## o) weight of vehicle on Front white

$$W = rac{R_F}{(b-x) \cdot rac{\cos( heta)}{b+\mu \cdot h}}$$

Open Calculator

 $9.977162^{\circ} = a \cos \left( \frac{7103\text{N}}{13000\text{N} \cdot \frac{2.7\text{m} - 1.2\text{m}}{2.7 + 0.00007210}} \right)$ 

### 7) Wheel Base on Front Wheel

$$\mathbf{b} = rac{\mathrm{R_F} \cdot \mathbf{\mu} \cdot \mathbf{h} + \mathrm{W} \cdot \mathrm{x} \cdot \mathrm{cos}(\mathbf{ heta})}{\mathrm{W} \cdot \mathrm{cos}(\mathbf{ heta}) - \mathrm{R_F}}$$

Open Calculator





## Effects on Rear Wheel (RW)

## 8) Braking Retardation on Rear Wheel

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

Open Calculator

$$\boxed{ 0.86885 \text{m/s}^2 = [\text{g}] \cdot \left( \frac{0.48 \cdot (2.7 \text{m} - 1.2 \text{m}) \cdot \cos(10°)}{2.7 \text{m} + 0.48 \cdot 0.007919 \text{m}} - \sin(10°) \right) }$$

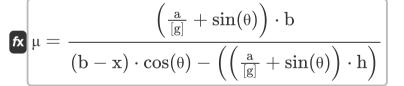
## 9) Friction Coefficient between Wheel and Road Surface on Rear Wheel

$$\mu = rac{\mathrm{R_R} \cdot \mathrm{b} - \mathrm{W} \cdot \mathrm{x} \cdot \mathrm{cos}(\theta)}{\mathrm{h} \cdot (\mathrm{W} \cdot \mathrm{cos}(\theta) - \mathrm{R_R})}$$

Open Calculator

$$\boxed{ 0.480028 = \frac{5700 \mathrm{N} \cdot 2.7 \mathrm{m} - 13000 \mathrm{N} \cdot 1.2 \mathrm{m} \cdot \cos(10°)}{0.007919 \mathrm{m} \cdot (13000 \mathrm{N} \cdot \cos(10°) - 5700 \mathrm{N})} }$$

#### 10) Friction Coefficient using Retardation on Rear Wheel



Open Calculator

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



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

 $h = rac{ ext{R}_{ ext{R}} \cdot ext{b} - ext{W} \cdot ext{x} \cdot ext{cos}( heta)}{ ext{u} \cdot ( ext{W} \cdot ext{cos}( heta) - ext{R}_{ ext{R}})}$ 

Open Calculator

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

 $\mathbf{h} = rac{rac{\mu \cdot (b-x) \cdot \cos(\theta)}{\left(rac{a}{[g]}
ight) + \sin(\theta)} - b}{\mu}$ 

Open Calculator

 $= \frac{\frac{0.48 \cdot (2.7 \mathrm{m} - 1.2 \mathrm{m}) \cdot \cos(10°)}{\left(\frac{0.86885 \mathrm{m/s}^2}{[\mathrm{g}]}\right) + \sin(10°)} - 2.7 \mathrm{m}}{0.48}$ 

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

 $\mathbf{x} = \mathrm{R_R} \cdot rac{\mathrm{b} + \mu \cdot \mathrm{h}}{\mathrm{W} \cdot \mathrm{cos}(\mathbf{ heta})} - \mu \cdot \mathrm{h}$ 

Open Calculator

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

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

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

Open Calculator 🗗

 $\boxed{1.2 \text{m} = 2.7 \text{m} - \left( \left( \frac{0.86885 \text{m/s}^2}{[\text{g}]} + \sin(10°) \right) \cdot \frac{2.7 \text{m} + 0.48 \cdot 0.007919 \text{m}}{0.48 \cdot \cos(10°)} \right) }$ 





#### 15) Normal Reaction Force at Rear Wheel

 $\mathbf{R}_{\mathrm{R}} = \mathrm{W} \cdot (\mathrm{x} + \mu \cdot \mathrm{h}) \cdot rac{\cos( heta)}{\mathrm{b} + \mu \cdot \mathrm{h}}$ 

Open Calculator 🗗

ех

 $15699.999 ext{N} = 13000 ext{N} \cdot (1.2 ext{m} + 0.48 \cdot 0.007919 ext{m}) \cdot rac{\cos(10\degree)}{2.7 ext{m} + 0.48 \cdot 0.007919 ext{m}}$ 

#### 16) Slope of Road on Rear Wheel

 $heta = a \cos \left(rac{ ext{R}_{ ext{R}}}{ ext{W} \cdot rac{ ext{x} + \mu \cdot ext{h}}{ ext{b} + \mu \cdot ext{h}}}
ight)$ 

Open Calculator

 $oxed{ex} 9.999966^\circ = a \cos igg( rac{5700 ext{N}}{13000 ext{N} \cdot rac{1.2 ext{m} + 0.48 \cdot 0.007919 ext{m}}{2.7 ext{m} + 0.48 \cdot 0.007919 ext{m}} igg)$ 

#### 17) Weight of Vehicle on Rear Wheel

 $W = rac{R_R}{(x + \mu \cdot h) \cdot rac{\cos( heta)}{b + \mu \cdot h}}$ 

Open Calculator

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



#### 18) Wheel Base of Vehicle using Retardation on Rear Wheel

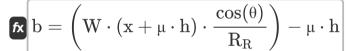
 $b = rac{\left(rac{a}{[g]} + \sin( heta)
ight) \cdot \mu \cdot h + \mu \cdot x \cdot \cos( heta)}{\mu \cdot \cos( heta) - \left(rac{a}{[g]} + \sin( heta)
ight)}$ 

Open Calculator

ex

$$2.7 \mathrm{m} = rac{\left(rac{0.86885 \mathrm{m/s^2}}{[\mathrm{g}]} + \sin(10\degree)
ight) \cdot 0.48 \cdot 0.007919 \mathrm{m} + 0.48 \cdot 1.2 \mathrm{m} \cdot \cos(10\degree)}{0.48 \cdot \cos(10\degree) - \left(rac{0.86885 \mathrm{m/s^2}}{[\mathrm{g}]} + \sin(10\degree)
ight)}$$

## 19) Wheel Base on Rear Wheel



Open Calculator 🗗

ex

$$2.7 \mathrm{m} = \left(13000 \mathrm{N} \cdot (1.2 \mathrm{m} + 0.48 \cdot 0.007919 \mathrm{m}) \cdot rac{\cos(10°)}{5700 \mathrm{N}} 
ight) - 0.48 \cdot 0.007919 \mathrm{m}$$



#### Variables Used

- a Braking Retardation BRW (Meter per Square Second)
- **b** Vehicle Wheelbase BRW (Meter)
- **h** Height of C.G. of Vehicle BRW (Meter)
- RF Normal Reaction at Front Wheel BRW (Newton)
- R<sub>R</sub> Normal Reaction at Rear Wheel BRW (Newton)
- W Vehicle Weight BRW (Newton)
- X Horizontal Distance of C.G. from Rear Axle BRW (Meter)
- θ Road Inclination Angle BRW (Degree)
- µ Friction Coefficient between Wheels and Ground BRW





#### **Constants, Functions, Measurements used**

- Constant: [g], 9.80665 Meter/Second<sup>2</sup>
   Gravitational acceleration on Earth
- Function: acos, acos(Number)

  Inverse trigonometric cosine function
- Function: cos, cos(Angle)
   Trigonometric cosine function
- Function: sin, sin(Angle)

  Trigonometric sine function
- Measurement: Length in Meter (m)
  Length Unit Conversion
- Measurement: Acceleration in Meter per Square Second (m/s²)

  Acceleration Unit Conversion
- Measurement: Force in Newton (N)
  Force Unit Conversion
- Measurement: Angle in Degree (°)

  Angle Unit Conversion





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