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All Wheel Braking for Racing Car Formulas

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List of 25 All Wheel Braking for Racing Car Formulas

All Wheel Braking for Racing Car

Effects on Front Wheel

1) Friction Coefficient between Wheel and Road Surface with Front Wheel Brake

Open Calculator

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

ex $$0.489999 = \frac{\frac{4625.314\text{N} \cdot 2.8\text{m}}{11000\text{N} \cdot \cos(5^\circ)} - 1.15\text{m}}{0.065\text{m}}$$

2) Front Wheel Reaction with All Wheel Braking

Open Calculator

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

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

3) Height of C.G. from Road Surface with Front Wheel Brake

Open Calculator

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

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

4) Horizontal Distance of C.G from Rear Axle with Front Wheel Brake

Open Calculator

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

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

5) Slope of Road from Braking with Front Wheel Reaction

Open Calculator

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

ex $$5.000027^\circ = a\cos\left(\frac{4625.314\text{N}}{11000\text{N} \cdot \frac{1.15\text{m} + 0.49 \cdot 0.065\text{m}}{2.8\text{m}}}\right)$$

6) Vehicle Weight with All Wheel Brake on Front Wheel

Open Calculator

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

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

7) Wheel Base with All Wheel Braking on Front Wheel

Open Calculator

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

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

Effects on Rear Wheel

8) Friction Coefficient between Wheel and Road Surface with Rear Wheel Brake

Open Calculator

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

ex $$0.48999 = \frac{2.8\text{m} - 1.15\text{m} - \frac{6332.83\text{N} \cdot 2.8\text{m}}{11000\text{N} \cdot \cos(5^\circ)}}{0.065\text{m}}$$

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

Open Calculator

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

ex $$0.064999\text{m} = \frac{2.8\text{m} - 1.15\text{m} - \frac{6332.83\text{N} \cdot 2.8\text{m}}{11000\text{N} \cdot \cos(5^\circ)}}{0.49}$$

10) Horizontal Distance of C.G from Rear Axle with Rear Wheel Brake

Open Calculator

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

ex $$1.149999\text{m} = 2.8\text{m} - 0.49 \cdot 0.065\text{m} - \frac{6332.83\text{N} \cdot 2.8\text{m}}{11000\text{N} \cdot \cos(5^\circ)}$$

11) Rear Wheel Reaction with All Wheel Braking

Open Calculator

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

ex $$6332.827\text{N} = 11000\text{N} \cdot (2.8\text{m} - 1.15\text{m} - 0.49 \cdot 0.065\text{m}) \cdot \frac{\cos(5^\circ)}{2.8\text{m}}$$

12) Slope of Road from Braking with Rear Wheel Reaction

Open Calculator

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

ex $$4.99974^\circ = a\cos\left(\frac{6332.83N}{11000N \cdot \frac{2.8m-1.15m-0.49\cdot 0.065m}{2.8m}}\right)$$

13) Vehicle Weight with All Wheel Brake on Rear Wheel

Open Calculator

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

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

14) Wheel Base with All Wheel Braking on Rear Wheel

Open Calculator

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

ex $$2.800002m = \frac{11000N \cdot \cos(5^\circ) \cdot (1.15m + 0.49 \cdot 0.065m)}{11000N \cdot \cos(5^\circ) - 6332.83N}$$

Vehicle Braking Dynamics

15) All Wheel Braking Retardation

Open Calculator

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

$$3.932267\text{m/s}^2 = [g] \cdot (0.49 \cdot \cos(5^\circ) - \sin(5^\circ))$$

16) Braking Force on Brake Drum on Level Road

Open Calculator

$$F = \frac{W}{g} \cdot f$$

$$7801.02\text{N} = \frac{11000\text{N}}{9.8\text{m/s}^2} \cdot 6.95\text{m/s}^2$$

17) Braking Torque of Disc Brake

Open Calculator

$$T_s = 2 \cdot p \cdot a_p \cdot \mu_p \cdot R_m \cdot n$$

$$0.054672\text{N*m} = 2 \cdot 8\text{N/m}^2 \cdot 0.02\text{m}^2 \cdot 0.34 \cdot 0.25\text{m} \cdot 2.01$$

18) Braking Torque of Leading Shoe

Open Calculator

$$T_l = \frac{W_l \cdot m \cdot \mu f \cdot k}{n_t + (\mu f \cdot k)}$$

$$1.243601\text{N*m} = \frac{105\text{N} \cdot 0.26\text{m} \cdot 0.35 \cdot 0.3\text{m}}{2.2\text{m} + (0.35 \cdot 0.3\text{m})}$$

19) Braking Torque of Trailing Shoe

Open Calculator

$$T_t = \frac{W_t \cdot n_t \cdot \mu_0 \cdot k}{n_t - \mu_0 \cdot k}$$

$$4.428705\text{N*m} = \frac{80\text{N} \cdot 2.2\text{m} \cdot 0.18 \cdot 0.3\text{m}}{2.2\text{m} - 0.18 \cdot 0.3\text{m}}$$

20) Friction Coefficient between Wheel and Road Surface with Retardation

Open Calculator

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

$$0.489768 = \frac{\frac{3.93\text{m/s}^2}{[g]} + \sin(5^\circ)}{\cos(5^\circ)}$$

21) Gradient Descend Brake Drum Force

Open Calculator

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

$$7802.94\text{N} = \frac{11000\text{N}}{9.8\text{m/s}^2} \cdot 6.95\text{m/s}^2 + 11000\text{N} \cdot \sin(0.01^\circ)$$

22) Ground Speed of Track Laying Vehicle

Open Calculator

fx $$V_g = \frac{E_{rpm} \cdot C}{16660 \cdot R_g}$$

ex $$0.026287\text{m/s} = \frac{5100\text{rev/min} \cdot 8.2\text{m}}{16660 \cdot 10}$$

23) Mean Lining Pressure of Brake Lining

Open Calculator

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

ex $$2143.174\text{N/m}^2 = \left(\frac{180}{8 \cdot \pi}\right) \cdot \frac{7800\text{N} \cdot 0.1\text{m}}{0.35 \cdot (5.01\text{m})^2 \cdot 0.68\text{m} \cdot 25^\circ}$$

24) Normal Force at Brake Shoe Contact Point

Open Calculator

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

ex $$638.4387\text{N} = \frac{7800\text{N} \cdot 0.1\text{m}}{8 \cdot 0.35 \cdot 25^\circ}$$

25) Wheel Heat Generation Rate

Open Calculator

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

ex $$87750\text{J/s} = \frac{7800\text{N} \cdot 45\text{m/s}}{4}$$

Variables Used

- **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)*
- E_{rpm} 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_g Overall Gear Reduction
- R_m Mean Radius of Caliper Unit to Disc Axis *(Meter)*
- R_R Normal Reaction at Rear Wheel *(Newton)*

- T_l Leading Shoe Braking Torque *(Newton Meter)*
- T_s Disc Brake Braking Torque *(Newton Meter)*
- T_t Trailing Shoe Braking Torque *(Newton Meter)*
- **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_l 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
- μ_0 Friction Coefficient for Smooth Road
- μ_p Friction Coefficient of Pad Material
- **μf** Friction Coefficient between Drum and Shoe

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Function: **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.
- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **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
- Measurement: **Torque** in Newton Meter (N*m)
  Torque Unit Conversion

Check other formula lists

- **All Wheel Braking for Racing Car Formulas**
- **Front Wheel Braking for Racing Cars Formulas**
- **Rear Wheel Braking for Racing Car Formulas**

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