# Important Angular Velocity Formulas PDF

Formulas
Examples
with Units

**List of 11**
**Important Angular Velocity Formulas**

## 1) Angular Velocity of Driven Wheel given Longitudinal Slip Velocity, Velocity of Free Rolling Wheel Formula

Evaluate Formula

Formula

$$\Omega = s_{ltd} + \Omega_0$$

Example with Units

$$58.5\,\text{rad/s} = 9\,\text{rad/s} + 49.5\,\text{rad/s}$$

## 2) Angular Velocity of Driven Wheel given Slip Ratio and Angular Velocity of Free Rolling Wheel Formula

Evaluate Formula

Formula

$$\Omega = \left(SR + 1\right) \cdot \Omega_0$$

Example with Units

$$58.41\,\text{rad/s} = \left(0.18 + 1\right) \cdot 49.5\,\text{rad/s}$$

## 3) Angular Velocity of Free Rolling Wheel given Longitudinal Slip Velocity, Velocity of Driven Wheel Formula

Evaluate Formula

Formula

$$\Omega_0 = \Omega - s_{ltd}$$

Example with Units

$$49.5\,\text{rad/s} = 58.5\,\text{rad/s} - 9\,\text{rad/s}$$

## 4) Angular Velocity of Free Rolling Wheel given Slip Ratio and Angular Velocity of Driven Wheel Formula

Evaluate Formula

Formula

$$\Omega_0 = \frac{\Omega}{SR + 1}$$

Example with Units

$$49.5763\,\text{rad/s} = \frac{58.5\,\text{rad/s}}{0.18 + 1}$$

## 5) Curb Force for Driven Wheel Formula

Evaluate Formula

Formula

$$F = \frac{G \cdot s}{r_d - h}$$

Example with Units

$$4426.8293\,\text{N} = \frac{5000\,\text{N} \cdot 0.363\,\text{m}}{0.55\,\text{m} - 0.14\,\text{m}}$$

## 6) Maximum Permissible Speed on Transitioned Curves Formula

Evaluate Formula

Formula

$$V_{max} = 0.347 \cdot \sqrt{\left( C_a + C_d \right) \cdot R_{curvature}}$$

Example with Units

$$0.7167\,\text{m/s} = 0.347 \cdot \sqrt{\left( 130\,\text{mm} + 150\,\text{mm} \right) \cdot 15235\,\text{mm}}$$

## 7) Mechanical Advantage of Wheel and Axle Formula

Evaluate Formula

Formula

$$MA = \frac{r_d}{R_a}$$

Example with Units

$$5.641 = \frac{0.55\,\text{m}}{0.0975\,\text{m}}$$

## 8) Normal Load on Wheels due to Gradient Formula

Evaluate Formula

Formula

$$F_N = M_v \cdot g \cdot \cos\left( \alpha \right)$$

Example with Units

$$76365.7405\,\text{N} = 9000\,\text{N} \cdot 9.8\,\text{m/s}^2 \cdot \cos\left( 0.524\,\text{rad} \right)$$

## 9) Variation of Rolling Resistance Coefficient at Varying Speed Formula

Evaluate Formula

Formula

$$f_r = 0.01 \cdot \left( 1 + \frac{V}{100} \right)$$

Example with Units

$$0.0145 = 0.01 \cdot \left( 1 + \frac{45\,\text{m/s}}{100} \right)$$

## 10) Wheel Flop Formula

Evaluate Formula

Formula

$$f = T_m \cdot \sin\left( \theta \right) \cdot \cos\left( \theta \right)$$

Example with Units

$$4.3301\,\text{mm} = 10\,\text{mm} \cdot \sin\left( 30° \right) \cdot \cos\left( 30° \right)$$

## 11) Wheel Force Formula

Evaluate Formula

Formula

$$F_w = 2 \cdot T \cdot \frac{\eta_t}{D_{wheel}} \cdot \frac{N}{n_{w\_rpm}}$$

Example with Units

$$6353.4398\,\text{N} = 2 \cdot 140\,\text{N*m} \cdot \frac{0.83}{.350\,\text{m}} \cdot \frac{500}{499\,\text{rev/min}}$$

## Variables used in list of Angular Velocity Formulas above

- $C_a$ Cant *(Millimeter)*
- $C_d$ Cant Deficiency *(Millimeter)*
- $D_{wheel}$ Diameter of Wheel *(Meter)*
- **f** Wheel Flop Factor *(Millimeter)*
- **F** Curb Force for Driven Wheel *(Newton)*
- $F_N$ Normal Load on Wheels due to Gradient *(Newton)*
- $f_r$ Rolling Resistance Coefficient
- $F_w$ Wheel Force *(Newton)*
- **g** Acceleration due to Gravity *(Meter per Square Second)*
- **G** Weight on Single Wheel *(Newton)*
- **h** Height of Curb *(Meter)*
- $M_v$ Vehicle Weight in Newtons *(Newton)*
- **MA** Mechanical Advantage of Wheel and Axle
- **N** Engine Speed in RPM
- $n_{w\_rpm}$ Wheel Speed *(Revolution per Minute)*
- $R_a$ Radius of Axle *(Meter)*
- $R_{curvature}$ Radius of Curvature *(Millimeter)*
- $r_d$ Effective Radius of Wheel *(Meter)*
- **s** Contact Point Distance from Wheel Center Axis *(Meter)*
- $s_{ltd}$ Longitudinal Slip Angular Velocity *(Radian per Second)*
- **SR** Slip Ratio
- **T** Engine Torque *(Newton Meter)*
- $T_m$ Trail *(Millimeter)*
- **V** Vehicle Speed *(Meter per Second)*
- $V_{max}$ Maximum Velocity *(Meter per Second)*
- **α** Angle of Inclination of Ground from Horizontal *(Radian)*
- $\eta_t$ Transmission Efficiency of Vehicle
- **θ** Head Angle *(Degree)*

## Constants, Functions, Measurements used in list of Angular Velocity Formulas above

- 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.*
- 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.*
- Measurement: **Length** in Meter (m), Millimeter (mm)
  *Length 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: **Force** in Newton (N)
  *Force Unit Conversion*
- Measurement: **Angle** in Radian (rad), Degree (°)
  *Angle Unit Conversion*
- Measurement: **Angular Velocity** in Radian per Second (rad/s), Revolution per Minute (rev/min)
  *Angular Velocity Unit Conversion*
- Measurement: **Torque** in Newton Meter (N*m)
  *Torque Unit Conversion*

- $\Omega$ Angular Velocity of Driven or Braked Wheel *(Radian per Second)*
- $\Omega_0$ Angular Velocity of Free Rolling Wheel *(Radian per Second)*

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