# Important Gear Trains Formulas PDF

Formulas
Examples
with Units

**List of 13**
**Important Gear Trains Formulas**

## 1) Braking or Holding Torque on Fixed Member given Input Torque Formula

Evaluate Formula

Formula

$$T = T_1 \cdot \left( \frac{\omega_1}{\omega_2} - 1 \right)$$

Example with Units

$$-2.8333\,\text{N*m} = 17\,\text{N*m} \cdot \left( \frac{95.492966\,\text{rev/min}}{114.591559\,\text{rev/min}} - 1 \right)$$

## 2) Holding or Braking or Fixing Torque on Fixed Member Formula

Evaluate Formula

Formula

$$T = T_1 \cdot \left( \frac{N_1}{N_2} - 1 \right)$$

Example with Units

$$196.6283\,\text{N*m} = 17\,\text{N*m} \cdot \left( \frac{1400\,\text{rev/min}}{700\,\text{rev/min}} - 1 \right)$$

## 3) Holding or Braking or Fixing Torque on Fixed Member given Input and Output Torque Formula

Evaluate Formula

Formula

$$T = -\left( T_1 + T_2 \right)$$

Example with Units

$$-35\,\text{N*m} = -\left( 17\,\text{N*m} + 18\,\text{N*m} \right)$$

## 4) Output Torque on Driven Member given Angular Speed of Driven and Driver Formula

Evaluate Formula

Formula

$$T_2 = T_1 \cdot \frac{N_1}{N_2}$$

Example with Units

$$213.6283\,\text{N*m} = 17\,\text{N*m} \cdot \frac{1400\,\text{rev/min}}{700\,\text{rev/min}}$$

## 5) Output Torque or Resisting or Load Torque on Driven Member Formula

Evaluate Formula

Formula

$$T_2 = -T_1 \cdot \frac{\omega_1}{\omega_2}$$

Example with Units

$$-14.1667\,\text{N*m} = -17\,\text{N*m} \cdot \frac{95.492966\,\text{rev/min}}{114.591559\,\text{rev/min}}$$

## 6) Speed Ratio of Compound Gear Train Formula

Evaluate Formula

Formula

$$i = \frac{P_d}{P'_d}$$

Example

$$0.5926 = \frac{16}{27}$$

## 7) Train Value given Number of Teeth Formula

Evaluate Formula

Formula

$$T_v = \frac{T_{dr}}{T_d}$$

Example

$$1.2821 = \frac{20}{15.6}$$

## 8) Train Value given Speed of Follower and Driver Formula

Evaluate Formula

Formula

$$T_v = \frac{N_f}{N_d}$$

Example with Units

$$0.8125 = \frac{26\,\text{rev/min}}{32\,\text{rev/min}}$$

## 9) Train Value of Compound Gear Train given product of Teeth on Driven and Driver Gear Formula

Evaluate Formula

Formula

$$T_v = \frac{P'_d}{P_d}$$

Example

$$1.6875 = \frac{27}{16}$$

## 10) Train Value of Compound Gear Train given Speed of Driven and Driver Gear Formula

Evaluate Formula

Formula

$$T_v = \frac{N_n}{N_{d'}}$$

Example with Units

$$0.7857 = \frac{22\,\text{rev/min}}{28\,\text{rev/min}}$$

## 11) Velocity Ratio Formula

Evaluate Formula

Formula

$$i = \frac{T_d}{T_{dr}}$$

Example

$$0.78 = \frac{15.6}{20}$$

## 12) Velocity Ratio of Compound Belt Drive Formula

Evaluate Formula

Formula

$$i = \frac{N_n}{N_{d'}}$$

Example with Units

$$0.7857 = \frac{22\,\text{rev/min}}{28\,\text{rev/min}}$$

## 13) Velocity Ratio of Compound Belt Drive given Product of Diameter of Driven Formula

Evaluate Formula

Formula

$$i = \frac{P_1}{P_2}$$

Example

$$0.78 = \frac{46.8}{60}$$

## Variables used in list of Gear Trains Formulas above

- **i** Velocity Ratio
- $N_1$ Angular Speed of Driving Member in RPM *(Revolution per Minute)*
- $N_2$ Angular Speed of Driven Member in RPM *(Revolution per Minute)*
- $N_d$ Speed of Driver *(Revolution per Minute)*
- $N_{d'}$ Speed of First Driver *(Revolution per Minute)*
- $N_f$ Speed of Follower *(Revolution per Minute)*
- $N_n$ Speed of Last Driven Pulley *(Revolution per Minute)*
- $P_1$ Product of Diameters of Drivers
- $P_2$ Product of Diameters of Drivens
- $P_d$ Product of Number of Teeth on Driven
- $P'_d$ Product of Number of Teeth on Drivers
- **T** Total Torque *(Newton Meter)*
- $T_1$ Input Torque on Driving Member *(Newton Meter)*
- $T_2$ Output Torque or Load Torque on Driven Member *(Newton Meter)*
- $T_d$ Number of Teeth on Driven
- $T_{dr}$ Number of Teeth on Driver
- $T_v$ Train Value
- $\omega_1$ Angular Speed of Driving Member *(Revolution per Minute)*
- $\omega_2$ Angular Speed of Driven Member *(Revolution per Minute)*

## Constants, Functions, Measurements used in list of Gear Trains Formulas above

- Measurement: **Frequency** in Revolution per Minute (rev/min)
  *Frequency 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*

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