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Dynamometer Formulas

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List of 19 Dynamometer Formulas

Dynamometer

1) Constant for Particular Shaft for Torsion Dynamometer

$$fx \quad k = \frac{G \cdot J}{L_{\text{shaft}}}$$

Open Calculator 

$$ex \quad 1095.238 = \frac{40\text{N/m}^2 \cdot 11.5\text{m}^4}{0.42\text{m}}$$

2) Distance Moved in One Revolution by Rope Brake Dynamometer

$$fx \quad d = \pi \cdot (D_{\text{wheel}} + d_{\text{rope}})$$

Open Calculator 

$$ex \quad 5.340708\text{m} = \pi \cdot (1.6\text{m} + 0.1\text{m})$$

3) Load on Brake for Rope Brake Dynamometer

$$fx \quad W = W_{\text{dead}} - S$$

Open Calculator 

$$ex \quad 7\text{N} = 9\text{N} - 2\text{N}$$



4) Tangential Effort for Epicyclic-Train Dynamometer

$$fx \quad P_t = \frac{W_{\text{end}} \cdot L_{\text{horizontal}}}{2 \cdot a_{\text{gear}}}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad 10.59615\text{N} = \frac{19\text{N} \cdot 1.45\text{m}}{2 \cdot 1.3\text{m}}$$

5) Tension in Slack Side of Belt for Belt Transmission Dynamometer

$$fx \quad T_2 = T_1 - \frac{W_{\text{end}} \cdot L_{\text{horizontal}}}{2 \cdot a_{\text{pulley}}}$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$ex \quad 6.694444\text{N} = 22\text{N} - \frac{19\text{N} \cdot 1.45\text{m}}{2 \cdot 0.9\text{m}}$$

6) Tension in Tight Side of Belt for Belt Transmission Dynamometer

$$fx \quad T_1 = T_2 + \frac{W_{\text{end}} \cdot L_{\text{horizontal}}}{2 \cdot a_{\text{pulley}}}$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f_img.jpg\)](#)

$$ex \quad 26.30556\text{N} = 11\text{N} + \frac{19\text{N} \cdot 1.45\text{m}}{2 \cdot 0.9\text{m}}$$

7) Torsion Equation for Torsion Dynamometer

$$fx \quad T = k \cdot \theta$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754_img.jpg\)](#)

$$ex \quad 17.04\text{N} \cdot \text{m} = 12 \cdot 1.42\text{rad}$$



8) Torsion Equation for Torsion Dynamometer using Modulus of Rigidity



$$\text{fx } T = \frac{G \cdot \theta \cdot J}{L_{\text{shaft}}}$$

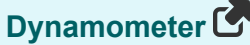
[Open Calculator](#)

$$\text{ex } 1555.238\text{N}\cdot\text{m} = \frac{40\text{N}/\text{m}^2 \cdot 1.42\text{rad} \cdot 11.5\text{m}^4}{0.42\text{m}}$$

Polar Moment of Inertia



9) Polar Moment of Inertia of Shaft for Hollow Shaft for Torsion Dynamometer

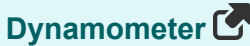


$$\text{fx } J = \frac{\pi}{32} \cdot (d_o^4 - d_i^4)$$

[Open Calculator](#)

$$\text{ex } 0.035619\text{m}^4 = \frac{\pi}{32} \cdot ((0.81\text{m})^4 - (0.51\text{m})^4)$$

10) Polar Moment of Inertia of Shaft for Solid Shaft for Torsion Dynamometer



$$\text{fx } J = \frac{\pi}{32} \cdot D_{\text{shaft}}^4$$

[Open Calculator](#)

$$\text{ex } 0.006136\text{m}^4 = \frac{\pi}{32} \cdot (0.5\text{m})^4$$



11) Polar Moment of Inertia of Shaft for Torsion Dynamometer

$$\text{fx } J = \frac{T \cdot L_{\text{shaft}}}{G \cdot \theta}$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$\text{ex } 0.096127\text{m}^4 = \frac{13\text{N}^*\text{m} \cdot 0.42\text{m}}{40\text{N}/\text{m}^2 \cdot 1.42\text{rad}}$$

Power Transmitted

12) Power Transmitted by Torsion Dynamometer

$$\text{fx } P = \frac{2 \cdot \pi \cdot N \cdot T}{60}$$

[Open Calculator !\[\]\(8bba887393ca45b761e5cb49e755e762_img.jpg\)](#)

$$\text{ex } 680.6784\text{W} = \frac{2 \cdot \pi \cdot 500 \cdot 13\text{N}^*\text{m}}{60}$$

13) Power Transmitted for Epicyclic-Train Dynamometer

$$\text{fx } P = \frac{2 \cdot \pi \cdot N \cdot T}{60}$$

[Open Calculator !\[\]\(0fb13ad0bfa3d86868cdd3883e5665b3_img.jpg\)](#)

$$\text{ex } 680.6784\text{W} = \frac{2 \cdot \pi \cdot 500 \cdot 13\text{N}^*\text{m}}{60}$$



14) Power Transmitted for Epicyclic-Train Dynamometer using Tangential Effort

$$fx \quad P = \frac{2 \cdot \pi \cdot N \cdot P_t \cdot r_p}{60}$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$ex \quad 131.9469W = \frac{2 \cdot \pi \cdot 500 \cdot 7N \cdot 0.36m}{60}$$

Torque Transmitted

15) Torque Acting on Shaft for Torsion Dynamometer

$$fx \quad T = \frac{G \cdot \theta \cdot J}{L_{shaft}}$$

[Open Calculator !\[\]\(73002692dd5e7a64e60946be3158e719_img.jpg\)](#)

$$ex \quad 1555.238N*m = \frac{40N/m^2 \cdot 1.42rad \cdot 11.5m^4}{0.42m}$$

16) Torque on Shaft of Prony Brake Dynamometer

$$fx \quad T = W_{end} \cdot L_{horizontal}$$

[Open Calculator !\[\]\(104fbf564e2e5a8fbd84f31656d114c7_img.jpg\)](#)

$$ex \quad 27.55N*m = 19N \cdot 1.45m$$

17) Torque on Shaft of Prony Brake Dynamometer using Radius of Pulley

$$fx \quad T = F \cdot R$$

[Open Calculator !\[\]\(21226b58c700e5231ab98d27101bac58_img.jpg\)](#)

$$ex \quad 32N*m = 8N \cdot 4m$$



18) Torque Transmitted for Epicyclic Train Dynamometer

$$fx \quad T = P_t \cdot r_p$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)

$$ex \quad 2.52N \cdot m = 7N \cdot 0.36m$$

19) Torque Transmitted if Power is known for Epicyclic-Train Dynamometer

$$fx \quad T = \frac{60 \cdot P}{2 \cdot \pi \cdot N}$$

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5_img.jpg\)](#)

$$ex \quad 17.18873N \cdot m = \frac{60 \cdot 900W}{2 \cdot \pi \cdot 500}$$



Variables Used








- **a_{gear}** Distance between Center of Gear and Pinion (Meter)
- **a_{pulley}** Distance between Loose Pulleys and T-Frame (Meter)
- **d** Distance Moved (Meter)
- **d_i** Shaft Inner Diameter (Meter)
- **d_o** Shaft Outer Diameter (Meter)
- **d_{rope}** Diameter of Rope (Meter)
- **D_{shaft}** Shaft Diameter (Meter)
- **D_{wheel}** Diameter of Wheel (Meter)
- **F** Frictional Resistance between Block and Pulley (Newton)
- **G** Modulus of Rigidity (Newton per Square Meter)
- **J** Polar Moment of Inertia of Shaft (Meter⁴)
- **k** Constant for a Particular Shaft
- **$L_{\text{horizontal}}$** Distance between Weight and Center of Pulley (Meter)
- **L_{shaft}** Shaft Length (Meter)
- **N** Speed of Shaft in RPM
- **P** Power (Watt)
- **P_t** Tangential Effort (Newton)
- **R** Radius of Pulley (Meter)
- **r_p** Pitch Circle Radius (Meter)
- **S** Spring Balance Reading (Newton)
- **T** Total Torque (Newton Meter)
- **T_1** Tension in Tight Side of Belt (Newton)



- **T_2** Tension in Slack Side of Belt (Newton)
- **W** Load Applied (Newton)
- **W_{dead}** Dead Load (Newton)
- **W_{end}** Weight at Outer End of Lever (Newton)
- **θ** Angle of Twist (Radian)



Constants, Functions, Measurements used

- **Constant:** **pi**, 3.14159265358979323846264338327950288
Archimedes' constant
- **Measurement:** **Length** in Meter (m)
Length Unit Conversion 
- **Measurement:** **Pressure** in Newton per Square Meter (N/m²)
Pressure Unit Conversion 
- **Measurement:** **Power** in Watt (W)
Power Unit Conversion 
- **Measurement:** **Force** in Newton (N)
Force Unit Conversion 
- **Measurement:** **Angle** in Radian (rad)
Angle Unit Conversion 
- **Measurement:** **Torque** in Newton Meter (N*m)
Torque Unit Conversion 
- **Measurement:** **Second Moment of Area** in Meter⁴ (m⁴)
Second Moment of Area Unit Conversion 



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