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Torsion Equation of Circular Shafts Formulas

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List of 17 Torsion Equation of Circular Shafts Formulas

Torsion Equation of Circular Shafts

1) Angle of Twist with known Shear Strain at Outer Surface of Shaft

$$\text{fx } \theta_{\text{Circularshafts}} = \frac{\eta \cdot L_{\text{shaft}}}{R}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$\text{ex } 72.86364\text{rad} = \frac{1.75 \cdot 4.58\text{m}}{110\text{mm}}$$

2) Angle of Twist with known Shear Stress in Shaft

$$\text{fx } \theta_{\text{Torsion}} = \frac{\tau \cdot L_{\text{shaft}}}{R \cdot G_{\text{Torsion}}}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$\text{ex } 0.187364\text{rad} = \frac{180\text{MPa} \cdot 4.58\text{m}}{110\text{mm} \cdot 40\text{GPa}}$$

3) Angle of Twist with known Shear Stress induced at Radius r from Center of Shaft

$$\text{fx } \theta_{\text{Torsion}} = \frac{L_{\text{shaft}} \cdot \tau}{R \cdot G_{\text{Torsion}}}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$\text{ex } 0.187364\text{rad} = \frac{4.58\text{m} \cdot 180\text{MPa}}{110\text{mm} \cdot 40\text{GPa}}$$



4) Length of Shaft with known Shear Strain at Outer Surface of Shaft

$$\text{fx } L_{\text{shaft}} = \frac{R \cdot \theta_{\text{Circularshafts}}}{\eta}$$

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

$$\text{ex } 4.525714\text{m} = \frac{110\text{mm} \cdot 72\text{rad}}{1.75}$$

5) Length of Shaft with known Shear Stress induced at Radius r from Center of Shaft

$$\text{fx } L_{\text{shaft}} = \frac{R \cdot G_{\text{Torsion}} \cdot \theta_{\text{Torsion}}}{\tau}$$

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

$$\text{ex } 4.571111\text{m} = \frac{110\text{mm} \cdot 40\text{GPa} \cdot 0.187\text{rad}}{180\text{MPa}}$$

6) Length of Shaft with known Shear Stress induced at Surface of Shaft

$$\text{fx } L_{\text{shaft}} = \frac{R \cdot G_{\text{Torsion}} \cdot \theta_{\text{Torsion}}}{\tau}$$

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

$$\text{ex } 4.571111\text{m} = \frac{110\text{mm} \cdot 40\text{GPa} \cdot 0.187\text{rad}}{180\text{MPa}}$$



7) Modulus of Rigidity of material of Shaft using Shear Stress-induced at Surface of Shaft

$$\text{fx } G_{\text{Torsion}} = \frac{\tau \cdot L_{\text{shaft}}}{R \cdot \theta_{\text{Torsion}}}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$\text{ex } 40.07778\text{GPa} = \frac{180\text{MPa} \cdot 4.58\text{m}}{110\text{mm} \cdot 0.187\text{rad}}$$

8) Modulus of Rigidity of Shaft if Shear Stress-induced at Radius 'r' from Center of Shaft

$$\text{fx } G_{\text{Torsion}} = \frac{L_{\text{shaft}} \cdot \tau}{R \cdot \theta_{\text{Torsion}}}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$\text{ex } 40.07778\text{GPa} = \frac{4.58\text{m} \cdot 180\text{MPa}}{110\text{mm} \cdot 0.187\text{rad}}$$

9) Radius of Shaft if Shear Stress induced at Radius r from Center of Shaft

$$\text{fx } R = \frac{r \cdot \tau}{T_r}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$\text{ex } 109.8\text{mm} = \frac{0.122\text{m} \cdot 180\text{MPa}}{200\text{MPa}}$$



10) Radius of Shaft using Shear Strain at Outer Surface of Shaft

$$\text{fx } R = \frac{\eta \cdot L_{\text{shaft}}}{\theta_{\text{Circularshafts}}}$$

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

$$\text{ex } 111.3194\text{mm} = \frac{1.75 \cdot 4.58\text{m}}{72\text{rad}}$$

11) Radius of Shaft using Shear Stress induced at Surface of Shaft

$$\text{fx } R = \frac{\tau \cdot L_{\text{shaft}}}{G_{\text{Torsion}} \cdot \theta_{\text{Torsion}}}$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$\text{ex } 110.2139\text{mm} = \frac{180\text{MPa} \cdot 4.58\text{m}}{40\text{GPa} \cdot 0.187\text{rad}}$$

12) Shear Strain at Outer Surface of Circular Shaft

$$\text{fx } \eta = \frac{R \cdot \theta_{\text{Circularshafts}}}{L_{\text{shaft}}}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$\text{ex } 1.729258 = \frac{110\text{mm} \cdot 72\text{rad}}{4.58\text{m}}$$

13) Shear Stress at Surface of Shaft using Shear Stress-induced at Radius 'r' from Center of Shaft

$$\text{fx } T_r = \frac{\tau \cdot r}{R}$$

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

$$\text{ex } 199.6364\text{MPa} = \frac{180\text{MPa} \cdot 0.122\text{m}}{110\text{mm}}$$



14) Shear Stress induced at Radius 'r' from Center of Shaft

$$\text{fx } \tau = \frac{T_r \cdot r}{R}$$

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

$$\text{ex } 221.8182\text{MPa} = \frac{200\text{MPa} \cdot 0.122\text{m}}{110\text{mm}}$$

15) Shear Stress induced at Radius 'r' from Center of Shaft using Modulus of Rigidity

$$\text{fx } T_r = \frac{r \cdot G_{\text{Torsion}} \cdot \theta_{\text{Circularshafts}}}{\tau}$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$\text{ex } 0.001952\text{MPa} = \frac{0.122\text{m} \cdot 40\text{GPa} \cdot 72\text{rad}}{180\text{MPa}}$$

16) Shear Stress induced at Surface of Shaft

$$\text{fx } \tau = \frac{R \cdot G_{\text{Torsion}} \cdot \theta_{\text{Torsion}}}{L_{\text{shaft}}}$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$\text{ex } 179.6507\text{MPa} = \frac{110\text{mm} \cdot 40\text{GPa} \cdot 0.187\text{rad}}{4.58\text{m}}$$



17) Value of Radius r using Shear Stress induced at Radius r from Center of Shaft

$$\text{fx } r = \frac{T_r \cdot R}{\tau}$$

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

$$\text{ex } 0.122222\text{m} = \frac{200\text{MPa} \cdot 110\text{mm}}{180\text{MPa}}$$



Variables Used

- G_{Torsion} Modulus of Rigidity (Gigapascal)
- L_{shaft} Length of Shaft (Meter)
- r Radius from Center to Distance r (Meter)
- R Radius of Shaft (Millimeter)
- T_r Shear Stress at Radius r (Megapascal)
- $\theta_{\text{Circularshafts}}$ Angle of Twist for Circular Shafts (Radian)
- θ_{Torsion} Angle of Twist SOM (Radian)
- T Shear Stress in Shaft (Megapascal)
- η Shear Strain



Constants, Functions, Measurements used

- **Measurement: Length** in Meter (m), Millimeter (mm)
Length Unit Conversion 
- **Measurement: Pressure** in Gigapascal (GPa)
Pressure Unit Conversion 
- **Measurement: Angle** in Radian (rad)
Angle Unit Conversion 
- **Measurement: Stress** in Megapascal (MPa)
Stress Unit Conversion 



Check other formula lists

- [Torsion Equation of Circular Shafts Formulas](#) 
- [Torsional Rigidity and Polar Modulus Formulas](#) 

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