



Torque Exerted on a Wheel with Radial Curved Vanes Formulas

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List of 50 Torque Exerted on a Wheel with Radial Curved Vanes Formulas

Torque Exerted on a Wheel with Radial Curved Vanes ☑

1) Angular Momentum at Inlet

$$\mathbf{f}$$
 $\mathbf{L} = \left(rac{\mathbf{w}_{\mathrm{f}}\cdot\mathbf{v}_{\mathrm{f}}}{\mathbf{G}}
ight)\cdot\mathbf{r}$

Open Calculator 🗗

ex
$$148.32 \text{kg*m}^2/\text{s} = \left(\frac{12.36 \text{N} \cdot 40 \text{m/s}}{10}\right) \cdot 3 \text{m}$$

2) Angular Momentum at Outlet 🛂

$$\mathbf{L} = \left(rac{\mathbf{w_f} \cdot \mathbf{v}}{\mathbf{G}}
ight) \cdot \mathbf{r}$$

Open Calculator 🗗

$$ext{ex} \ 35.93052 ext{kg*m}^2/ ext{s} = \left(rac{12.36 ext{N} \cdot 9.69 ext{m/s}}{10}
ight) \cdot 3 ext{m}$$

3) Angular Velocity for Work Done on Wheel per Second

$$\omega = rac{\mathbf{w} \cdot \mathbf{G}}{\mathbf{w}_{\mathrm{f}} \cdot (\mathbf{v}_{\mathrm{f}} \cdot \mathbf{r} + \mathbf{v} \cdot \mathbf{r}_{\mathrm{O}})}$$

Open Calculator





4) Efficiency of System

 $\eta = \left(1 - \left(rac{\mathrm{v}}{\mathrm{v_f}}
ight)^2
ight)$

Open Calculator 🖸

 $\boxed{0.941315 = \left(1 - \left(\frac{9.69 \mathrm{m/s}}{40 \mathrm{m/s}}\right)^2\right)}$

5) Initial Velocity for Work Done if Jet leaves in Motion of Wheel

 $\mathbf{x} = rac{\left(rac{\mathrm{P}_{\mathrm{dc}}\cdot\mathrm{G}}{\mathrm{w}_{\mathrm{f}}}
ight) + \left(\mathrm{v}\cdot\mathrm{v}_{\mathrm{f}}
ight)}{\mathrm{v}_{\mathrm{f}}}$

Open Calculator 🗗

ex $54.37042 \mathrm{m/s} = rac{\left(rac{2209 \mathrm{W} \cdot 10}{12.36 \mathrm{N}}
ight) + \left(9.69 \mathrm{m/s} \cdot 40 \mathrm{m/s}
ight)}{40 \mathrm{m/s}}$

6) Initial Velocity given Power Delivered to Wheel

 $\mathbf{x} \mathbf{u} = \left(\left(rac{\mathrm{P}_{\mathrm{dc}} \cdot \mathrm{G}}{\mathrm{w}_{\mathrm{f}} \cdot \mathrm{v}_{\mathrm{f}}}
ight) - (\mathrm{v})
ight)$

Open Calculator



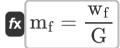
7) Initial Velocity when Work Done at Vane Angle is 90 and Velocity is Zero

 $\mathbf{f}\mathbf{x} \mathbf{u} = rac{\mathbf{w} \cdot \mathbf{G}}{\mathbf{w}_{\mathrm{f}} \cdot \mathbf{v}_{\mathrm{f}}}$

Open Calculator 🚰

 $ext{ex} 78.8835 ext{m/s} = rac{3.9 ext{KJ} \cdot 10}{12.36 ext{N} \cdot 40 ext{m/s}}$

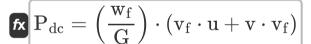
8) Mass of Fluid Striking Vane per Second



Open Calculator

ex $1.236 \text{kg} = \frac{12.36 \text{N}}{10}$

9) Power Delivered to Wheel



Open Calculator 🗗

 $ext{ex} \ 2209.474 ext{W} = \left(rac{12.36 ext{N}}{10}
ight) \cdot (40 ext{m/s} \cdot 35 ext{m/s} + 9.69 ext{m/s} \cdot 40 ext{m/s})$

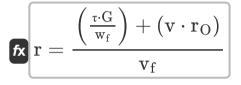


10) Radius at Inlet for Work Done on Wheel per Second 🖸

 $\mathbf{x} = rac{\left(rac{\mathbf{w} \cdot \mathbf{G}}{\mathbf{w}_{\mathrm{f}} \cdot \mathbf{\omega}}
ight) - \left(\mathbf{v} \cdot \mathbf{r}_{\mathrm{O}}
ight)}{\mathbf{v}_{\mathrm{f}}}$

Open Calculator

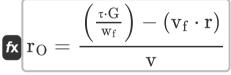
11) Radius at Inlet with Known Torque by Fluid



Open Calculator

ex $8.813149 \mathrm{m} = rac{\left(rac{292 \mathrm{N^*m \cdot 10}}{12.36 \mathrm{N}}
ight) + (9.69 \mathrm{m/s \cdot 12 m})}{40 \mathrm{m/s}}$

12) Radius at Outlet for Torque Exerted by Fluid



Open Calculator

ex $11.99649 \mathrm{m} = rac{\left(rac{292 \mathrm{N^*m \cdot 10}}{12.36 \mathrm{N}}
ight) - \left(40 \mathrm{m/s \cdot 3m}
ight)}{9.69 \mathrm{m/s}}$





Open Calculator

 $\mathbf{r}_{\mathrm{O}} = rac{\left(rac{\mathrm{w}\cdot\mathrm{G}}{\mathrm{w}_{\mathrm{f}}\cdot\mathrm{\omega}}
ight) - \left(\mathrm{v}_{\mathrm{f}}\cdot\mathrm{r}
ight)}{\mathrm{v}}$

14) Speed of Wheel given Tangential Velocity at Inlet Tip of Vane



15) Speed of Wheel given Tangential Velocity at Outlet Tip of Vane

$$\Omega = rac{{{
m v}_{
m tangential} \cdot 60}}{{2 \cdot \pi \cdot {
m r}_{
m O}}}$$
 Open Calculator $oldsymbol{arphi}$

$$0.795775 \text{rev/s} = \frac{60 \text{m/s} \cdot 60}{2 \cdot \pi \cdot 12 \text{m}}$$

16) Torque Exerted by Fluid

$$au = \left(rac{\mathrm{W_f}}{\mathrm{G}}
ight) \cdot \left(\mathrm{v_f} \cdot \mathrm{r} + \mathrm{v} \cdot \mathrm{r_O}
ight)$$

$$ext{ex} \ 292.0421 ext{N*m} = \left(rac{12.36 ext{N}}{10}
ight) \cdot (40 ext{m/s} \cdot 3 ext{m} + 9.69 ext{m/s} \cdot 12 ext{m})$$





Open Calculator

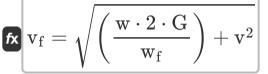
17) Velocity at Point given Efficiency of System

fx $\left| \mathbf{v} = \sqrt{1 - \eta} \cdot \mathbf{v}_{\mathrm{f}} \right|$

Open Calculator

ex $17.88854 \text{m/s} = \sqrt{1 - 0.80} \cdot 40 \text{m/s}$

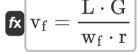
18) Velocity for Work Done if there is no Loss of Energy



Open Calculator

ex $80.02859 \text{m/s} = \sqrt{\left(\frac{3.9 \text{KJ} \cdot 2 \cdot 10}{12.36 \text{N}}\right) + (9.69 \text{m/s})^2}$

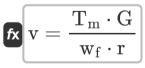
19) Velocity given Angular Momentum at Inlet 🔄



Open Calculator 🚰

 $ext{ex} \left[67.42179 ext{m/s} = rac{250 ext{kg*m}^2/ ext{s} \cdot 10}{12.36 ext{N} \cdot 3 ext{m}}
ight]$

20) Velocity given Angular Momentum at Outlet 🚰

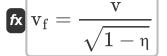


 $ext{ex} 10.38296 ext{m/s} = rac{38.5 ext{kg*m/s} \cdot 10}{12.36 ext{N} \cdot 3 ext{m}}$





21) Velocity given Efficiency of System 🗗

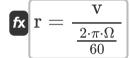


Open Calculator 🚰

 $m = 21.6675 m/s = rac{9.69 m/s}{\sqrt{1-0.80}}$

Radius of the Wheel

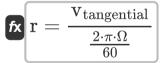
22) Radius of Wheel for Tangential Velocity at Inlet Tip of Vane



Open Calculator 🗗

ex 7.012873m = $\frac{9.69$ m/s $\frac{2 \cdot \pi \cdot 2.1$ rev/s $60}$

23) Radius of Wheel for Tangential Velocity at Outlet Tip of Vane

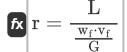


Open Calculator

ex $4.547284 \mathrm{m} = \frac{60 \mathrm{m/s}}{\frac{2 \cdot \pi \cdot 2.1 \mathrm{rev/s}}{60}}$



24) Radius of Wheel given Angular Momentum at Inlet

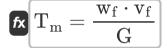


Open Calculator

 $= \frac{250 \text{kg*m}^2/\text{s}}{\frac{12.36 \text{N} \cdot 40 \text{m/s}}{10}}$

Tangential momentum and Tangential velocity

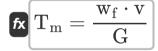
25) Tangential Momentum of Fluid Striking Vanes at Inlet



Open Calculator

 $= 49.44 \text{kg*m/s} = \frac{12.36 \text{N} \cdot 40 \text{m/s}}{10}$

26) Tangential Momentum of Fluid Striking Vanes at Outlet 🚰



Open Calculator 🗗

= 11.97684kg*m/s = $\frac{12.36 \text{N} \cdot 9.69 \text{m/s}}{10}$



27) Tangential Velocity at Inlet Tip of Vane

 $\mathbf{v}_{\mathrm{tangential}} = \left(\frac{2 \cdot \pi \cdot \Omega}{60} \right) \cdot \mathbf{r}$

Open Calculator 🗗

 $extbf{ex} 39.58407 ext{m/s} = \left(rac{2 \cdot \pi \cdot 2.1 ext{rev/s}}{60}
ight) \cdot 3 ext{m}$

28) Tangential Velocity at Outlet Tip of Vane

 $\mathbf{v}_{\mathrm{tangential}} = \left(rac{2 \cdot \pi \cdot \Omega}{60}
ight) \cdot \mathbf{r}$

Open Calculator

29) Velocity given Tangential Momentum of Fluid Striking Vanes at Inlet

 $\mathbf{x} = rac{\mathrm{T_m} \cdot \mathrm{G}}{\mathrm{w_f}}$

Open Calculator 🗗

 $ext{ex} 31.14887 ext{m/s} = rac{38.5 ext{kg*m/s} \cdot 10}{12.36 ext{N}}$



30) Velocity given Tangential Momentum of Fluid Striking Vanes at Outlet

Open Calculator 2

 $u = \frac{T_m \cdot G}{w_f}$

 $31.14887 \text{m/s} = \frac{38.5 \text{kg*m/s} \cdot 10}{12.26 \text{N}}$ 12.36N

Velocity at Inlet

31) Velocity at Inlet given Torque by Fluid 🗲

 $=rac{\left(rac{ au\cdot\mathrm{G}}{\mathrm{w_{\mathrm{f}}}}
ight)+\left(\mathrm{v}\cdot\mathrm{r}
ight)}{\mathrm{r_{\mathrm{O}}}}$

Open Calculator

 $\left(\frac{292 \mathrm{N^*m\cdot 10}}{12.36 \mathrm{N}}\right) + (9.69 \mathrm{m/s\cdot 3m})$ ex 22.10966 m/s =12m

32) Velocity at Inlet given Work Done on Wheel 🗗

 $= \frac{\left(\frac{\mathbf{w} \cdot \mathbf{G}}{\mathbf{w}_{\mathbf{f}} \cdot \mathbf{\omega}}\right) - \mathbf{v} \cdot \mathbf{r}_{\mathbf{O}}}{\mathbf{v} \cdot \mathbf{r}_{\mathbf{O}}}$

Open Calculator

42.14615 m/s =





33) Velocity at Inlet when Work Done at Vane Angle is 90 and Velocity is

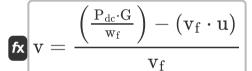
Zero 🛂

$$\mathbf{v}_{\mathrm{f}} = rac{\mathbf{w} \cdot \mathbf{G}}{\mathbf{w}_{\mathrm{f}} \cdot \mathbf{u}}$$

Open Calculator 🚰

 $m = rac{3.9
m KJ \cdot 10}{12.36
m N \cdot 35 m/s}$

Velocity at Outlet

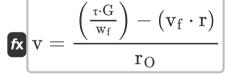


Open Calculator 🗗

 $oxed{egin{array}{c} oxed{ex} 9.680421 \mathrm{m/s} = rac{\left(rac{2209 \mathrm{W} \cdot 10}{12.36 \mathrm{N}}
ight) - \left(40 \mathrm{m/s} \cdot 35 \mathrm{m/s}
ight)}{40 \mathrm{m/s}} \end{array}}$

34) Velocity at Outlet given Power Delivered to Wheel

35) Velocity at Outlet given Torque by Fluid 🗹



Open Calculator 🗗

 $egin{align*} egin{align*} egin{align*} egin{align*} egin{align*} 9.687163 ext{m/s} &= rac{\left(rac{292 ext{N*m} \cdot 10}{12.36 ext{N}}
ight) - \left(40 ext{m/s} \cdot 3 ext{m}
ight)}{12 ext{m}} \end{aligned}$



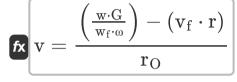


36) Velocity at Outlet given Work Done if Jet leaves in Motion of Wheel 🗗

 $=rac{\left(rac{\mathrm{w}\cdot\mathrm{G}}{\mathrm{w_{\mathrm{f}}}}
ight)-\left(\mathrm{v_{\mathrm{f}}\cdot\mathrm{u}}
ight)}{\mathrm{v_{\mathrm{f}}}}$

Open Calculator

37) Velocity at Outlet given Work Done on Wheel 🛂

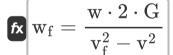


Open Calculator 2

ex $10.22654 \text{m/s} = \frac{\left(\frac{3.9 \text{KJ} \cdot 10}{12.36 \text{N} \cdot 13 \text{rad/s}}\right) - (40 \text{m/s} \cdot 3 \text{m})}{12}$

Weight of the Fluid

38) Weight of Fluid for Work Done if there is no loss of Energy 🗗

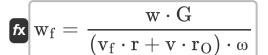


Open Calculator

 $= \frac{3.9 \text{KJ} \cdot 2 \cdot 10}{\left(40 \text{m/s}\right)^2 - \left(9.69 \text{m/s}\right)^2}$

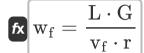


39) Weight of Fluid for Work Done on Wheel per Second



Open Calculator 🗗

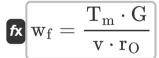
40) Weight of Fluid given Angular Momentum at Inlet



Open Calculator

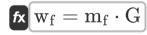
 $ext{ex} \ 20.83333 ext{N} = rac{250 ext{kg*m}^2/ ext{s} \cdot 10}{40 ext{m/s} \cdot 3 ext{m}}$

41) Weight of Fluid given Angular Momentum at Outlet



Open Calculator 🗗

42) Weight of Fluid given Mass of Fluid Striking Vane per Second



Open Calculator

 $m ex 9N = 0.9 kg \cdot 10$





43) Weight of Fluid given Power Delivered to Wheel

 $\mathbf{w}_{\mathrm{f}} = rac{\mathrm{P}_{\mathrm{dc}} \cdot \mathrm{G}}{\mathrm{v}_{\mathrm{f}} \cdot \mathrm{u} + \mathrm{v} \cdot \mathrm{v}_{\mathrm{f}}}$

Open Calculator 🖸

V1 CC + V V1

ex $12.35735 \mathrm{N} = rac{2209 \mathrm{W} \cdot 10}{40 \mathrm{m/s} \cdot 35 \mathrm{m/s} + 9.69 \mathrm{m/s} \cdot 40 \mathrm{m/s}}$

44) Weight of Fluid given Tangential Momentum of Fluid Striking Vanes at Inlet

 $\mathbf{w}_{\mathrm{f}} = rac{\mathrm{T_{m} \cdot G}}{\mathrm{v_{\mathrm{f}}}}$

Open Calculator 🚰

 $= \frac{38.5 \text{kg*m/s} \cdot 10}{40 \text{m/s}}$

45) Weight of Fluid given Work Done if Jet leaves in Motion of Wheel

 $\mathbf{w}_{\mathrm{f}} = rac{\mathbf{w} \cdot \mathbf{G}}{\mathbf{v}_{\mathrm{f}} \cdot \mathbf{u} - \mathbf{v} \cdot \mathbf{v}_{\mathrm{f}}}$

Open Calculator 🖸

 $ext{ex} 38.52232 ext{N} = rac{3.9 ext{KJ} \cdot 10}{40 ext{m/s} \cdot 35 ext{m/s} - 9.69 ext{m/s} \cdot 40 ext{m/s}}$



46) Weight of Fluid when Work Done at Vane Angle is 90 and Velocity is Zero

 $\mathbf{w}_{\mathrm{f}} = rac{\mathbf{w} \cdot \mathbf{G}}{\mathbf{v}_{\mathrm{f}} \cdot \mathbf{u}}$

Open Calculator 🚰

= 27.85714N = $\frac{3.9 \mathrm{KJ} \cdot 10}{40 \mathrm{m/s} \cdot 35 \mathrm{m/s}}$

Work Done 🗗

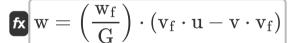
47) Work Done for Radial Discharge at Vane Angle is 90 and Velocity is

 $\mathbf{w} = \left(\frac{\mathbf{w}_{\mathrm{f}}}{\mathbf{G}}\right) \cdot \left(\mathbf{v}_{\mathrm{f}} \cdot \mathbf{u}\right)$

Open Calculator 🗗

 $\boxed{1.7304 \mathrm{KJ} = \left(\frac{12.36 \mathrm{N}}{10}\right) \cdot \left(40 \mathrm{m/s} \cdot 35 \mathrm{m/s}\right)}$

48) Work Done if Jet leaves in Direction as that of Motion of Wheel



Open Calculator 🗗

 $= 1.251326 \mathrm{KJ} = \left(\frac{12.36 \mathrm{N}}{10}\right) \cdot \left(40 \mathrm{m/s} \cdot 35 \mathrm{m/s} - 9.69 \mathrm{m/s} \cdot 40 \mathrm{m/s}\right)$



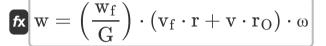
49) Work Done if there is no Loss of Energy 🚰

 $\mathbf{w} = \left(rac{\mathrm{w_f}}{2} \cdot \mathrm{G} \right) \cdot \left(\mathrm{v_f^2} - \mathrm{v^2} \right)$

Open Calculator 🗗

 $\boxed{ \text{ex} \ 0.093077 \text{KJ} = \left(\frac{12.36 \text{N}}{2} \cdot 10 \right) \cdot \left((40 \text{m/s})^2 - (9.69 \text{m/s})^2 \right) }$

50) Work Done on Wheel per Second



Open Calculator

ex

 $m [3.796547KJ = \left(rac{12.36N}{10}
ight) \cdot (40m/s \cdot 3m + 9.69m/s \cdot 12m) \cdot 13rad/s]$



Variables Used

- G Specific Gravity of Fluid
- L Angular Momentum (Kilogram Square Meter per Second)
- **m**_f Fluid Mass (Kilogram)
- Pdc Power Delivered (Watt)
- r Radius of wheel (Meter)
- r_O Radius of Outlet (Meter)
- Tm Tangential Momentum (Kilogram Meter per Second)
- **u** Initial Velocity (Meter per Second)
- V Velocity of Jet (Meter per Second)
- V_f Final Velocity (Meter per Second)
- Vtangential Tangential Velocity (Meter per Second)
- W Work Done (Kilojoule)
- W_f Weight of Fluid (Newton)
- n Efficiency of Jet
- T Torque Exerted on Wheel (Newton Meter)
- ω Angular Velocity (Radian per Second)
- Ω Angular Speed (Revolution per Second)





Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- Function: sqrt, sqrt(Number)
 Square root function
- Measurement: Length in Meter (m)

 Length Unit Conversion
- Measurement: Weight in Kilogram (kg)
 Weight Unit Conversion
- Measurement: Speed in Meter per Second (m/s)
 Speed Unit Conversion
- Measurement: Energy in Kilojoule (KJ)
 Energy Unit Conversion
- Measurement: Power in Watt (W)
 Power Unit Conversion
- Measurement: Force in Newton (N)
 Force Unit Conversion
- Measurement: Angular Velocity in Radian per Second (rad/s), Revolution per Second (rev/s)
 Angular Velocity Unit Conversion
- Measurement: Torque in Newton Meter (N*m)

 Torque Unit Conversion
- Measurement: Angular Momentum in Kilogram Square Meter per Second (kg*m²/s)
 - Angular Momentum Unit Conversion
- Measurement: Momentum in Kilogram Meter per Second (kg*m/s)
 Momentum Unit Conversion





Check other formula lists

 Torque Exerted on a Wheel with Radial Curved Vanes Formulas

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