Torque Exerted on a Wheel with Radial Curved Vanes Formulas

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

Open Calculator

$$L = \left(\frac{w_f \cdot v_f}{G}\right) \cdot r$$

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

Open Calculator

$$L = \left(\frac{w_f \cdot v}{G}\right) \cdot r$$

ex $$35.93052\text{kg*m}^2/\text{s} = \left(\frac{12.36\text{N} \cdot 9.69\text{m/s}}{10}\right) \cdot 3\text{m}$$

3) Angular Velocity for Work Done on Wheel per Second

Open Calculator

$$\omega = \frac{w \cdot G}{w_f \cdot (v_f \cdot r + v \cdot r_O)}$$

ex $$13.35424\text{rad/s} = \frac{3.9\text{KJ} \cdot 10}{12.36\text{N} \cdot (40\text{m/s} \cdot 3\text{m} + 9.69\text{m/s} \cdot 12\text{m})}$$

4) Efficiency of System

Open Calculator

fx $$\eta = \left(1 - \left(\frac{v}{v_f}\right)^2\right)$$

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

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

Open Calculator

fx $$u = \frac{\left(\frac{P_{dc} \cdot G}{w_f}\right) + (v \cdot v_f)}{v_f}$$

ex $$54.37042\text{m/s} = \frac{\left(\frac{2209\text{W} \cdot 10}{12.36\text{N}}\right) + (9.69\text{m/s} \cdot 40\text{m/s})}{40\text{m/s}}$$

6) Initial Velocity given Power Delivered to Wheel

Open Calculator

fx $$u = \left(\left(\frac{P_{dc} \cdot G}{w_f \cdot v_f}\right) - (v)\right)$$

ex $$34.99042\text{m/s} = \left(\left(\frac{2209\text{W} \cdot 10}{12.36\text{N} \cdot 40\text{m/s}}\right) - (9.69\text{m/s})\right)$$

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

Open Calculator

fx $$u = \frac{w \cdot G}{w_f \cdot v_f}$$

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

8) Mass of Fluid Striking Vane per Second

Open Calculator

fx $$m_f = \frac{w_f}{G}$$

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

9) Power Delivered to Wheel

Open Calculator

fx $$P_{dc} = \left(\frac{w_f}{G}\right) \cdot (v_f \cdot u + v \cdot v_f)$$

ex $$2209.474\text{W} = \left(\frac{12.36\text{N}}{10}\right) \cdot (40\text{m/s} \cdot 35\text{m/s} + 9.69\text{m/s} \cdot 40\text{m/s})$$

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

Open Calculator

fx $$r = \frac{\left(\frac{w \cdot G}{w_f \cdot \omega}\right) - (v \cdot r_O)}{v_f}$$

ex $$3.160961\text{m} = \frac{\left(\frac{3.9\text{KJ} \cdot 10}{12.36\text{N} \cdot 13\text{rad/s}}\right) - (9.69\text{m/s} \cdot 12\text{m})}{40\text{m/s}}$$

11) Radius at Inlet with Known Torque by Fluid

Open Calculator

fx $$r = \frac{\left(\frac{\tau \cdot G}{w_f}\right) + (v \cdot r_O)}{v_f}$$

ex $$8.813149\text{m} = \frac{\left(\frac{292\text{N*m} \cdot 10}{12.36\text{N}}\right) + (9.69\text{m/s} \cdot 12\text{m})}{40\text{m/s}}$$

12) Radius at Outlet for Torque Exerted by Fluid

Open Calculator

fx $$r_O = \frac{\left(\frac{\tau \cdot G}{w_f}\right) - (v_f \cdot r)}{v}$$

ex $$11.99649\text{m} = \frac{\left(\frac{292\text{N*m} \cdot 10}{12.36\text{N}}\right) - (40\text{m/s} \cdot 3\text{m})}{9.69\text{m/s}}$$

13) Radius at Outlet for Work Done on Wheel per Second

Open Calculator

fx $$r_O = \frac{\left(\frac{w \cdot G}{w_f \cdot \omega}\right) - (v_f \cdot r)}{v}$$

ex $$12.66444\text{m} = \frac{\left(\frac{3.9\text{KJ} \cdot 10}{12.36\text{N} \cdot 13\text{rad/s}}\right) - (40\text{m/s} \cdot 3\text{m})}{9.69\text{m/s}}$$

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

Open Calculator

fx $$\Omega = \frac{v_{tangential} \cdot 60}{2 \cdot \pi \cdot r}$$

ex $$3.183099\text{rev/s} = \frac{60\text{m/s} \cdot 60}{2 \cdot \pi \cdot 3\text{m}}$$

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

Open Calculator

fx $$\Omega = \frac{v_{tangential} \cdot 60}{2 \cdot \pi \cdot r_O}$$

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

16) Torque Exerted by Fluid

Open Calculator

fx $$\tau = \left(\frac{w_f}{G}\right) \cdot (v_f \cdot r + v \cdot r_O)$$

ex $$292.0421\text{N*m} = \left(\frac{12.36\text{N}}{10}\right) \cdot (40\text{m/s} \cdot 3\text{m} + 9.69\text{m/s} \cdot 12\text{m})$$

17) Velocity at Point given Efficiency of System

Open Calculator

$$v = \sqrt{1 - \eta} \cdot v_f$$

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

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

Open Calculator

$$v_f = \sqrt{\left(\frac{w \cdot 2 \cdot G}{w_f}\right) + v^2}$$

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

19) Velocity given Angular Momentum at Inlet

Open Calculator

$$v_f = \frac{L \cdot G}{w_f \cdot r}$$

$$67.42179\text{m/s} = \frac{250\text{kg*m}^2\text{/s} \cdot 10}{12.36\text{N} \cdot 3\text{m}}$$

20) Velocity given Angular Momentum at Outlet

Open Calculator

$$v = \frac{T_m \cdot G}{w_f \cdot r}$$

$$10.38296\text{m/s} = \frac{38.5\text{kg*m/s} \cdot 10}{12.36\text{N} \cdot 3\text{m}}$$

21) Velocity given Efficiency of System

Open Calculator

fx $$v_f = \frac{V}{\sqrt{1 - \eta}}$$

ex $$21.6675\text{m/s} = \frac{9.69\text{m/s}}{\sqrt{1 - 0.80}}$$

Radius of the Wheel

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

Open Calculator

fx $$r = \frac{v}{\frac{2 \cdot \pi \cdot \Omega}{60}}$$

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

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

Open Calculator

fx $$r = \frac{v_{tangential}}{\frac{2 \cdot \pi \cdot \Omega}{60}}$$

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

24) Radius of Wheel given Angular Momentum at Inlet

Open Calculator

fx $$r = \frac{L}{\frac{w_f \cdot v_f}{G}}$$

ex $$5.056634\text{m} = \frac{250\text{kg*m}^2/\text{s}}{\frac{12.36\text{N} \cdot 40\text{m/s}}{10}}$$

Tangential momentum and Tangential velocity

25) Tangential Momentum of Fluid Striking Vanes at Inlet

Open Calculator

fx $$T_m = \frac{w_f \cdot v_f}{G}$$

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

26) Tangential Momentum of Fluid Striking Vanes at Outlet

Open Calculator

fx $$T_m = \frac{w_f \cdot v}{G}$$

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

27) Tangential Velocity at Inlet Tip of Vane

Open Calculator

fx $$v_{tangential} = \left(\frac{2 \cdot \pi \cdot \Omega}{60}\right) \cdot r$$

ex $$39.58407\text{m/s} = \left(\frac{2 \cdot \pi \cdot 2.1\text{rev/s}}{60}\right) \cdot 3\text{m}$$

28) Tangential Velocity at Outlet Tip of Vane

Open Calculator

fx $$v_{tangential} = \left(\frac{2 \cdot \pi \cdot \Omega}{60}\right) \cdot r$$

ex $$39.58407\text{m/s} = \left(\frac{2 \cdot \pi \cdot 2.1\text{rev/s}}{60}\right) \cdot 3\text{m}$$

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

Open Calculator

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

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

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

Open Calculator

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

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

Velocity at Inlet

31) Velocity at Inlet given Torque by Fluid

Open Calculator

$$v_f = \frac{\left(\frac{\tau \cdot G}{w_f}\right) + (v \cdot r)}{r_O}$$

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

32) Velocity at Inlet given Work Done on Wheel

Open Calculator

$$v_f = \frac{\left(\frac{w \cdot G}{w_f \cdot \omega}\right) - v \cdot r_O}{r}$$

$$42.14615\text{m/s} = \frac{\left(\frac{3.9\text{KJ} \cdot 10}{12.36\text{N} \cdot 13\text{rad/s}}\right) - 9.69\text{m/s} \cdot 12\text{m}}{3\text{m}}$$

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

Open Calculator

fx $$v_f = \frac{w \cdot G}{w_f \cdot u}$$

ex $$90.15257\text{m/s} = \frac{3.9\text{KJ} \cdot 10}{12.36\text{N} \cdot 35\text{m/s}}$$

Velocity at Outlet

34) Velocity at Outlet given Power Delivered to Wheel

Open Calculator

fx $$v = \frac{\left(\frac{P_{dc} \cdot G}{w_f}\right) - (v_f \cdot u)}{v_f}$$

ex $$9.680421\text{m/s} = \frac{\left(\frac{2209\text{W} \cdot 10}{12.36\text{N}}\right) - (40\text{m/s} \cdot 35\text{m/s})}{40\text{m/s}}$$

35) Velocity at Outlet given Torque by Fluid

Open Calculator

fx $$v = \frac{\left(\frac{\tau \cdot G}{w_f}\right) - (v_f \cdot r)}{r_O}$$

ex $$9.687163\text{m/s} = \frac{\left(\frac{292\text{N*m} \cdot 10}{12.36\text{N}}\right) - (40\text{m/s} \cdot 3\text{m})}{12\text{m}}$$

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

Open Calculator

fx $$v = \frac{\left(\frac{w \cdot G}{w_f}\right) - (v_f \cdot u)}{v_f}$$

ex $$43.8835\text{m/s} = \frac{\left(\frac{3.9\text{KJ} \cdot 10}{12.36\text{N}}\right) - (40\text{m/s} \cdot 35\text{m/s})}{40\text{m/s}}$$

37) Velocity at Outlet given Work Done on Wheel

Open Calculator

fx $$v = \frac{\left(\frac{w \cdot G}{w_f \cdot \omega}\right) - (v_f \cdot r)}{r_O}$$

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

Weight of the Fluid

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

Open Calculator

fx $$w_f = \frac{w \cdot 2 \cdot G}{v_f^2 - v^2}$$

ex $$51.78926\text{N} = \frac{3.9\text{KJ} \cdot 2 \cdot 10}{(40\text{m/s})^2 - (9.69\text{m/s})^2}$$

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

Open Calculator

fx $$w_f = \frac{w \cdot G}{(v_f \cdot r + v \cdot r_O) \cdot \omega}$$

ex $$12.6968\text{N} = \frac{3.9\text{KJ} \cdot 10}{(40\text{m/s} \cdot 3\text{m} + 9.69\text{m/s} \cdot 12\text{m}) \cdot 13\text{rad/s}}$$

40) Weight of Fluid given Angular Momentum at Inlet

Open Calculator

fx $$w_f = \frac{L \cdot G}{v_f \cdot r}$$

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

41) Weight of Fluid given Angular Momentum at Outlet

Open Calculator

fx $$w_f = \frac{T_m \cdot G}{v \cdot r_O}$$

ex $$91.97884\text{N} = \frac{38.5\text{kg*m/s} \cdot 10}{9.69\text{m/s} \cdot 12\text{m}}$$

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

Open Calculator

fx $$w_f = m_f \cdot G$$

ex $$9\text{N} = 0.9\text{kg} \cdot 10$$

43) Weight of Fluid given Power Delivered to Wheel

Open Calculator

fx $$w_f = \frac{P_{dc} \cdot G}{v_f \cdot u + v \cdot v_f}$$

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

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

Open Calculator

fx $$w_f = \frac{T_m \cdot G}{v_f}$$

ex $$9.625\text{N} = \frac{38.5\text{kg*m/s} \cdot 10}{40\text{m/s}}$$

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

Open Calculator

fx $$w_f = \frac{w \cdot G}{v_f \cdot u - v \cdot v_f}$$

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

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

Open Calculator

$$w_f = \frac{w \cdot G}{v_f \cdot u}$$

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

Work Done

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

Open Calculator

$$w = \left(\frac{w_f}{G}\right) \cdot (v_f \cdot u)$$

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

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

Open Calculator

$$w = \left(\frac{w_f}{G}\right) \cdot (v_f \cdot u - v \cdot v_f)$$

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

49) Work Done if there is no Loss of Energy

Open Calculator

fx $$w = \left(\frac{w_f}{2} \cdot G\right) \cdot \left(v_f^2 - v^2\right)$$

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

fx $$w = \left(\frac{w_f}{G}\right) \cdot \left(v_f \cdot r + v \cdot r_O\right) \cdot \omega$$

ex

$$3.796547\text{KJ} = \left(\frac{12.36\text{N}}{10}\right) \cdot (40\text{m/s} \cdot 3\text{m} + 9.69\text{m/s} \cdot 12\text{m}) \cdot 13\text{rad/s}$$

Variables Used

- **G** Specific Gravity of Fluid
- **L** Angular Momentum *(Kilogram Square Meter per Second)*
- **m_f** Fluid Mass *(Kilogram)*
- **P_{dc}** Power Delivered *(Watt)*
- **r** Radius of wheel *(Meter)*
- **r_O** Radius of Outlet *(Meter)*
- **T_m** 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)*
- **$v_{tangential}$** Tangential Velocity *(Meter per Second)*
- **w** Work Done *(Kilojoule)*
- **w_f** Weight of Fluid *(Newton)*
- **η** Efficiency of Jet
- **τ** 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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