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Newtonian Flow Formulas

Calculators! Examples! Conversions!

List of 14 Newtonian Flow Formulas

Newtonian Flow

1) Coefficient of Drag Equation with Angle of Attack

Open Calculator

fx $C_D = 2 \cdot (\sin(\alpha))^3$

ex $0.013671 = 2 \cdot (\sin(10.94^\circ))^3$

2) Coefficient of Drag Equation with Coefficient of Normal Force

Open Calculator

fx $C_D = \mu \cdot \sin(\alpha)$

ex $0.085401 = 0.45 \cdot \sin(10.94^\circ)$

3) Coefficient of Lift Equation with Angle of Attack

Open Calculator

fx $C_L = 2 \cdot (\sin(\alpha))^2 \cdot \cos(\alpha)$

ex $0.070724 = 2 \cdot (\sin(10.94^\circ))^2 \cdot \cos(10.94^\circ)$

4) Coefficient of Lift Equation with Coefficient of Normal Force

Open Calculator

fx $C_L = \mu \cdot \cos(\alpha)$

ex $0.441822 = 0.45 \cdot \cos(10.94^\circ)$

5) Drag Force with Angle of Attack

Open Calculator

fx $$F_D = \frac{F_L}{\cot(\alpha)}$$

ex $$77.41415\text{N} = \frac{400.5\text{N}}{\cot(10.94°)}$$

6) Exact Normal Shock Wave Maximum Coefficient of Pressure

Open Calculator

fx $$C_{p,max} = \frac{2}{Y \cdot M^2} \cdot \left(\frac{P_T}{P} - 1\right)$$

ex $$2.910156 = \frac{2}{1.6 \cdot (8)^2} \cdot \left(\frac{120000\text{Pa}}{800\text{Pa}} - 1\right)$$

7) Force Exerted on Surface given Static Pressure

Open Calculator

fx $$F = A \cdot (p - p_{static})$$

ex $$2.52\text{N} = 2.1\text{m}^2 \cdot (251.2\text{Pa} - 250\text{Pa})$$

8) Lift Force with Angle of Attack

Open Calculator

fx $$F_L = F_D \cdot \cot(\alpha)$$

ex $$413.8778\text{N} = 80\text{N} \cdot \cot(10.94°)$$

9) Mass Flux Incident on Surface Area

Open Calculator

fx $$G = \rho \cdot v \cdot A \cdot \sin(\theta)$$

ex $$2.406764\text{kg/s/m}^2 = 0.11\text{kg/m}^3 \cdot 60\text{m/s} \cdot 2.1\text{m}^2 \cdot \sin(10°)$$

10) Maximum Pressure Coefficient

Open Calculator

fx $$C_{p,max} = \frac{P_T - P}{0.5 \cdot \rho \cdot V_\infty^2}$$

ex $$225.6635 = \frac{120000\text{Pa} - 800\text{Pa}}{0.5 \cdot 0.11\text{kg/m}^3 \cdot (98\text{m/s})^2}$$

11) Modified Newtonian Law

Open Calculator

fx $$C_p = C_{p,max} \cdot (\sin(\theta))^2$$

ex $$0.018092 = 0.60 \cdot (\sin(10°))^2$$

12) Pressure Coefficient for Slender 2D Bodies

Open Calculator

fx $$C_p = 2 \cdot \left((\theta)^2 + k_{curvature} \cdot y\right)$$

ex $$0.540923 = 2 \cdot \left((10°)^2 + 0.2\text{m} \cdot 1.2\text{m}\right)$$

13) Pressure Coefficient for Slender Bodies of Revolution

Open Calculator

fx $$C_p = 2 \cdot (\theta)^2 + k_{curvature} \cdot y$$

ex $$0.300923 = 2 \cdot (10°)^2 + 0.2m \cdot 1.2m$$

14) Time Rate of Change of Momentum of Mass Flux

Open Calculator

fx $$F = \rho_{Fluid} \cdot u_{Fluid}^2 \cdot A \cdot (\sin(\theta))^2$$

ex $$1.353524N = 9.5kg/m^3 \cdot (1.5m/s)^2 \cdot 2.1m^2 \cdot (\sin(10°))^2$$

Variables Used

- **A** Area *(Square Meter)*
- **C_D** Drag Coefficient
- **C_L** Lift Coefficient
- **C_p** Pressure Coefficient
- **$C_{p,max}$** Maximum Pressure Coefficient
- **F** Force *(Newton)*
- **F_D** Drag Force *(Newton)*
- **F_L** Lift Force *(Newton)*
- **G** Mass Flux(g) *(Kilogram per Second per Square Meter)*
- **$k_{curvature}$** Curvature of Surface *(Meter)*
- **M** Mach Number
- **p** Surface Pressure *(Pascal)*
- **P** Pressure *(Pascal)*
- **p_{static}** Static Pressure *(Pascal)*
- **P_T** Total Pressure *(Pascal)*
- **u_{Fluid}** Fluid Velocity *(Meter per Second)*
- **v** Velocity *(Meter per Second)*
- **V_∞** Freestream Velocity *(Meter per Second)*
- **y** Distance of Point from Centroidal Axis *(Meter)*
- **Y** Specific Heat Ratio
- **α** Angle of Attack *(Degree)*
- **θ** Angle of Inclination *(Degree)*

- **μ** Coefficient of Force
- **ρ** Density of Material *(Kilogram per Cubic Meter)*
- **ρ_{Fluid}** Density of Fluid *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used

- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **cot**, cot(Angle)
  Cotangent is a trigonometric function that is defined as the ratio of the adjacent side to the opposite side in a right triangle.
- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Mass Flux** in Kilogram per Second per Square Meter (kg/s/m²)
  Mass Flux Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion

Check other formula lists

- Approximate Methods of Hypersonic Inviscid Flowfields Formulas
- Boundary Layer Equations for Hypersonic Flow Formulas
- Computational Fluid Dynamic Solutions Formulas
- Elements of Kinetic Theory Formulas
- Hypersonic Equivalence Principle and Blast-Wave Theory Formulas
- Hypersonic Flight Paths Velocity of Altitude Map Formulas
- Hypersonic Flow and Disturbances Formulas
- Hypersonic Inviscid Flow Formulas
- Hypersonic Viscous Interactions Formulas
- Newtonian Flow Formulas
- Oblique Shock Relation Formulas
- Space-Marching Finite Difference Method: Additional Solutions of the Euler Equations Formulas
- Viscous Flow Fundamentals Formulas