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Kinematics of Flow Formulas

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List of 17 Kinematics of Flow Formulas

Kinematics of Flow

1) Actual Discharge in Venturimeter

Open Calculator

fx $$Q_a = C'_d \cdot \left(\frac{A_1 \cdot A_2}{\sqrt{(A_1^2) - (A_2^2)}} \cdot \sqrt{2 \cdot [g] \cdot h_v} \right)$$

ex $$57376.77\text{cm}^3/\text{s} = 0.94 \cdot \left(\frac{314\text{cm}^2 \cdot 78.5\text{cm}^2}{\sqrt{\left((314\text{cm}^2)^2\right) - \left((78.5\text{cm}^2)^2\right)}} \cdot \sqrt{2 \cdot [g] \cdot 289\text{cm}} \right)$$

2) Air Resistance Force

Open Calculator

fx $$F_a = c \cdot v'^2$$

ex $$720\text{N} = 0.2 \cdot (60\text{m/s})^2$$

3) Angular Velocity of Vortex using Depth of Parabola

Open Calculator

fx $$\omega = \sqrt{\frac{Z \cdot 2 \cdot 9.81}{r_1^2}}$$

ex $$1.999835\text{rad/s} = \sqrt{\frac{3185\text{cm} \cdot 2 \cdot 9.81}{(1250\text{cm})^2}}$$

4) Coefficient of pitot-tube for velocity at any point

Open Calculator

$$C_v = \frac{V_p}{\sqrt{2 \cdot 9.81 \cdot h_p}}$$

$$0.980314 = \frac{6.3\text{m/s}}{\sqrt{2 \cdot 9.81 \cdot 210.5\text{cm}}}$$

5) Depth of Parabola formed at Free Surface of Water

Open Calculator

$$Z = \frac{\left(\omega^2\right) \cdot \left(r_1^2\right)}{2 \cdot 9.81}$$

$$3185.525\text{cm} = \frac{\left((2\text{rad/s})^2\right) \cdot \left((1250\text{cm})^2\right)}{2 \cdot 9.81}$$

6) Difference in Pressure Head for heavier Liquid in Manometer

Open Calculator

$$h = z' \cdot \left(\frac{S_h}{S_o} - 1\right)$$

$$246.8139\text{cm} = 19.8\text{cm} \cdot \left(\frac{13.6}{1.01} - 1\right)$$

7) Difference in pressure head for light liquid in manometer

Open Calculator

$$h_l = z' \cdot \left(1 - \left(\frac{S_l}{S_o}\right)\right)$$

$$6.077228\text{cm} = 19.8\text{cm} \cdot \left(1 - \left(\frac{0.7}{1.01}\right)\right)$$

8) Drag coefficient given Drag force

Open Calculator

$$C_d = \frac{F_{dD} \cdot 2}{A_p \cdot \rho_{mf} \cdot V_r^2}$$

$$0.002001 = \frac{368\text{N} \cdot 2}{18800\text{cm}^2 \cdot 998\text{kg/m}^3 \cdot (14\text{m/s})^2}$$

9) Height or depth of paraboloid for volume of air

Open Calculator

$$h_c = \left(\frac{D^2}{2 \cdot \left(r_1^2\right)} \right) \cdot (L - H_i)$$

$$172.872\text{cm} = \left(\frac{(1050\text{cm})^2}{2 \cdot \left((1250\text{cm})^2\right)} \right) \cdot (2500\text{cm} - 2010\text{cm})$$

10) Rate of flow or discharge

Open Calculator

$$Q = A_{cs} \cdot v_{avg}$$

$$994500\text{cm}^3/\text{s} = 130\text{cm}^2 \cdot 76.5\text{m/s}$$

11) Relative velocity of fluid with respect to body given drag force

Open Calculator

$$V_r = \sqrt{\frac{F_{dD} \cdot 2}{A_p \cdot \rho_{mf} \cdot C_d}}$$

$$14.00489\text{m/s} = \sqrt{\frac{368\text{N} \cdot 2}{18800\text{cm}^2 \cdot 998\text{kg/m}^3 \cdot 0.002}}$$

12) Resultant bend force along x and y direction

Open Calculator

fx $$F_R = \sqrt{\left(F_x^2\right) + \left(F_y^2\right)}$$

ex $$52392.75\text{N} = \sqrt{\left((48000\text{N})^2\right) + \left((21000\text{N})^2\right)}$$

13) Resultant velocity for two velocity components

Open Calculator

fx $$V = \sqrt{\left(u^2\right) + \left(v^2\right)}$$

ex $$10\text{m/s} = \sqrt{\left((6\text{m/s})^2\right) + \left((8\text{m/s})^2\right)}$$

14) Total Pressure Force at Bottom of Cylinder

Open Calculator

fx $$F_b = \rho \cdot 9.81 \cdot \pi \cdot \left(r_1^2\right) \cdot H + F_t$$

ex $$436306.3\text{N} = 997\text{kg/m}^3 \cdot 9.81 \cdot \pi \cdot \left((1250\text{cm})^2\right) \cdot 1.1\text{cm} + 383495\text{N}$$

15) Total pressure force on top of cylinder

Open Calculator

fx $$F_t = \left(\frac{LD}{4}\right) \cdot \left(\omega^2\right) \cdot \pi \cdot \left(r_1^4\right)$$

ex $$383495.2\text{N} = \left(\frac{5\text{kg/m}^3}{4}\right) \cdot \left((2\text{rad/s})^2\right) \cdot \pi \cdot \left((1250\text{cm})^4\right)$$

16) Velocity at any point for coefficient of pitot-tube

Open Calculator

fx $$V_p = C_v \cdot \sqrt{2 \cdot 9.81 \cdot h_p}$$

ex $$6.297985\text{m/s} = 0.98 \cdot \sqrt{2 \cdot 9.81 \cdot 210.5\text{cm}}$$

17) Velocity of Fluid Particle

Open Calculator

fx $$v_f = \frac{d}{t_a}$$

ex $$1.25\text{m/s} = \frac{10000\text{cm}}{80\text{s}}$$

Variables Used

- A_1 Cross Section Area of Venturimeter Inlet *(Square Centimeter)*
- A_2 Cross Section Area of Venturimeter Throat *(Square Centimeter)*
- A_{cs} Cross-Sectional Area *(Square Centimeter)*
- A_p Projected Area of Body *(Square Centimeter)*
- **c** Air Constant
- C_d Drag Coefficient for Fluid Flow
- C'_d Coefficient of Discharge of Venturimeter
- C_v Coefficient of Pitot Tube
- **d** Displacement *(Centimeter)*
- **D** Diameter *(Centimeter)*
- F_a Air Resistance *(Newton)*
- F_b Pressure Force on Bottom *(Newton)*
- F_{dD} Drag Force by Fluid on Body *(Newton)*
- F_R Resultant Force on Pipe Bend *(Newton)*
- F_t Pressure Force on Top *(Newton)*
- F_x Force along X-Direction on Pipe Bend *(Newton)*
- F_y Force along Y-Direction on Pipe Bend *(Newton)*
- **h** Difference in Pressure Head in Manometer *(Centimeter)*
- **H** Cylinder Height *(Centimeter)*
- h_c Height of Crack *(Centimeter)*
- H_i Initial Height of Liquid *(Centimeter)*
- h_l Difference in Pressure Head for Light Liquid *(Centimeter)*
- h_p Rise of Liquid in Pitot Tube *(Centimeter)*

- h_v Net Head of Liquid in Venturimeter *(Centimeter)*
- **L** Length *(Centimeter)*
- **LD** Liquid Density *(Kilogram per Cubic Meter)*
- **Q** Rate of Flow *(Cubic Centimeter per Second)*
- Q_a Actual Discharge through Venturimeter *(Cubic Centimeter per Second)*
- r_1 Radius *(Centimeter)*
- S_h Specific Gravity of Heavier Liquid
- S_l Specific Gravity of Lighter Liquid
- S_o Specific Gravity of Flowing Liquid
- t_a Total Time Taken *(Second)*
- **u** Velocity Component at U *(Meter per Second)*
- **v** Velocity Component at V *(Meter per Second)*
- **v'** Velocity *(Meter per Second)*
- **V** Resultant Velocity *(Meter per Second)*
- v_{avg} Average Velocity *(Meter per Second)*
- v_f Velocity of Fluid Particle *(Meter per Second)*
- V_p Velocity at Any Point for Pitot Tube *(Meter per Second)*
- V_r Relative Velocity of Fluid Past Body *(Meter per Second)*
- **z'** Difference in Liquid Level in Manometer *(Centimeter)*
- **Z** Depth of Parabola *(Centimeter)*
- **ρ** Density *(Kilogram per Cubic Meter)*
- ρ_{mf} Density of Moving Fluid *(Kilogram per Cubic Meter)*
- **ω** Angular Velocity *(Radian per Second)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Centimeter (cm)
  Length Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Area** in Square Centimeter (cm²)
  Area Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Centimeter per Second (cm³/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Angular Velocity** in Radian per Second (rad/s)
  Angular Velocity Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion

Check other formula lists

- **Kinematics of Flow Formulas**
- **Turbulent Flow Formulas**

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