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Liquid Jet Formulas

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List of 12 Liquid Jet Formulas

Liquid Jet

1) Angle of Jet given Maximum Vertical Elevation

Open Calculator

fx $$\Theta = a\sin\left(\sqrt{\frac{H\cdot 2\cdot g}{V_o^2}}\right)$$

ex $$24.4997^\circ = a\sin\left(\sqrt{\frac{23\text{m}\cdot 2\cdot 9.8\text{m/s}^2}{(51.2\text{m/s})^2}}\right)$$

2) Angle of Jet given Time of Flight of Liquid Jet

Open Calculator

fx $$\Theta = a\sin\left(T\cdot\frac{g}{2\cdot V_o}\right)$$

ex $$25.50971^\circ = a\sin\left(4.5\text{s}\cdot\frac{9.8\text{m/s}^2}{2\cdot 51.2\text{m/s}}\right)$$

3) Angle of Jet given Time to Reach Highest Point

Open Calculator

fx $$\Theta = a\sin\left(T\cdot\frac{g}{V_o}\right)$$

ex $$59.46603^\circ = a\sin\left(4.5\text{s}\cdot\frac{9.8\text{m/s}^2}{51.2\text{m/s}}\right)$$

4) Friction Velocity

Open Calculator

fx $$V_f = V \cdot \sqrt{\frac{f}{8}}$$

ex $$9.899343\text{m/s} = 17.2\text{m/s} \cdot \sqrt{\frac{2.65}{8}}$$

5) Horizontal Range of Jet

Open Calculator

fx $$L = V_o^2 \cdot \frac{\sin(2 \cdot \Theta)}{g}$$

ex $$267.4939\text{m} = (51.2\text{m/s})^2 \cdot \frac{\sin(2 \cdot 45^\circ)}{9.8\text{m/s}^2}$$

6) Initial Velocity given Time of Flight of Liquid Jet

Open Calculator

fx $$V_o = T \cdot \frac{g}{\sin(\Theta)}$$

ex $$62.36682\text{m/s} = 4.5\text{s} \cdot \frac{9.8\text{m/s}^2}{\sin(45^\circ)}$$

7) Initial Velocity given Time to Reach Highest Point of Liquid

Open Calculator

fx $$V_o = T' \cdot \frac{g}{\sin(\Theta)}$$

ex $$207.8894\text{m/s} = 15\text{s} \cdot \frac{9.8\text{m/s}^2}{\sin(45^\circ)}$$

8) Initial Velocity of Liquid Jet given Maximum Vertical Elevation

Open Calculator

fx $$V_o = \sqrt{H \cdot 2 \cdot \frac{g}{\sin(\Theta) \cdot \sin(\Theta)}}$$

ex $$30.02665\text{m/s} = \sqrt{23\text{m} \cdot 2 \cdot \frac{9.8\text{m/s}^2}{\sin(45^\circ) \cdot \sin(45^\circ)}}$$

9) Maximum Vertical Elevation of Jet Profile

Open Calculator

fx $$H = \frac{V_o^2 \cdot \sin(\Theta) \cdot \sin(\Theta)}{2 \cdot g}$$

ex $$66.87347\text{m} = \frac{(51.2\text{m/s})^2 \cdot \sin(45^\circ) \cdot \sin(45^\circ)}{2 \cdot 9.8\text{m/s}^2}$$

10) Mean Velocity given Frictional Velocity

Open Calculator

fx $$V = \frac{V_f}{\sqrt{\frac{f}{8}}}$$

ex $$10.42493\text{m/s} = \frac{6\text{m/s}}{\sqrt{\frac{2.65}{8}}}$$

11) Time of Flight of Jet

Open Calculator

fx $$T = \frac{2 \cdot V_o \cdot \sin(\Theta)}{g}$$

ex $$7.388544\text{s} = \frac{2 \cdot 51.2\text{m/s} \cdot \sin(45^\circ)}{9.8\text{m/s}^2}$$

12) Variation of y with x in Free Liquid Jet

Open Calculator

fx $$y = x \cdot \tan(\Theta) - \frac{g \cdot x^2 \cdot \sec(\Theta)}{2 \cdot V_o^2}$$

ex $$0.199894\text{m} = 0.2\text{m} \cdot \tan(45^\circ) - \frac{9.8\text{m/s}^2 \cdot (0.2\text{m})^2 \cdot \sec(45^\circ)}{2 \cdot (51.2\text{m/s})^2}$$

Variables Used

- **f** Friction Factor
- **g** Acceleration due to Gravity *(Meter per Square Second)*
- **H** Maximum Vertical Elevation *(Meter)*
- **L** Range *(Meter)*
- **T** Time of Flight *(Second)*
- **T'** Time to Reach Highest Point *(Second)*
- **V** Mean Velocity *(Meter per Second)*
- V_f Friction Velocity *(Meter per Second)*
- V_o Initial Velocity of Liquid Jet *(Meter per Second)*
- **x** Length x *(Meter)*
- **y** Length y *(Meter)*
- **Θ** Angle of Liquid Jet *(Degree)*

Constants, Functions, Measurements used

- Function: **asin**, asin(Number)
  The inverse sine function, is a trigonometric function that takes a ratio of two sides of a right triangle and outputs the angle opposite the side with the given ratio.
- Function: **sec**, sec(Angle)
  Secant is a trigonometric function that is defined ratio of the hypotenuse to the shorter side adjacent to an acute angle (in a right-angled triangle); the reciprocal of a cosine.
- 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.
- 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.
- Function: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion

- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion

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