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Notches and Weirs Formulas

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List of 27 Notches and Weirs Formulas

Notches and Weirs

Discharge

1) Coefficient of Discharge for Time Required to Empty Reservoir

Open Calculator

fx $$C_d = \frac{3 \cdot A}{t_a \cdot L_w \cdot \sqrt{2 \cdot [g]}} \cdot \left(\frac{1}{\sqrt{H_f}} - \frac{1}{\sqrt{H_i}} \right)$$

ex $$0.822977 = \frac{3 \cdot 50\text{m}^2}{80\text{s} \cdot 1.21\text{m} \cdot \sqrt{2 \cdot [g]}} \cdot \left(\frac{1}{\sqrt{0.17\text{m}}} - \frac{1}{\sqrt{186.1\text{m}}} \right)$$

2) Discharge over Broad-Crested Weir

Open Calculator

fx $$Q = 1.705 \cdot C_d \cdot L_w \cdot H^{\frac{3}{2}}$$

ex $$52.1915\text{m}^3/\text{s} = 1.705 \cdot 0.8 \cdot 1.21\text{m} \cdot (10\text{m})^{\frac{3}{2}}$$

3) Discharge over Broad-Crested Weir for Head of Liquid at Middle

Open Calculator

fx $$Q = C_d \cdot L_w \cdot \sqrt{2 \cdot [g] \cdot (h^2 \cdot H - h^3)}$$

ex $$38.58275\text{m}^3/\text{s} = 0.8 \cdot 1.21\text{m} \cdot \sqrt{2 \cdot [g] \cdot \left((9\text{m})^2 \cdot 10\text{m} - (9\text{m})^3 \right)}$$

4) Discharge over Broad-Crested Weir with Velocity of Approach

Open Calculator

fx $$Q = 1.705 \cdot C_d \cdot L_w \cdot \left((H + h_a)^{\frac{3}{2}} - h_a^{\frac{3}{2}} \right)$$

ex $$59.69284\text{m}^3/\text{s} = 1.705 \cdot 0.8 \cdot 1.21\text{m} \cdot \left((10\text{m} + 1.2\text{m})^{\frac{3}{2}} - (1.2\text{m})^{\frac{3}{2}} \right)$$

5) Discharge over Rectangle Notch or Weir

Open Calculator

fx $$Q_{th} = \frac{2}{3} \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot [g]} \cdot H^{\frac{3}{2}}$$

ex $$90.37731\text{m}^3/\text{s} = \frac{2}{3} \cdot 0.8 \cdot 1.21\text{m} \cdot \sqrt{2 \cdot [g]} \cdot (10\text{m})^{\frac{3}{2}}$$

6) Discharge over Rectangle Weir Considering Bazin's formula

Open Calculator

fx $$Q = \left(0.405 + \frac{0.003}{H}\right) \cdot L_w \cdot \sqrt{2 \cdot [g]} \cdot H^{\frac{3}{2}}$$

ex $$68.68111\text{m}^3/\text{s} = \left(0.405 + \frac{0.003}{10\text{m}}\right) \cdot 1.21\text{m} \cdot \sqrt{2 \cdot [g]} \cdot (10\text{m})^{\frac{3}{2}}$$

7) Discharge over Rectangle Weir Considering Francis's formula

Open Calculator

fx $$Q' = 1.84 \cdot L_w \cdot \left((H_i + H_f)^{\frac{3}{2}} - H_f^{\frac{3}{2}}\right)$$

ex $$5659.859\text{m}^3/\text{s} = 1.84 \cdot 1.21\text{m} \cdot \left((186.1\text{m} + 0.17\text{m})^{\frac{3}{2}} - (0.17\text{m})^{\frac{3}{2}}\right)$$

8) Discharge over Rectangle Weir for Bazin's formula with Velocity of Approach

Open Calculator

fx $$Q = \left(0.405 + \frac{0.003}{H + h_a}\right) \cdot L_w \cdot \sqrt{2 \cdot [g]} \cdot (H + h_a)^{\frac{3}{2}}$$

ex $$81.40103\text{m}^3/\text{s} = \left(0.405 + \frac{0.003}{10\text{m} + 1.2\text{m}}\right) \cdot 1.21\text{m} \cdot \sqrt{2 \cdot [g]} \cdot (10\text{m} + 1.2\text{m})^{\frac{3}{2}}$$

9) Discharge over Rectangle Weir with Two End Contractions

Open Calculator

fx $$Q = \frac{2}{3} \cdot C_d \cdot (L_w - 0.2 \cdot H) \cdot \sqrt{2 \cdot [g]} \cdot H^{\frac{3}{2}}$$

ex $$-59.006677\text{m}^3/\text{s} = \frac{2}{3} \cdot 0.8 \cdot (1.21\text{m} - 0.2 \cdot 10\text{m}) \cdot \sqrt{2 \cdot [g]} \cdot (10\text{m})^{\frac{3}{2}}$$

10) Discharge over Trapezoidal Notch or Weir

Open Calculator

fx
$$Q_{th} = \frac{2}{3} \cdot C_{d1} \cdot L_w \cdot \sqrt{2 \cdot [g]} \cdot H^{\frac{3}{2}} + \frac{8}{15} \cdot C_{d2} \cdot \tan\left(\frac{\angle A}{2}\right) \cdot \sqrt{2 \cdot [g]} \cdot H^{\frac{5}{2}}$$

ex
$$201.2609\text{m}^3/\text{s} = \frac{2}{3} \cdot 0.63 \cdot 1.21\text{m} \cdot \sqrt{2 \cdot [g]} \cdot (10\text{m})^{\frac{3}{2}} + \frac{8}{15} \cdot 0.65 \cdot \tan\left(\frac{30^\circ}{2}\right) \cdot \sqrt{2 \cdot [g]} \cdot (10\text{m})^{\frac{5}{2}}$$

11) Discharge over Triangular Notch or Weir

Open Calculator

fx
$$Q_{th} = \frac{8}{15} \cdot C_d \cdot \tan\left(\frac{\angle A}{2}\right) \cdot \sqrt{2 \cdot [g]} \cdot H^{\frac{5}{2}}$$

ex
$$160.1093\text{m}^3/\text{s} = \frac{8}{15} \cdot 0.8 \cdot \tan\left(\frac{30^\circ}{2}\right) \cdot \sqrt{2 \cdot [g]} \cdot (10\text{m})^{\frac{5}{2}}$$

12) Discharge with Velocity of Approach

Open Calculator

fx
$$Q' = \frac{2}{3} \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot [g]} \cdot \left((H_i + H_f)^{\frac{3}{2}} - H_f^{\frac{3}{2}}\right)$$

ex
$$7265.439\text{m}^3/\text{s} = \frac{2}{3} \cdot 0.8 \cdot 1.21\text{m} \cdot \sqrt{2 \cdot [g]} \cdot \left((186.1\text{m} + 0.17\text{m})^{\frac{3}{2}} - (0.17\text{m})^{\frac{3}{2}}\right)$$

13) Discharge without Velocity of Approach

Open Calculator

fx
$$Q' = \frac{2}{3} \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot [g]} \cdot H_i^{\frac{3}{2}}$$

ex
$$7255.695\text{m}^3/\text{s} = \frac{2}{3} \cdot 0.8 \cdot 1.21\text{m} \cdot \sqrt{2 \cdot [g]} \cdot (186.1\text{m})^{\frac{3}{2}}$$

14) Head of Liquid above V-notch

Open Calculator

fx
$$H = \left(\frac{Q_{th}}{\frac{8}{15} \cdot C_d \cdot \tan\left(\frac{\angle A}{2}\right) \cdot \sqrt{2 \cdot [g]}}\right)^{0.4}$$

ex
$$7.94201\text{m} = \left(\frac{90\text{m}^3/\text{s}}{\frac{8}{15} \cdot 0.8 \cdot \tan\left(\frac{30^\circ}{2}\right) \cdot \sqrt{2 \cdot [g]}}\right)^{0.4}$$

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15) Head of Liquid at Crest

Open Calculator

$$H = \left(\frac{Q_{th}}{\frac{2}{3} \cdot C_d \cdot L_w \cdot \sqrt{2 \cdot [g]}} \right)^{\frac{2}{3}}$$

$$9.972148\text{m} = \left(\frac{90\text{m}^3/\text{s}}{\frac{2}{3} \cdot 0.8 \cdot 1.21\text{m} \cdot \sqrt{2 \cdot [g]}} \right)^{\frac{2}{3}}$$

16) Time Required to Empty Reservoir

Open Calculator

$$t_a = \left(\frac{3 \cdot A}{C_d \cdot L_w \cdot \sqrt{2 \cdot [g]}} \right) \cdot \left(\frac{1}{\sqrt{H_f}} - \frac{1}{\sqrt{H_i}} \right)$$

$$82.29767\text{s} = \left(\frac{3 \cdot 50\text{m}^2}{0.8 \cdot 1.21\text{m} \cdot \sqrt{2 \cdot [g]}} \right) \cdot \left(\frac{1}{\sqrt{0.17\text{m}}} - \frac{1}{\sqrt{186.1\text{m}}} \right)$$

17) Time Required to Empty Tank with Triangular Weir or Notch

Open Calculator

$$t_a = \left(\frac{5 \cdot A}{4 \cdot C_d \cdot \tan\left(\frac{\angle A}{2}\right) \cdot \sqrt{2 \cdot [g]}} \right) \cdot \left(\frac{1}{H_f^{\frac{3}{2}}} - \frac{1}{H_i^{\frac{3}{2}}} \right)$$

$$939.2406\text{s} = \left(\frac{5 \cdot 50\text{m}^2}{4 \cdot 0.8 \cdot \tan\left(\frac{30°}{2}\right) \cdot \sqrt{2 \cdot [g]}} \right) \cdot \left(\frac{1}{(0.17\text{m})^{\frac{3}{2}}} - \frac{1}{(186.1\text{m})^{\frac{3}{2}}} \right)$$

Geometric DImension

18) Length of Crest of Weir or Notch

Open Calculator

$$L_w = \frac{3 \cdot A}{C_d \cdot t_a \cdot \sqrt{2 \cdot [g]}} \cdot \left(\frac{1}{\sqrt{H_f}} - \frac{1}{\sqrt{H_i}} \right)$$

$$1.244752\text{m} = \frac{3 \cdot 50\text{m}^2}{0.8 \cdot 80\text{s} \cdot \sqrt{2 \cdot [g]}} \cdot \left(\frac{1}{\sqrt{0.17\text{m}}} - \frac{1}{\sqrt{186.1\text{m}}} \right)$$

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19) Length of Section for Discharge over Rectangle Notch or Weir

Open Calculator

$$L_w = \frac{Q_{th}}{\frac{2}{3} \cdot C_d \cdot \sqrt{2 \cdot [g]} \cdot l_a^{\frac{3}{2}}}$$

$$0.655891\text{m} = \frac{90\text{m}^3/\text{s}}{\frac{2}{3} \cdot 0.8 \cdot \sqrt{2 \cdot [g]} \cdot (15\text{m})^{\frac{3}{2}}}$$

20) Length of Weir Considering Bazin's formula with Velocity of Approach

Open Calculator

$$L_n = \frac{Q}{0.405 + \frac{0.003}{l_a + h_a}} \cdot \sqrt{2 \cdot [g]} \cdot (l_a + h_a)^{\frac{3}{2}}$$

$$28507.18\text{m} = \frac{40\text{m}^3/\text{s}}{0.405 + \frac{0.003}{15\text{m} + 1.2\text{m}}} \cdot \sqrt{2 \cdot [g]} \cdot (15\text{m} + 1.2\text{m})^{\frac{3}{2}}$$

21) Length of Weir Considering Bazin's formula without Velocity of Approach

Open Calculator

$$L_n = \frac{Q}{0.405 + \frac{0.003}{l_a}} \cdot \sqrt{2 \cdot [g]} \cdot l_a^{\frac{3}{2}}$$

$$25398.19\text{m} = \frac{40\text{m}^3/\text{s}}{0.405 + \frac{0.003}{15\text{m}}} \cdot \sqrt{2 \cdot [g]} \cdot (15\text{m})^{\frac{3}{2}}$$

22) Length of Weir Considering Francis's formula

Open Calculator

$$L_w = \frac{Q}{1.84 \cdot \left((H_i + h_a)^{\frac{3}{2}} - h_a^{\frac{3}{2}}\right)}$$

$$0.008485\text{m} = \frac{40\text{m}^3/\text{s}}{1.84 \cdot \left((186.1\text{m} + 1.2\text{m})^{\frac{3}{2}} - (1.2\text{m})^{\frac{3}{2}}\right)}$$

23) Length of Weir for Broad-Crested Weir and Head of Liquid at Middle

Open Calculator

fx $$L_w = \frac{Q}{C_d \cdot \sqrt{2 \cdot [g] \cdot \left(h^2 \cdot l_a - h^3\right)}}$$

ex $$0.512126\text{m} = \frac{40\text{m}^3/\text{s}}{0.8 \cdot \sqrt{2 \cdot [g] \cdot \left((9\text{m})^2 \cdot 15\text{m} - (9\text{m})^3\right)}}$$

24) Length of Weir for Broad-Crested Weir with Velocity of Approach

Open Calculator

fx $$L_w = \frac{Q}{1.705 \cdot C_d \cdot \left((l_a + h_a)^{\frac{3}{2}} - h_a^{\frac{3}{2}}\right)}$$

ex $$0.459006\text{m} = \frac{40\text{m}^3/\text{s}}{1.705 \cdot 0.8 \cdot \left((15\text{m} + 1.2\text{m})^{\frac{3}{2}} - (1.2\text{m})^{\frac{3}{2}}\right)}$$

25) Length of Weir for Discharge over Broad-Crested Weir

Open Calculator

fx $$L_w = \frac{Q}{1.705 \cdot C_d \cdot l_a^{\frac{3}{2}}}$$

ex $$0.504788\text{m} = \frac{40\text{m}^3/\text{s}}{1.705 \cdot 0.8 \cdot (15\text{m})^{\frac{3}{2}}}$$

26) Length of Weir or Notch for Velocity of Approach

Open Calculator

fx $$L_w = \frac{Q}{\frac{2}{3} \cdot C_d \cdot \sqrt{2 \cdot [g]} \cdot \left((H_i + H_f)^{\frac{3}{2}} - H_f^{\frac{3}{2}}\right)}$$

ex $$0.006662\text{m} = \frac{40\text{m}^3/\text{s}}{\frac{2}{3} \cdot 0.8 \cdot \sqrt{2 \cdot [g]} \cdot \left((186.1\text{m} + 0.17\text{m})^{\frac{3}{2}} - (0.17\text{m})^{\frac{3}{2}}\right)}$$

27) Length of Weir or Notch without Velocity of Approach

Open Calculator

fx $$L_w = \frac{Q}{\frac{2}{3} \cdot C_d \cdot \sqrt{2 \cdot [g]} \cdot H_i^{\frac{3}{2}}}$$

ex $$0.006671\text{m} = \frac{40\text{m}^3/\text{s}}{\frac{2}{3} \cdot 0.8 \cdot \sqrt{2 \cdot [g]} \cdot (186.1\text{m})^{\frac{3}{2}}}$$

Variables Used

- **∠A** Angle A *(Degree)*
- **A** Area of Weir *(Square Meter)*
- C_d Coefficient of Discharge
- C_{d1} Coefficient of Discharge Rectangular
- C_{d2} Coefficient of Discharge Triangular
- **h** Head of Liquid Middle *(Meter)*
- **H** Head of Liquid *(Meter)*
- h_a Head Due to Velocity of Approach *(Meter)*
- H_f Final Height of Liquid *(Meter)*
- H_i Initial Height of Liquid *(Meter)*
- l_a Arc Length of Circle *(Meter)*
- L_n Length of Notches *(Meter)*
- L_w Length of Weir *(Meter)*
- **Q** Discharge Weir *(Cubic Meter per Second)*
- **Q'** Discharge *(Cubic Meter per Second)*
- Q_{th} Theoretical Discharge *(Cubic Meter per Second)*
- t_a Total Time Taken *(Second)*

Constants, Functions, Measurements used

- 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.
- 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: **Area** in Square Meter (m^2)
  Area Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion

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