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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 $$C_d = \frac{3 \cdot A}{t_{total} \cdot L_{weir} \cdot \sqrt{2 \cdot [g]}} \cdot \left( \frac{1}{\sqrt{H_f}} - \frac{1}{\sqrt{H_i}} \right)$$

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

#### 2) Discharge over Broad-Crested Weir

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

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

### 5) Discharge over Rectangle Notch or Weir

Open Calculator

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

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

### 6) Discharge over Rectangle Weir Considering Bazin's formula

Open Calculator

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

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

### 7) Discharge over Rectangle Weir Considering Francis's formula

Open Calculator

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

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

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

Open Calculator

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

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

### 9) Discharge over Rectangle Weir with Two End Contractions

Open Calculator

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

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

## 10) Discharge over Trapezoidal Notch or Weir

Open Calculator

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

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

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

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

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

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

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

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

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

ex

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

### 15) Head of Liquid at Crest

Open Calculator

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

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

### 16) Time Required to Empty Reservoir

Open Calculator

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

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

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

Open Calculator

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

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

## Geometric DImension

### 18) Length of Crest of Weir or Notch

Open Calculator

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

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

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

Open Calculator

**fx**
$$L_{weir} = \frac{Q_{th}}{\frac{2}{3} \cdot C_d \cdot \sqrt{2 \cdot [g]} \cdot l_{Arc}^{\frac{3}{2}}}$$

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

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

Open Calculator

**fx**
$$L_{notch} = \frac{Q}{0.405 + \frac{0.003}{l_{Arc} + h_a}} \cdot \sqrt{2 \cdot [g]} \cdot (l_{Arc} + h_a)^{\frac{3}{2}}$$

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

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

Open Calculator

**fx**
$$L_{notch} = \frac{Q}{0.405 + \frac{0.003}{l_{Arc}}} \cdot \sqrt{2 \cdot [g]} \cdot l_{Arc}^{\frac{3}{2}}$$

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

### 22) Length of Weir Considering Francis's formula

Open Calculator

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

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

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

Open Calculator

$$L_{weir} = \frac{Q}{C_d \cdot \sqrt{2 \cdot [g] \cdot \left(h^2 \cdot l_{Arc} - h^3\right)}}$$

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

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

Open Calculator

$$L_{weir} = \frac{Q}{1.705 \cdot C_d \cdot \left((l_{Arc} + h_a)^{\frac{3}{2}} - h_a^{\frac{3}{2}}\right)}$$

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

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

Open Calculator

$$L_{weir} = \frac{Q}{1.705 \cdot C_d \cdot l_{Arc}^{\frac{3}{2}}}$$

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

### 26) Length of Weir or Notch for Velocity of Approach

Open Calculator

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

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

## 27) Length of Weir or Notch without Velocity of Approach

Open Calculator

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

**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

- $\angle A$ 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)*
- $l_{Arc}$ Arc Length of Circle *(Meter)*
- $L_{notch}$ Length of Notches *(Meter)*
- $L_{weir}$ 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)*
- $t_{total}$ Total Time Taken *(Second)*

## Constants, Functions, Measurements used

- Constant: **[g]**, 9.80665 Meter/Second²
  *Gravitational acceleration on Earth*
- Function: **sqrt**, sqrt(Number)
  *Square root function*
- Function: **tan**, tan(Angle)
  *Trigonometric tangent function*
- Measurement: **Length** in Meter (m)
  *Length Unit Conversion*
- Measurement: **Time** in Second (s)
  *Time Unit Conversion*
- Measurement: **Area** in Square Meter (m²)
  *Area Unit Conversion*
- Measurement: **Angle** in Degree (°)
  *Angle Unit Conversion*
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m³/s)
  *Volumetric Flow Rate Unit Conversion*

## Check other formula lists

- **Notches and Weirs Formulas**
- **Orifices and Mouthpieces Formulas**

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