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# Flow in Open Channels Formulas

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# List of 19 Flow in Open Channels Formulas

## Flow in Open Channels

### 1) Area of Flow for Circular Channel

$$fx \quad A = (R^2) \cdot \left( \theta - \left( \frac{\sin(2 \cdot \theta)}{2} \right) \right)$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b\_img.jpg\)](#)

$$ex \quad 1.733345m^2 = \left( (0.75m)^2 \right) \cdot \left( 2.687rad - \left( \frac{\sin(2 \cdot 2.687rad)}{2} \right) \right)$$

### 2) Bazin's constant

$$fx \quad K = (\sqrt{m}) \cdot \left( \left( \frac{157.6}{C} \right) - 1.81 \right)$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d\_img.jpg\)](#)

$$ex \quad 0.531147 = (\sqrt{0.423m}) \cdot \left( \left( \frac{157.6}{60} \right) - 1.81 \right)$$

### 3) Chezy's constant considering Bazin formula

$$fx \quad C = \frac{157.6}{1.81 + \left( \frac{K}{\sqrt{m}} \right)}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d\_img.jpg\)](#)

$$ex \quad 60.00518 = \frac{157.6}{1.81 + \left( \frac{0.531}{\sqrt{0.423m}} \right)}$$




4) Chezy's constant considering Kutter's formula 

$$\text{fx } C = \frac{23 + \left(\frac{0.00155}{i}\right) + \left(\frac{1}{n}\right)}{1 + \left(23 + \left(\frac{0.00155}{i}\right)\right) \cdot \left(\frac{n}{\sqrt{m}}\right)}$$

Open Calculator 


$$\text{ex } 60.72016 = \frac{23 + \left(\frac{0.00155}{0.005}\right) + \left(\frac{1}{0.0145}\right)}{1 + \left(23 + \left(\frac{0.00155}{0.005}\right)\right) \cdot \left(\frac{0.0145}{\sqrt{0.423m}}\right)}$$

5) Chezy's constant considering Manning's formula 

$$\text{fx } C = \left(\frac{1}{n}\right) \cdot \left(m^{\frac{1}{6}}\right)$$

Open Calculator 

$$\text{ex } 59.75241 = \left(\frac{1}{0.0145}\right) \cdot \left((0.423m)^{\frac{1}{6}}\right)$$

6) Chezy's constant considering velocity 

$$\text{fx } C = \frac{v}{\sqrt{m \cdot i}}$$

Open Calculator 

$$\text{ex } 60.01418 = \frac{2.76\text{m/s}}{\sqrt{0.423m \cdot 0.005}}$$



## 7) Critical depth considering flow in open channels

$$\text{fx } h_c = \left( \frac{q^2}{[g]} \right)^{\frac{1}{3}}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95\_img.jpg\)](#)

$$\text{ex } 0.389077\text{m} = \left( \frac{(0.76\text{m}^2/\text{s})^2}{[g]} \right)^{\frac{1}{3}}$$

## 8) Critical depth considering minimum specific energy

$$\text{fx } h_c = \left( \frac{2}{3} \right) \cdot E_{\min}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2\_img.jpg\)](#)

$$\text{ex } 0.386667\text{m} = \left( \frac{2}{3} \right) \cdot 0.58\text{m}$$

## 9) Critical Depth using Critical Velocity

$$\text{fx } h_c = \frac{V_c^2}{[g]}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7\_img.jpg\)](#)

$$\text{ex } 0.387747\text{m} = \frac{(1.95\text{m/s})^2}{[g]}$$




10) Critical velocity considering flow in open channels 

$$fx \quad V_c = \sqrt{[g] \cdot h_c}$$

Open Calculator 

$$ex \quad 1.953148\text{m/s} = \sqrt{[g] \cdot 0.389\text{m}}$$

11) Discharge per unit width considering flow in open channels 

$$fx \quad q = \sqrt{(h_c^3) \cdot [g]}$$

Open Calculator 

$$ex \quad 0.759775\text{m}^2/\text{s} = \sqrt{((0.389\text{m})^3) \cdot [g]}$$

12) Hydraulic mean depth considering Bazin formula 

$$fx \quad m = \left( \frac{K}{\left( \left( \frac{157.6}{C} \right) - 1.81 \right)} \right)^2$$

Open Calculator 

$$ex \quad 0.422765\text{m} = \left( \frac{0.531}{\left( \left( \frac{157.6}{60} \right) - 1.81 \right)} \right)^2$$


13) Hydraulic mean depth considering Manning's formula 

$$fx \quad m = (C \cdot n)^6$$

Open Calculator 

$$ex \quad 0.433626\text{m} = (60 \cdot 0.0145)^6$$



14) Hydraulic mean depth using Chezy's formula 

$$fx \quad m = \left( \frac{1}{i} \right) \cdot \left( \frac{v}{C} \right)^2$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0\_img.jpg\)](#)

$$ex \quad 0.4232m = \left( \frac{1}{0.005} \right) \cdot \left( \frac{2.76m/s}{60} \right)^2$$

15) Manning's coefficient or constant 

$$fx \quad n = \left( \frac{1}{C} \right) \cdot m^{\frac{1}{6}}$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5\_img.jpg\)](#)

$$ex \quad 0.01444 = \left( \frac{1}{60} \right) \cdot (0.423m)^{\frac{1}{6}}$$

16) Minimum Specific Energy using Critical Depth 

$$fx \quad E_{\min} = \left( \frac{3}{2} \right) \cdot h_c$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60\_img.jpg\)](#)

$$ex \quad 0.5835m = \left( \frac{3}{2} \right) \cdot 0.389m$$

17) Radius of Circular Channel using Wetted Perimeter 

$$fx \quad R = \frac{P}{2 \cdot \theta}$$

[Open Calculator !\[\]\(5abce1a84a655b073239ab33e1199487\_img.jpg\)](#)

$$ex \quad 0.176777m = \frac{0.95m}{2 \cdot 2.687rad}$$



### 18) Velocity of Chezy's formula

$$\text{fx } v = C \cdot \sqrt{m \cdot i}$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5\_img.jpg\)](#)

$$\text{ex } 2.759348\text{m/s} = 60 \cdot \sqrt{0.423\text{m} \cdot 0.005}$$

### 19) Wetted Perimeter for Circular Channel

$$\text{fx } P = 2 \cdot R \cdot \theta$$

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5\_img.jpg\)](#)

$$\text{ex } 4.0305\text{m} = 2 \cdot 0.75\text{m} \cdot 2.687\text{rad}$$








## Variables Used

- **A** Area of Flow of Circular Channel (*Square Meter*)
- **C** Chezy's Constant for Flow in Open Channel
- **E<sub>min</sub>** Minimum Specific Energy for Open Channel Flow (*Meter*)
- **h<sub>c</sub>** Critical Depth for Flow in Open Channel (*Meter*)
- **i** Slope of Bed of Open Channel
- **K** Bazin's Constant for Flow in Open Channel
- **m** Hydraulic Mean Depth for Open Channel (*Meter*)
- **n** Manning's Coefficient for Open Channel Flow
- **P** Wetted perimeter of circular open channel (*Meter*)
- **q** Discharge Per Unit Width in Open Channel (*Square Meter per Second*)
- **R** Radius of Circular Open Channel (*Meter*)
- **v** Flow Velocity in Open Channel (*Meter per Second*)
- **V<sub>c</sub>** Critical Velocity for Flow in Open Channel (*Meter per Second*)
- **θ** Half Angle by Water Surface in Circular Channel (*Radian*)





## Constants, Functions, Measurements used

- **Constant:** **[g]**, 9.80665 Meter/Second<sup>2</sup>  
*Gravitational acceleration on Earth*
- **Function:** **sin**, sin(Angle)  
*Trigonometric sine function*
- **Function:** **sqrt**, sqrt(Number)  
*Square root function*
- **Measurement:** **Length** in Meter (m)  
*Length Unit Conversion* 
- **Measurement:** **Area** in Square Meter (m<sup>2</sup>)  
*Area Unit Conversion* 
- **Measurement:** **Speed** in Meter per Second (m/s)  
*Speed Unit Conversion* 
- **Measurement:** **Angle** in Radian (rad)  
*Angle Unit Conversion* 
- **Measurement:** **Kinematic Viscosity** in Square Meter per Second (m<sup>2</sup>/s)  
*Kinematic Viscosity Unit Conversion* 



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