

calculatoratoz.comunitsconverters.com

Gradually Varied Flow in Channels Formulas

[Calculators!](#)[Examples!](#)[Conversions!](#)

Bookmark calculatoratoz.com, unitsconverters.com

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**
Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**
Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

[Please leave your feedback here...](#)



List of 36 Gradually Varied Flow in Channels Formulas

Gradually Varied Flow in Channels

1) Area of Section given Energy Gradient

$$\text{fx } S = \left(Q_{\text{eg}}^2 \cdot \frac{T}{\left(1 - \left(\frac{i}{m}\right)\right) \cdot ([g])} \right)^{\frac{1}{3}}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$\text{ex } 4.007819\text{m}^2 = \left((12.5\text{m}^3/\text{s})^2 \cdot \frac{2\text{m}}{\left(1 - \left(\frac{2.02}{4}\right)\right) \cdot ([g])} \right)^{\frac{1}{3}}$$

2) Area of Section given Froude Number

$$\text{fx } S = \left(\left(Q_f^2 \cdot \frac{T}{[g] \cdot Fr^2} \right) \right)^{\frac{1}{3}}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$\text{ex } 3.997777\text{m}^2 = \left(\left((177\text{m}^3/\text{s})^2 \cdot \frac{2\text{m}}{[g] \cdot (10)^2} \right) \right)^{\frac{1}{3}}$$

3) Area of Section given Total Energy

$$\text{fx } S = \left(\frac{Q_f^2}{2 \cdot [g] \cdot (E_t - d_f)} \right)^{0.5}$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$\text{ex } 4.000068\text{m}^2 = \left(\frac{(177\text{m}^3/\text{s})^2}{2 \cdot [g] \cdot (103.13\text{J} - 3.3\text{m})} \right)^{0.5}$$



4) Bed Slope given Energy Slope of Rectangular channel

$$\text{fx } S_0 = \frac{S_f}{\left(\frac{C}{d_f}\right)^{\frac{10}{3}}}$$

Open Calculator 

$$\text{ex } 2.749304 = \frac{2.001}{\left(\frac{3\text{m}}{3.3\text{m}}\right)^{\frac{10}{3}}}$$

5) Bed Slope given Slope of Dynamic Equation of Gradually Varied Flow

$$\text{fx } S_0 = S_f + \left(m \cdot \left(1 - \left(F_{r(d)}^2\right)\right)\right)$$

Open Calculator 

$$\text{ex } 4.041 = 2.001 + \left(4 \cdot \left(1 - \left((0.7)^2\right)\right)\right)$$

6) Bottom Slope of Channel given Energy Gradient

$$\text{fx } S_0 = i + S_f$$

Open Calculator 

$$\text{ex } 4.021 = 2.02 + 2.001$$

7) Chezy Formula for Bed Slope given Energy Slope of Rectangular Channel

$$\text{fx } S_0 = \frac{S_f}{\left(\frac{C}{d_f}\right)^3}$$

Open Calculator 

$$\text{ex } 2.663331 = \frac{2.001}{\left(\frac{3\text{m}}{3.3\text{m}}\right)^3}$$



8) Chezy Formula for Depth of Flow given Energy Slope of Rectangular Channel

$$\text{fx } d_f = \frac{C}{\left(\frac{S_f}{S_0}\right)^{\frac{1}{3}}}$$

Open Calculator 

$$\text{ex } 3.779448\text{m} = \frac{3\text{m}}{\left(\frac{2.001}{4.001}\right)^{\frac{1}{3}}}$$

9) Chezy Formula for Normal Depth given Energy Slope of Rectangular Channel

$$\text{fx } C = \left(\left(\frac{S_f}{S_0}\right)^{\frac{1}{3}}\right) \cdot d_f$$

Open Calculator 

$$\text{ex } 2.61943\text{m} = \left(\left(\frac{2.001}{4.001}\right)^{\frac{1}{3}}\right) \cdot 3.3\text{m}$$

10) Depth of Flow given Energy Slope of Rectangular channel

$$\text{fx } d_f = \frac{C}{\left(\frac{S_f}{S_0}\right)^{\frac{3}{10}}}$$

Open Calculator 

$$\text{ex } 3.693156\text{m} = \frac{3\text{m}}{\left(\frac{2.001}{4.001}\right)^{\frac{3}{10}}}$$



11) Depth of Flow given Total Energy

[Open Calculator !\[\]\(bd1a142de767a21e5362c595f844a4ff_img.jpg\)](#)

$$\text{fx } d_f = E_t - \left(\frac{Q_f^2}{2 \cdot [g] \cdot S^2} \right)$$

$$\text{ex } 3.793897\text{m} = 103.13\text{J} - \left(\frac{(177\text{m}^3/\text{s})^2}{2 \cdot [g] \cdot (4.01\text{m}^2)^2} \right)$$

12) Discharge given Energy Gradient

[Open Calculator !\[\]\(830769b31eeeaca920791081939ff8ba_img.jpg\)](#)

$$\text{fx } Q_{eg} = \left(\left(\left(1 - \left(\frac{i}{m} \right) \right) \cdot \frac{[g] \cdot S^3}{T} \right) \right)^{0.5}$$

$$\text{ex } 12.51021\text{m}^3/\text{s} = \left(\left(\left(1 - \left(\frac{2.02}{4} \right) \right) \cdot \frac{[g] \cdot (4.01\text{m}^2)^3}{2m} \right) \right)^{0.5}$$

13) Discharge given Froude Number

[Open Calculator !\[\]\(47734e4656765d20df4fdbd5b7aff048_img.jpg\)](#)

$$\text{fx } Q_f = \frac{Fr}{\sqrt{\frac{T}{[g] \cdot S^3}}}$$

$$\text{ex } 177.8123\text{m}^3/\text{s} = \frac{10}{\sqrt{\frac{2m}{[g] \cdot (4.01\text{m}^2)^3}}}$$

14) Discharge given Total Energy

[Open Calculator !\[\]\(41aea2746216b27a6939d696d8e035da_img.jpg\)](#)

$$\text{fx } Q_f = \left((E_t - d_f) \cdot 2 \cdot [g] \cdot S^2 \right)^{0.5}$$

$$\text{ex } 177.4395\text{m}^3/\text{s} = \left((103.13\text{J} - 3.3\text{m}) \cdot 2 \cdot [g] \cdot (4.01\text{m}^2)^2 \right)^{0.5}$$



15) Energy Gradient given Bed Slope

fx $i = S_0 - S_f$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

ex $2 = 4.001 - 2.001$

16) Energy Gradient given Slope

fx $i = \left(1 - \left(Q_{eg}^2 \cdot \frac{T}{[g] \cdot S^3} \right) \right) \cdot m$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

ex $2.02323 = \left(1 - \left((12.5\text{m}^3/\text{s})^2 \cdot \frac{2\text{m}}{[g] \cdot (4.01\text{m}^2)^3} \right) \right) \cdot 4$

17) Froude Number given Slope of Dynamic Equation of Gradually Varied Flow

fx $F_{r(d)} = \sqrt{1 - \left(\frac{S_0 - S_f}{m} \right)}$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

ex $0.707107 = \sqrt{1 - \left(\frac{4.001 - 2.001}{4} \right)}$

18) Froude Number given Top Width

fx $Fr = \sqrt{Q_f^2 \cdot \frac{T}{[g] \cdot S^3}}$

[Open Calculator !\[\]\(5abce1a84a655b073239ab33e1199487_img.jpg\)](#)

ex $9.954315 = \sqrt{(177\text{m}^3/\text{s})^2 \cdot \frac{2\text{m}}{[g] \cdot (4.01\text{m}^2)^3}}$



19) Normal Depth given Energy Slope of Rectangular channel

$$fx \quad C = \left(\left(\frac{S_f}{S_0} \right)^{\frac{3}{10}} \right) \cdot d_f$$

[Open Calculator !\[\]\(9dfdaff1d86ba3c1f8353b4d1b61b8c5_img.jpg\)](#)

$$ex \quad 2.680634m = \left(\left(\frac{2.001}{4.001} \right)^{\frac{3}{10}} \right) \cdot 3.3m$$

20) Slope of Dynamic Equation of Gradually Varied Flow given Energy Gradient

$$fx \quad m = \frac{i}{1 - \left(Q_{eg}^2 \cdot \frac{T}{[g] \cdot S^3} \right)}$$

[Open Calculator !\[\]\(2b376d1a92330ab09dad2665d2f89bf5_img.jpg\)](#)

$$ex \quad 3.993615 = \frac{2.02}{1 - \left((12.5m^3/s)^2 \cdot \frac{2m}{[g] \cdot (4.01m^2)^3} \right)}$$

21) Slope of Dynamic Equation of Gradually Varied Flows

$$fx \quad m = \frac{S_0 - S_f}{1 - \left(F_{r(d)}^2 \right)}$$

[Open Calculator !\[\]\(c444627dab9fee9a1550c053ffaaaae2_img.jpg\)](#)

$$ex \quad 3.921569 = \frac{4.001 - 2.001}{1 - \left((0.7)^2 \right)}$$

22) Top Width given Energy Gradient

$$fx \quad T = \left(\left(1 - \left(\frac{i}{m} \right) \right) \right) \cdot \frac{[g] \cdot S^3}{Q_{eg}^2}$$

[Open Calculator !\[\]\(06a315363e7801bba8c7489a6694af19_img.jpg\)](#)

$$ex \quad 2.003268m = \left(\left(1 - \left(\frac{2.02}{4} \right) \right) \right) \cdot \frac{[g] \cdot (4.01m^2)^3}{(12.5m^3/s)^2}$$



23) Top Width given Froude Number

$$\text{fx } T = \frac{Fr^2 \cdot S^3 \cdot [g]}{Q_f^2}$$

[Open Calculator !\[\]\(6605b201d6f14d9b3bcb8ab5f274d107_img.jpg\)](#)

$$\text{ex } 2.0184\text{m} = \frac{(10)^2 \cdot (4.01\text{m}^2)^3 \cdot [g]}{(177\text{m}^3/\text{s})^2}$$

24) Total Energy of Flow

$$\text{fx } E_t = d_f + \frac{Q_f^2}{2 \cdot [g] \cdot S^2}$$

[Open Calculator !\[\]\(e8fb589d58dad1692debababa5e928b6_img.jpg\)](#)

$$\text{ex } 102.6361\text{J} = 3.3\text{m} + \frac{(177\text{m}^3/\text{s})^2}{2 \cdot [g] \cdot (4.01\text{m}^2)^2}$$

Energy Slope

25) Chezy Formula for Energy Slope of Rectangular Channel

$$\text{fx } S_f = S_0 \cdot \left(\frac{C}{d_f} \right)^3$$

[Open Calculator !\[\]\(e9474ce1d70442456f8fe9c393ea149c_img.jpg\)](#)

$$\text{ex } 3.006011 = 4.001 \cdot \left(\frac{3\text{m}}{3.3\text{m}} \right)^3$$

26) Energy Slope given Slope of Dynamic Equation of Gradually Varied Flow

$$\text{fx } S_f = S_0 - \left(m \cdot \left(1 - \left(F_{r(d)}^2 \right) \right) \right)$$

[Open Calculator !\[\]\(9db214d549b9aeebe72aa11d3a5c4b1a_img.jpg\)](#)

$$\text{ex } 1.961 = 4.001 - \left(4 \cdot \left(1 - \left((0.7)^2 \right) \right) \right)$$



27) Energy Slope of Channel given Energy Gradient

fx $S_f = S_0 - i$

[Open Calculator !\[\]\(c3d993ca47bfe2a953c700506ce31fa0_img.jpg\)](#)

ex $1.981 = 4.001 - 2.02$

28) Energy Slope of Rectangular channel

fx $S_f = S_0 \cdot \left(\frac{C}{d_f} \right)^{\frac{10}{3}}$

[Open Calculator !\[\]\(17413706fd4997a1a4bdf85c6864eee1_img.jpg\)](#)

ex $2.91201 = 4.001 \cdot \left(\frac{3m}{3.3m} \right)^{\frac{10}{3}}$

Wide Rectangular Channel

29) Bed Slope of Channel given Slope of Dynamic Equation of Gradually Varied Flow

fx $S_0 = \frac{m}{\left(\frac{1 - \left(\left(\frac{y}{d_f} \right)^{\frac{10}{3}} \right)}{1 - \left(\left(\frac{h_c}{d_f} \right)^3 \right)} \right)}$

[Open Calculator !\[\]\(95b425611cbd2b8716a140cf67c81822_img.jpg\)](#)

ex $4.190987 = \frac{4}{\left(\frac{1 - \left(\left(\frac{1.5m}{3.3m} \right)^{\frac{10}{3}} \right)}{1 - \left(\left(\frac{1.001m}{3.3m} \right)^3 \right)} \right)}$



30) Bed Slope of Channel given Slope of Dynamic Equation of GVF through Chezy formula

$$\text{fx } S_0 = \frac{m}{\left(\frac{1 - \left(\left(\frac{y}{d_f} \right)^3 \right)}{1 - \left(\left(\left(\frac{h_c}{d_f} \right)^3 \right) \right)} \right)}$$

Open Calculator 

$$\text{ex } 4.291382 = \frac{4}{\left(\frac{1 - \left(\left(\frac{1.5\text{m}}{3.3\text{m}} \right)^3 \right)}{1 - \left(\left(\left(\frac{1.001\text{m}}{3.3\text{m}} \right)^3 \right) \right)} \right)}$$

31) Chezy Formula for Critical Depth of Channel given Slope of Dynamic Equation of GVF

$$\text{fx } H_C = \left(\left(\left(1 - \left(\left(\frac{1 - \left(\left(\frac{y}{d_f} \right)^3 \right)}{\frac{m}{S_0}} \right) \right) \right)^{\frac{1}{3}} \right) \right) \cdot d_f$$

Open Calculator 

$$\text{ex } 0.106454\text{m} = \left(\left(\left(1 - \left(\left(\frac{1 - \left(\left(\frac{1.5\text{m}}{3.3\text{m}} \right)^3 \right)}{\frac{4}{4.001}} \right) \right) \right)^{\frac{1}{3}} \right) \right) \cdot 3.3\text{m}$$



32) Chezy Formula for Normal Depth of Channel given Slope of Dynamic Equation of GVF

fxOpen Calculator 

$$y = \left(\left(1 - \left(\left(\frac{m}{S_0} \right) \cdot \left(\left(1 - \left(\left(\left(\frac{h_c}{d_f} \right)^3 \right) \right) \right) \right) \right) \right)^{\frac{1}{3}} \right) \cdot d_f$$

ex

$$1.003896\text{m} = \left(\left(1 - \left(\left(\frac{4}{4.001} \right) \cdot \left(\left(1 - \left(\left(\left(\frac{1.001\text{m}}{3.3\text{m}} \right)^3 \right) \right) \right) \right) \right)^{\frac{1}{3}} \right) \cdot 3.3\text{m}$$

33) Chezy Formula for Slope of Dynamic Equation of Gradually Varied Flow

fxOpen Calculator 

$$m = S_0 \cdot \left(\frac{1 - \left(\left(\frac{y}{d_f} \right)^3 \right)}{1 - \left(\left(\left(\frac{h_c}{d_f} \right)^3 \right) \right)} \right)$$

ex

$$3.729335 = 4.001 \cdot \left(\frac{1 - \left(\left(\frac{1.5\text{m}}{3.3\text{m}} \right)^3 \right)}{1 - \left(\left(\left(\frac{1.001\text{m}}{3.3\text{m}} \right)^3 \right) \right)} \right)$$



34) Critical Depth of Channel given Slope of Dynamic Equation of Gradually Varied Flow

[Open Calculator !\[\]\(dfbd6b3763a6d1d9afaa974f64e2e4b5_img.jpg\)](#)

$$fx \quad H_C = \left(\left(1 - \left(\frac{1 - \left(\left(\frac{y}{d_f} \right)^{\frac{10}{3}} \right)}{\frac{m}{S_0}} \right) \right)^{\frac{1}{3}} \right) \cdot d_f$$

$$ex \quad 0.081154m = \left(\left(1 - \left(\frac{1 - \left(\left(\frac{1.5m}{3.3m} \right)^{\frac{10}{3}} \right)}{\frac{4}{4.001}} \right) \right)^{\frac{1}{3}} \right) \cdot 3.3m$$

35) Normal Depth of Channel given Slope of Dynamic Equation of Gradually Varied Flow

[Open Calculator !\[\]\(ec9132f1d27c8919987d92907322654d_img.jpg\)](#)

$$y = \left(\left(1 - \left(\left(\frac{m}{S_0} \right) \cdot \left(1 - \left(\left(\left(\frac{h_c}{d_f} \right)^3 \right) \right) \right) \right) \right)^{\frac{3}{10}} \right) \cdot d_f$$

$$ex \quad 1.130762m = \left(\left(1 - \left(\left(\frac{4}{4.001} \right) \cdot \left(1 - \left(\left(\left(\frac{1.001m}{3.3m} \right)^3 \right) \right) \right) \right) \right)^{\frac{3}{10}} \right) \cdot 3.3m$$



36) Slope of Dynamic Equations of Gradually Varied Flow [Open Calculator](#) 

$$\text{fx } m = S_0 \cdot \left(\frac{1 - \left(\left(\frac{y}{d_f} \right)^{\frac{10}{3}} \right)}{1 - \left(\left(\frac{h_c}{d_f} \right)^3 \right)} \right)$$

$$\text{ex } 3.818671 = 4.001 \cdot \left(\frac{1 - \left(\left(\frac{1.5\text{m}}{3.3\text{m}} \right)^{\frac{10}{3}} \right)}{1 - \left(\left(\frac{1.001\text{m}}{3.3\text{m}} \right)^3 \right)} \right)$$



Variables Used

- **C** Critical Depth of Channel (Meter)
- **d_f** Depth of Flow (Meter)
- **E_t** Total Energy in Open Channel (Joule)
- **F_{r(d)}** Froude No by Dynamic Equation
- **Fr** Froude Number
- **h_C** Critical Depth of Weir (Meter)
- **H_C** Critical Depth of Channel GVF Flow (Meter)
- **i** Hydraulic Gradient to Head Loss
- **m** Slope of Line
- **Q_{eg}** Discharge by Energy Gradient (Cubic Meter per Second)
- **Q_f** Discharge for GVF Flow (Cubic Meter per Second)
- **S** Wetted Surface Area (Square Meter)
- **S₀** Bed Slope of Channel
- **S_f** Energy Slope
- **T** Top Width (Meter)
- **y** Normal Depth (Meter)



Constants, Functions, Measurements used

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



Check other formula lists

- **Gradually Varied Flow in Channels Formulas** 

Feel free to SHARE this document with your friends!

PDF Available in

[English](#) [Spanish](#) [French](#) [German](#) [Russian](#) [Italian](#) [Portuguese](#) [Polish](#) [Dutch](#)

2/1/2024 | 4:10:48 PM UTC

[Please leave your feedback here...](#)

