



Laminar Flow between Parallel Plates, both plates at rest Formulas

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Examples!

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List of 30 Laminar Flow between Parallel Plates, both plates at rest Formulas

Laminar Flow between Parallel Plates, both plates at rest

1) Discharge given Mean Velocity of Flow



Open Calculator 🗗

$$m ex \ 97.2m^3/s = 3m \cdot 32.4m/s$$

 $\mathbf{f} \mathbf{x} \, \mathbf{Q} = \mathbf{w} \cdot \mathbf{V}_{\mathrm{mean}}$

2) Discharge given Viscosity

$$extstyle Q = ext{dp} | ext{dr} \cdot rac{ ext{w}^3}{12 \cdot ext{$\mu_{ ext{viscosity}}$}} |$$

Open Calculator 🚰

ex
$$37.5 \text{m}^3/\text{s} = 17 \text{N/m}^3 \cdot \frac{(3\text{m})^3}{12 \cdot 10.2 \text{P}}$$

3) Distance between Plates given Discharge

$$\mathbf{x} = \left(rac{Q \cdot 12 \cdot \mu_{viscosity}}{dp | dr}
ight)^{rac{1}{3}}$$

ex
$$3.408514 \mathrm{m} = \left(\frac{55 \mathrm{m}^3/\mathrm{s} \cdot 12 \cdot 10.2 \mathrm{P}}{17 \mathrm{N/m}^3} \right)^{\frac{1}{3}}$$





4) Distance between Plates given Maximum Velocity between Plates 🖸



Open Calculator 2

$$\mathbf{w} = \sqrt{rac{8 \cdot \mu_{viscosity} \cdot V_{max}}{dp|dr}}$$

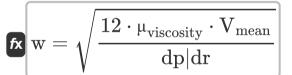
ex
$$2.987976 m = \sqrt{\frac{8 \cdot 10.2 P \cdot 18.6 m/s}{17 N/m^3}}$$

5) Distance between Plates given Mean Velocity of Flow

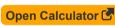


$$ext{ex} 1.697531 ext{m} = rac{55 ext{m}^3/ ext{s}}{32.4 ext{m/s}}$$

6) Distance between Plates given Mean Velocity of Flow with Pressure Gradient 🔽



$$= \sqrt{\frac{12 \cdot 10.2 P \cdot 32.4 m/s}{17 N/m^3}}$$







7) Distance between Plates given Pressure Difference

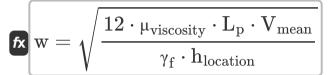
 $\mathbf{w} = \sqrt{12 \cdot V_{\mathrm{mean}} \cdot \mu_{\mathrm{viscosity}} \cdot rac{L_{\mathrm{p}}}{\Lambda \, \mathbf{p}}}$

Open Calculator

V Second Viscosity
$$\Delta P$$

ex
$$1.726782 \mathrm{m} = \sqrt{12 \cdot 32.4 \mathrm{m/s} \cdot 10.2 \mathrm{P} \cdot \frac{0.10 \mathrm{m}}{13.3 \mathrm{N/m^2}}}$$

8) Distance between Plates given Pressure Head Drop



Open Calculator

ex
$$1.458653 \mathrm{m} = \sqrt{rac{12 \cdot 10.2 \mathrm{P} \cdot 0.10 \mathrm{m} \cdot 32.4 \mathrm{m/s}}{9.81 \mathrm{kN/m^3} \cdot 1.9 \mathrm{m}}}$$

9) Distance between Plates given Shear Stress Distribution Profile

$$\mathbf{x} = 2 \cdot \left(\mathrm{R} - \left(rac{ au}{\mathrm{dp} | \mathrm{dr}}
ight)
ight)$$

$$extbf{ex} \left[2.847059 ext{m} = 2 \cdot \left(6.9 ext{m} - \left(rac{93.1 ext{Pa}}{17 ext{N/m}^3}
ight)
ight)$$



10) Distance between Plates using Velocity Distribution Profile

 $\mathbf{f}\mathbf{x} = rac{\left(rac{-\mathrm{v}\cdot 2\cdot \mu_{\mathrm{viscosity}}}{\mathrm{dp}|\mathrm{dr}}
ight) + \left(\mathrm{R}^2
ight)}{\mathrm{R}}$

Open Calculator

 $extbf{ex} 5.829217 ext{m} = rac{\left(rac{-61.57 ext{m/s} \cdot 2 \cdot 10.2 ext{P}}{17 ext{N/m}^3}
ight) + \left(\left(6.9 ext{m}
ight)^2
ight)}{6.9 ext{m}}$

11) Horizontal Distance given Shear Stress Distribution Profile

 $ext{R} = rac{ ext{w}}{2} + \left(rac{ au}{ ext{dp}| ext{dr}}
ight)$

Open Calculator 🗗

 $ext{ex} \left[6.976471 ext{m} = rac{3 ext{m}}{2} + \left(rac{93.1 ext{Pa}}{17 ext{N/m}^3}
ight)
ight]$

12) Length of Pipe given Pressure Difference

 $\mathbf{L}_{\mathrm{p}} = rac{\Delta \mathrm{P} \cdot \mathrm{w} \cdot \mathrm{w}}{\mu_{\mathrm{viscosity}} \cdot 12 \cdot \mathrm{V}_{\mathrm{mean}}}$

Open Calculator 🗗

 $= \frac{13.3 \text{N/m}^2 \cdot 3 \text{m} \cdot 3 \text{m}}{10.2 \text{P} \cdot 12 \cdot 32.4 \text{m/s}}$



13) Length of Pipe given Pressure Head Drop

 $\mathrm{L_p} = rac{\gamma_{\mathrm{f}} \cdot \mathrm{w} \cdot \mathrm{w} \cdot \mathrm{h_{location}}}{12 \cdot \mu_{\mathrm{viscosity}} \cdot \mathrm{V_{mean}}}$

Open Calculator

 $= \frac{0.422998 m}{12 \cdot 10.2 P \cdot 32.4 m/s}$

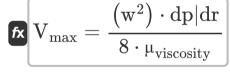
14) Maximum Shear Stress in fluid

fx $au_{
m smax} = 0.5 \cdot {
m dp} |{
m dr} \cdot {
m w}|$

Open Calculator

 $ext{ex} \ 25.5 ext{N/mm}^2 = 0.5 \cdot 17 ext{N/m}^3 \cdot 3 ext{m}$

15) Maximum Velocity between Plates



Open Calculator

ex $18.75 ext{m/s} = rac{\left((3 ext{m})^2 \right) \cdot 17 ext{N/m}^3}{8 \cdot 10.2 ext{P}}$

16) Maximum Velocity given Mean Velocity of Flow

fx $V_{
m max} = 1.5 \cdot V_{
m mean}$

Open Calculator

 $ext{ex} ext{ } 48.6 ext{m/s} = 1.5 \cdot 32.4 ext{m/s}$





17) Pressure Difference

Open Calculator

Open Calculator

Open Calculator 2

 $\Delta P = 12 \cdot \mu_{
m viscosity} \cdot V_{
m mean} \cdot rac{L_{
m p}}{
m w^2}$

 $ext{ex} \left[4.4064 ext{N/m}^2 = 12 \cdot 10.2 ext{P} \cdot 32.4 ext{m/s} \cdot rac{0.10 ext{m}}{\left(3 ext{m}
ight)^2}
ight]$

18) Pressure Head Drop

 $\mathbf{f_{k}} \mathbf{h}_{\mathrm{location}} = rac{12 \cdot \mu_{\mathrm{viscosity}} \cdot L_{\mathrm{p}} \cdot V_{\mathrm{mean}}}{\gamma_{\mathrm{f}}}$

 $4.042569 \mathrm{m} = rac{12 \cdot 10.2 \mathrm{P} \cdot 0.10 \mathrm{m} \cdot 32.4 \mathrm{m/s}}{9.81 \mathrm{kN/m^3}}$

19) Shear Stress Distribution Profile

 $au = -\mathrm{dp} |\mathrm{dr} \cdot \left(rac{\mathrm{w}}{2} - \mathrm{R}
ight)$

 $ext{ex} 91.8 ext{Pa} = -17 ext{N/m}^3 \cdot \left(rac{3 ext{m}}{2} - 6.9 ext{m}
ight)$



20) Velocity Distribution Profile

fx

Open Calculator 2

$$\left[v = - \left(rac{1}{2 \cdot \mu_{
m viscosity}}
ight) \cdot dp | dr \cdot \left(w \cdot R - \left(R^2
ight)
ight)
ight]$$

$$224.25 \mathrm{m/s} = - \left(\frac{1}{2 \cdot 10.2 \mathrm{P}}\right) \cdot 17 \mathrm{N/m^3} \cdot \left(3 \mathrm{m} \cdot 6.9 \mathrm{m} - \left(\left(6.9 \mathrm{m}\right)^2\right)\right)$$

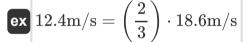
Mean Velocity of Flow G

21) Mean Velocity of Flow given Maximum Velocity



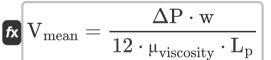
$$V_{
m mean} = \left(rac{2}{3}
ight) \cdot V_{
m max}$$

Open Calculator



22) Mean Velocity of Flow given Pressure Difference 🗗





$$ext{ex} \ 32.59804 ext{m/s} = rac{13.3 ext{N/m}^2 \cdot 3 ext{m}}{12 \cdot 10.2 ext{P} \cdot 0.10 ext{m}}$$





23) Mean Velocity of Flow given Pressure Gradient

 $V_{
m mean} = \left(rac{w^2}{12 \cdot \mu_{
m viscosity}}
ight) \cdot dp |dr|$

Open Calculator 🗗

 $oxed{ex} 12.5 \mathrm{m/s} = \left(rac{\left(3\mathrm{m}
ight)^2}{12\cdot 10.2 \mathrm{P}}
ight) \cdot 17 \mathrm{N/m^3}$

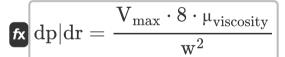
24) Mean Velocity of Flow given Pressure Head Drop

 $V_{
m mean} = rac{\Delta P \cdot S \cdot \left(D_{
m pipe}^2
ight)}{12 \cdot \mu_{
m viscosity} \cdot L_{
m p}}$

Open Calculator

Pressure Gradient

25) Pressure Gradient given Maximum Velocity between Plates



Open Calculator

 $ext{ex} 16.864 ext{N/m}^{_3} = rac{18.6 ext{m/s} \cdot 8 \cdot 10.2 ext{P}}{(3 ext{m})^2}$



26) Pressure Gradient given Shear Stress Distribution Profile

 $d\mathbf{p}|d\mathbf{r} = -rac{ au}{rac{\mathrm{w}}{2} - \mathrm{R}}$

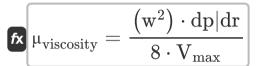
Open Calculator

 $\frac{\frac{\mathsf{w}}{2}-\mathsf{R}}{\mathsf{R}}$

ex $17.24074 \mathrm{N/m^3} = -rac{93.1 \mathrm{Pa}}{rac{3\mathrm{m}}{2} - 6.9 \mathrm{m}}$

Dynamic Viscosity

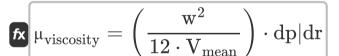
27) Dynamic Viscosity given Maximum Velocity between Plates



Open Calculator 🗗

ex $10.28226P = \frac{\left((3m)^2\right) \cdot 17N/m^3}{8 \cdot 18.6m/s}$

28) Dynamic Viscosity given Mean Velocity of Flow with Pressure Gradient



$$oxed{ex} 3.935185 \mathrm{P} = \left(rac{(3\mathrm{m})^2}{12 \cdot 32.4 \mathrm{m/s}}
ight) \cdot 17 \mathrm{N/m^3}$$



29) Dynamic Viscosity given Pressure Difference

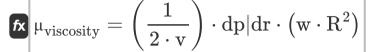


Open Calculator 2

$$\mu_{
m viscosity} = rac{\Delta P \cdot w}{12 \cdot V_{
m mean} \cdot L_{
m p}}$$

$$ext{ex} 10.26235 ext{P} = rac{13.3 ext{N/m}^2 \cdot 3 ext{m}}{12 \cdot 32.4 ext{m/s} \cdot 0.10 ext{m}}$$

30) Dynamic Viscosity using Velocity Distribution Profile 🖸





Variables Used

- Dpipe Diameter of Pipe (Meter)
- **dp|dr** Pressure Gradient (Newton per Cubic Meter)
- h_{location} Head Loss due to Friction (Meter)
- L_p Length of Pipe (Meter)
- Q Discharge in Laminar Flow (Cubic Meter per Second)
- R Horizontal Distance (Meter)
- S Specific Weight of Liquid in Piezometer (Kilonewton per Cubic Meter)
- **v** Velocity of Liquid (Meter per Second)
- V_{max} Maximum Velocity (Meter per Second)
- V_{mean} Mean Velocity (Meter per Second)
- **w** Width (Meter)
- γ_f Specific Weight of Liquid (Kilonewton per Cubic Meter)
- ΔP Pressure Difference (Newton per Square Meter)
- µ_{viscosity} Dynamic Viscosity (Poise)
- T_{smax} Maximum Shear Stress in Shaft (Newton per Square Millimeter)
- τ Shear Stress (Pascal)





Constants, Functions, Measurements used

- Function: sqrt, sqrt(Number) Square root function
- Measurement: Length in Meter (m) Length Unit Conversion
- Measurement: Pressure in Newton per Square Meter (N/m²) Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s) Speed Unit Conversion
- Measurement: Volumetric Flow Rate in Cubic Meter per Second (m³/s) Volumetric Flow Rate Unit Conversion
- Measurement: Dynamic Viscosity in Poise (P) Dynamic Viscosity Unit Conversion
- Measurement: Specific Weight in Kilonewton per Cubic Meter (kN/m³) Specific Weight Unit Conversion
- Measurement: Pressure Gradient in Newton per Cubic Meter (N/m³) Pressure Gradient Unit Conversion
- Measurement: Stress in Pascal (Pa), Newton per Square Millimeter (N/mm²)







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- Laminar Flow around a Sphere-Stokes' Law Formulas [
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- **Laminar Flow between Parallel** Plates, both plates at rest

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