



Flow Over Sphere Formulas

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List of 20 Flow Over Sphere Formulas

Flow Over Sphere **C**

Pressure Coefficient 2

1) Polar Coordinate given Surface Pressure Coefficient

$$ag{6} ag{1} ag{2} ag{2}$$

Open Calculator 🗗

ex
$$0.302746$$
rad = $a \sin \left(\sqrt{\frac{4}{9} \cdot (1 - 0.8)} \right)$

- 2) Surface Pressure Coefficient for Flow over Sphere
- $\left|\mathbf{C}_{\mathrm{p}}=1-rac{9}{4}\cdot\left(\sin(heta)
 ight)^{2}
 ight|$

Open Calculator

$$0.066213 = 1 - rac{9}{4} \cdot \left(\sin(0.7 ext{rad})
ight)^2$$

Radial Velocity 2

3) Doublet Strength given Radial Velocity 🗗

$$\mu = 2 \cdot \pi \cdot \mathrm{r}^3 \cdot \left(\mathrm{V}_{\infty} + rac{\mathrm{V}_{\mathrm{r}}}{\cos(heta)}
ight)$$

Open Calculator 🚰

$$ext{ex} \left[9997.426 ext{m}^3/ ext{s} = 2 \cdot \pi \cdot \left(2.758 ext{m}
ight)^3 \cdot \left(68 ext{m/s} + rac{6 ext{m/s}}{\cos(0.7 ext{rad})}
ight)$$

4) Freestream Velocity given Radial Velocity

$$V_{\infty} = rac{\mu}{2 \cdot \pi \cdot \mathrm{r}^3} - rac{V_{\mathrm{r}}}{\cos(heta)}$$

Open Calculator 🗗

ex
$$68.01953 \mathrm{m/s} = \frac{10000 \mathrm{m}^3/\mathrm{s}}{2 \cdot \pi \cdot (2.758 \mathrm{m})^3} - \frac{6 \mathrm{m/s}}{\cos(0.7 \mathrm{rad})}$$

5) Polar Coordinate given Radial Velocity

$$heta = a \cos igg(rac{{
m V_r}}{rac{\mu}{2 \cdot \pi \cdot {
m r}^3} - {
m V_{\infty}}} igg)$$

Open Calculator 🛂

$$ext{ex} \ 0.702943 ext{rad} = a \cos \left(rac{6 ext{m/s}}{rac{10000 ext{m}^3/ ext{s}}{2 \cdot \pi \cdot (2.758 ext{m})^3} - 68 ext{m/s}}
ight)$$





6) Radial Coordinate given Radial Velocity

 $\mathbf{r} = \left(rac{\mu}{2 \cdot \pi \cdot \left(V_{\infty} + rac{V_{\mathrm{r}}}{\cos(heta)}
ight)}
ight)^{rac{1}{3}}$

Open Calculator

ex $2.758237 \mathrm{m} = \left(rac{10000 \mathrm{m}^3/\mathrm{s}}{2 \cdot \pi \cdot \left(68 \mathrm{m/s} + rac{6 \mathrm{m/s}}{\cos(0.7 \mathrm{rad})}
ight)}
ight)^{rac{1}{3}}$

7) Radial Velocity for Flow over Sphere

 $\left| \mathbf{K}
ight| V_{
m r} = - \left(V_{\infty} - rac{\mu}{2 \cdot \pi \cdot {
m r}^3}
ight) \cdot \cos(heta) \, .$

Open Calculator

 $= \frac{6.014934 \text{m/s} - \left(68 \text{m/s} - \frac{10000 \text{m}^3/\text{s}}{2 \cdot \pi \cdot (2.758 \text{m})^3}\right) \cdot \cos(0.7 \text{rad}) }{2 \cdot \pi \cdot (2.758 \text{m})^3}$

Stagnation Point

- 8) Doublet Strength given Radial Coordinate of Stagnation Point
- fx $\mu = 2 \cdot \pi \cdot V_{\infty} \cdot R_{s}^{3}$

Open Calculator 🗗

 $ext{ex} \ 738.2994 ext{m}^3/ ext{s} = 2 \cdot \pi \cdot 68 ext{m/s} \cdot (1.2 ext{m})^3$



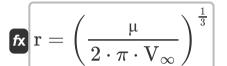
9) Freestream Velocity at Stagnation Point for Flow over Sphere

 $\left| \mathbf{V}_{\infty} = rac{\mu}{2 \cdot \pi \cdot \mathrm{R_s^3}}
ight|$

Open Calculator 🗗

$$\texttt{ex} \ 921.0356 \text{m/s} = \frac{10000 \text{m}^3/\text{s}}{2 \cdot \pi \cdot \left(1.2 \text{m}\right)^3}$$

10) Radial Coordinate of Stagnation Point for Flow over Sphere



Open Calculator

$$=$$
 $2.860468 ext{m} = \left(rac{10000 ext{m}^3/ ext{s}}{2 \cdot \pi \cdot 68 ext{m/s}}
ight)^{rac{1}{3}}$

Surface Velocity over Sphere 🗗

11) Freestream Velocity given Maximum Surface Velocity

$$V_{\infty} = rac{2}{3} \cdot V_{
m s,max}$$

$$oxed{ex} 16.66667 ext{m/s} = rac{2}{3} \cdot 25 ext{m/s}$$



12) Freestream Velocity given Surface Velocity for Flow over Sphere 🖒

 $\left| \mathbf{V}_{\infty}
ight| = rac{2}{3} \cdot rac{V_{ heta}}{\sin(heta)}$

Open Calculator 🗗

 $60.02112 \text{m/s} = \frac{2}{3} \cdot \frac{58 \text{m/s}}{\sin(0.7 \text{rad})}$

13) Maximum Surface Velocity for Flow over Sphere

 $\left[V_{
m s,max} = rac{3}{2} \cdot V_{\infty}
ight]$

Open Calculator 🗗

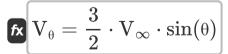
 $\boxed{102 \text{m/s} = \frac{3}{2} \cdot 68 \text{m/s}}$

14) Polar Coordinate given Surface Velocity for Flow over Sphere

 $heta = a \sin\!\left(rac{2}{3}\cdotrac{{
m V}_{ heta}}{{
m V}_{\infty}}
ight)$

Open Calculator 🗗

15) Surface Velocity for Incompressible Flow over Sphere



Open Calculator

 $= \frac{3}{2} \cdot 68 \text{m/s} \cdot \sin(0.7 \text{rad})$





Tangential Velocity &

16) Doublet Strength given Tangential Velocity

 $\left|\mathbf{r} = 4 \cdot \mathbf{\pi} \cdot \mathbf{r}^3 \cdot \left(rac{\mathrm{V}_{ heta}}{\sin(heta)} - \mathrm{V}_{\infty}
ight)
ight|$

Open Calculator 🗗

 $ext{ex} \left[5808.182 ext{m}^3/ ext{s} = 4 \cdot \pi \cdot \left(2.758 ext{m}
ight)^3 \cdot \left(rac{58 ext{m/s}}{\sin(0.7 ext{rad})} - 68 ext{m/s}
ight)
ight]$

17) Freestream Velocity given Tangential Velocity

 $\left| \mathrm{V}_{\infty}
ight| = rac{\mathrm{V}_{\mathrm{ heta}}}{\sin(\mathrm{ heta})} - rac{\mathrm{\mu}}{4 \cdot \pi \cdot \mathrm{r}^3}$

Open Calculator 🗗

 $ext{ex} \ 52.09954 ext{m/s} = rac{58 ext{m/s}}{\sin(0.7 ext{rad})} - rac{10000 ext{m}^3/ ext{s}}{4 \cdot \pi \cdot (2.758 ext{m})^3}$

18) Polar Coordinate given Tangential Velocity

 $ag{k} = a \sin igg(rac{{
m V}_{
m heta}}{{
m V}_{\infty} + rac{\mu}{4 \cdot \pi \cdot {
m r}^3}} igg)$

Open Calculator

 $oxed{ex} 0.579398 {
m rad} = a \sin \left(rac{58 {
m m/s}}{68 {
m m/s} + rac{10000 {
m m}^3/{
m s}}{4 \cdot \pi \cdot (2.758 {
m m})^3}}
ight)$



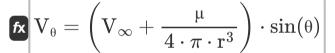
19) Radial Coordinate given Tangential Velocity

Open Calculator

$$\mathbf{f}$$
 $\mathbf{r} = \left(rac{\mu}{4 \cdot \pi \cdot \left(rac{V_{ heta}}{\sin(heta)} - V_{\infty}
ight)}
ight)^{rac{1}{3}}$

$$\mathbf{ex} \ 3.305579 \mathrm{m} = \left(\frac{10000 \mathrm{m}^3/\mathrm{s}}{4 \cdot \pi \cdot \left(\frac{58 \mathrm{m/s}}{\sin(0.7 \mathrm{rad})} - 68 \mathrm{m/s} \right)} \right)^{\frac{1}{3}}$$

20) Tangential Velocity for Flow over Sphere 🖸



Open Calculator

ex
$$68.24336 \text{m/s} = \left(68 \text{m/s} + \frac{10000 \text{m}^3/\text{s}}{4 \cdot \pi \cdot (2.758 \text{m})^3}\right) \cdot \sin(0.7 \text{rad})$$



Variables Used

- C_p Pressure Coefficient
- r Radial Coordinate (Meter)
- R_s Radius of Sphere (Meter)
- V_∞ Freestream Velocity (Meter per Second)
- **V**_r Radial Velocity (Meter per Second)
- V_{s.max} Maximum Surface Velocity (Meter per Second)
- V_A Tangential Velocity (Meter per Second)
- θ Polar Angle (Radian)
- µ Doublet Strength (Cubic Meter per Second)





Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- Function: acos, acos(Number)

 Inverse trigonometric cosine function
- Function: asin, asin(Number)
 Inverse trigonometric sine function
- Function: cos, cos(Angle)
 Trigonometric cosine function
- Function: sin, sin(Angle)
 Trigonometric sine function
- Function: sqrt, sqrt(Number)
 Square root function
- Measurement: Length in Meter (m)
 Length Unit Conversion
- Measurement: Speed in Meter per Second (m/s)
 Speed Unit Conversion
- Measurement: Angle in Radian (rad)
 Angle Unit Conversion
- Measurement: Volumetric Flow Rate in Cubic Meter per Second (m³/s)

 Volumetric Flow Rate Unit Conversion





Check other formula lists

• Flow Over Sphere Formulas

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