



Lift Distribution 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 30 Lift Distribution Formulas

Lift Distribution

Elliptical Lift Distribution

1) Aspect Ratio given Induced Angle of Attack

$$oldsymbol{\Lambda} ext{AR}_{ ext{ELD}} = rac{ ext{C}_{ ext{L,ELD}}}{\pi \cdot lpha_{ ext{i}}}$$

Open Calculator 🗗

$$\boxed{2.470395 = \frac{1.49}{\pi \cdot 11^\circ}}$$

2) Aspect Ratio given Induced Drag Coefficient

$$extstyle extstyle ext$$

Open Calculator



3) Circulation at given Distance along Wingspan

 $\Gamma = \Gamma_{
m o} \cdot \sqrt{1 - \left(2 \cdot rac{
m a}{
m b}
ight)^2}$

Open Calculator 🖸

ex $13.99862 \mathrm{m}^2/\mathrm{s} = 14 \mathrm{m}^2/\mathrm{s} \cdot \sqrt{1 - \left(2 \cdot \frac{16.4 \mathrm{mm}}{2340 \mathrm{mm}}\right)^2}$

V (2540)

4) Circulation at Origin given Downwash

fx $\Gamma_{
m o} = -2 \cdot {
m w} \cdot {
m b}$

Open Calculator

ex $14.04 \mathrm{m^2/s} = -2 \cdot -3 \mathrm{m/s} \cdot 2340 \mathrm{mm}$

5) Circulation at Origin given Induced Angle of Attack

fx $\Gamma_{
m o} = 2 \cdot {
m b} \cdot {
m a_i} \cdot {
m V}_{\infty}$

Open Calculator 🚰

 $ext{ex} 13.92668 ext{m}^2/ ext{s} = 2 \cdot 2340 ext{mm} \cdot 11\degree \cdot 15.5 ext{m/s}$

6) Circulation at Origin given Lift of Wing

 $\Gamma_{
m o} = 4 \cdot rac{{
m F_L}}{
ho_{\infty} \cdot {
m V}_{\infty} \cdot {
m b} \cdot \pi}$

Open Calculator

 $ag{488.8N} = 14.0074 ext{m}^2/ ext{s} = 4 \cdot rac{488.8 ext{N}}{1.225 ext{kg/m}^3 \cdot 15.5 ext{m/s} \cdot 2340 ext{mm} \cdot \pi}$



7) Circulation at Origin in Elliptical Lift Distribution

 $oxed{\Gamma_{
m o} = 2 \cdot {
m V}_{\infty} \cdot {
m S}_0 \cdot rac{{
m C}_{
m l}}{\pi \cdot {
m b}}}$

Open Calculator

ex $13.97911 \mathrm{m}^2/\mathrm{s} = 2 \cdot 15.5 \mathrm{m/s} \cdot 2.21 \mathrm{m}^2 \cdot \frac{1.5}{\pi \cdot 2340 \mathrm{mm}}$

8) Coefficient of Lift given Circulation at Origin

 $oldsymbol{\Gamma_{
m L,ELD}} = \pi \cdot {
m b} \cdot rac{\Gamma_{
m o}}{2 \cdot {
m V}_{\infty} \cdot {
m S}_0}$

Open Calculator

 $ext{ex} 1.502242 = \pi \cdot 2340 ext{mm} \cdot rac{14 ext{m}^2/ ext{s}}{2 \cdot 15.5 ext{m/s} \cdot 2.21 ext{m}^2}$

- 9) Coefficient of Lift given Induced Angle of Attack
- fx $ext{C}_{ ext{L,ELD}} = \pi \cdot lpha_{ ext{i}} \cdot ext{AR}_{ ext{ELD}}$

Open Calculator 🗗

ex $1.495793 = \pi \cdot 11\degree \cdot 2.48$

10) Coefficient of Lift given Induced Drag Coefficient

fx $C_{
m L,ELD} = \sqrt{\pi \cdot AR_{
m ELD} \cdot C_{
m D,i,ELD}}$

Open Calculator

 $\mathbf{ex} \, \big| \, 1.497949 = \sqrt{\pi \cdot 2.48 \cdot 0.288} \,$



11) Downwash in Elliptical Lift Distribution

 $\left[\mathbf{w} = -rac{\Gamma_{
m o}}{2\cdot {
m b}}
ight]$

Open Calculator 🚰

 $ext{ex} ext{-}2.991453 ext{m/s} = -rac{14 ext{m}^2/ ext{s}}{2 \cdot 2340 ext{mm}}$

12) Freestream Velocity given Circulation at Origin

 $V_{\infty} = \pi \cdot {
m b} \cdot rac{\Gamma_{
m o}}{2 \cdot {
m S}_0 \cdot {
m C}_{
m L,ELD}}$

Open Calculator

ex $15.62735 \mathrm{m/s} = \pi \cdot 2340 \mathrm{mm} \cdot rac{14 \mathrm{m^2/s}}{2 \cdot 2.21 \mathrm{m^2} \cdot 1.49}$

13) Freestream Velocity given Induced Angle of Attack

 $\left| V_{\infty}
ight| = rac{\Gamma_{
m o}}{2 \cdot {
m b} \cdot {
m a_i}}
ight|$

Open Calculator

ex $15.5816 \mathrm{m/s} = rac{14 \mathrm{m^2/s}}{2 \cdot 2340 \mathrm{mm} \cdot 11}^\circ$

14) Induced Angle of Attack given Aspect Ratio

 $lpha_{
m i} = rac{{
m C_l}}{\pi \cdot {
m AR_{ELD}}}$







15) Induced Angle of Attack given Circulation at Origin

 $\left|lpha_{
m i}
ight|lpha_{
m i}=rac{\Gamma_{
m o}}{2\cdot{
m b}\cdot{
m V}}$

Open Calculator 2

Open Calculator

$$extbf{ex} 11.05791^\circ = rac{14 ext{m}^2/ ext{s}}{2 \cdot 2340 ext{mm} \cdot 15.5 ext{m/s}}$$

16) Induced Angle of Attack given Coefficient of Lift 🛂

$$egin{aligned} egin{aligned} lpha_{
m i} = \mathrm{S}_0 \cdot rac{\mathrm{C}_1}{\pi \cdot \mathrm{b}^2} \end{aligned}$$

 $ext{ex} 11.04141^{\circ} = 2.21 ext{m}^2 \cdot rac{1.5}{\pi \cdot \left(2340 ext{mm}
ight)^2}$

17) Induced Angle of Attack given Downwash 🗗

 $\left| lpha_{
m i} = - \left(rac{
m w}{
m V_{
m co}}
ight)
ight|$ $| 11.08951^{\circ} = -\left(\frac{-3\text{m/s}}{15.5\text{m/s}} \right) |$ Open Calculator

18) Induced Drag Coefficient given Aspect Ratio

$\left| \mathrm{C}_{\mathrm{D,i,ELD}} = rac{\mathrm{C}_{\mathrm{L,ELD}}^2}{\pi \cdot \mathrm{AR_{ELD}}} ight|$

Open Calculator 2

$$oxed{ex} 0.284952 = rac{{{{(1.49)}^2}}}{{\pi \cdot 2.48}}$$







19) Lift at given Distance along Wingspan

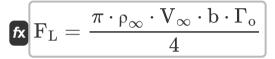
 $\mathbf{E} egin{aligned} \mathbf{L} =
ho_{\infty} \cdot V_{\infty} \cdot \Gamma_{o} \cdot \sqrt{1 - \left(2 \cdot rac{a}{b}
ight)^{2}} \end{aligned}$

Open Calculator 🚰

ex

$$265.7989 ext{N} = 1.225 ext{kg/m}^3 \cdot 15.5 ext{m/s} \cdot 14 ext{m}^2/ ext{s} \cdot \sqrt{1 - \left(2 \cdot rac{16.4 ext{mm}}{2340 ext{mm}}
ight)^2}$$

20) Lift of Wing given Circulation at Origin



Open Calculator

 $ext{ex} oxed{488.5416 ext{N} = rac{\pi \cdot 1.225 ext{kg/m}^3 \cdot 15.5 ext{m/s} \cdot 2340 ext{mm} \cdot 14 ext{m}^2/ ext{s}}{4}}$

General Lift Distribution

21) Aspect Ratio given Induced Drag Factor

$$ext{AR}_{ ext{GLD}} = rac{(1+\delta) \cdot ext{C}_{ ext{L,GLD}}^2}{\pi \cdot ext{C}_{ ext{D,i,GLD}}}$$

$$extbf{ex} 15.04641 = rac{(1+0.05)\cdot (1.47)^2}{\pi \cdot 0.048}$$

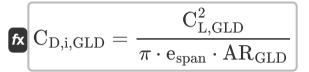


22) Induced Drag Coefficient given Induced Drag Factor

 $oldsymbol{ au} egin{equation} \mathbf{C}_{\mathrm{D,i,GLD}} = rac{(1+\delta) \cdot \mathrm{C}_{\mathrm{L,GLD}}^2}{\pi \cdot \mathrm{AR}_{\mathrm{GLD}}} \end{gathered}$

Open Calculator

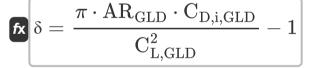
23) Induced Drag Coefficient given Span Efficiency Factor



Open Calculator

ex $0.048269 = \frac{(1.47)^2}{\pi \cdot 0.95 \cdot 15}$

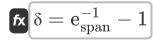
24) Induced Drag Factor given Induced Drag Coefficient



Open Calculator 🗗

 $= \frac{0.046761 = \frac{\pi \cdot 15 \cdot 0.048}{(1.47)^2} - 1 }{(1.47)^2}$

25) Induced Drag Factor given Span Efficiency Factor



Open Calculator

 $oxed{ex} 0.052632 = (0.95)^{-1} - 1$







26) Induced Lift Slope Factor given Lift Curve Slope of Finite Wina 🛂

 $rac{\pi \cdot \mathrm{AR}_{\mathrm{GLD}} \cdot \left(rac{\mathrm{a}_0}{\mathrm{a}_{\mathrm{C,l}}} - 1
ight)}{\mathrm{a}_0} - 1$

Open Calculator

 $egin{align*} egin{align*} egin{align*} egin{align*} egin{align*} egin{align*} egin{align*} rac{6.28 ext{rad}^{-1}}{5.54 ext{rad}^{-1}} - 1 \end{pmatrix} \ egin{align*} egin{align*} -1 & 0.002313 = rac{\pi \cdot 15 \cdot \left(rac{6.28 ext{rad}^{-1}}{5.54 ext{rad}^{-1}} - 1
ight)}{6.28 ext{rad}^{-1}} - 1 \end{pmatrix} \end{aligned}$

27) Lift Coefficient given Induced Drag Factor 🗗

 $\left| \mathbf{C}_{\mathrm{L,GLD}} = \sqrt{rac{\pi \cdot \mathrm{AR_{GLD} \cdot C_{\mathrm{D,i,GLD}}}}{1+\delta}}
ight|$

Open Calculator

ex $1.467731 = \sqrt{\frac{\pi \cdot 15 \cdot 0.048}{1 + 0.05}}$

28) Lift Coefficient given Span Efficiency Factor 🗗

 $ag{C}_{ ext{L,GLD}} = \sqrt{\pi \cdot ext{e}_{ ext{span}} \cdot ext{AR}_{ ext{GLD}} \cdot ext{C}_{ ext{D,i,GLD}}}$

Open Calculator 2

ex $1.465895 = \sqrt{\pi \cdot 0.95 \cdot 15 \cdot 0.048}$

29) Span Efficiency Factor 💪

fx $e_{\mathrm{span}} = (1+\delta)^{-1}$

Open Calculator

 $0.952381 = (1+0.05)^{-1}$





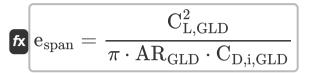




30) Span Efficiency Factor given Induced Drag Coefficient 🗗



Open Calculator



$$extbf{ex} \ 0.955328 = rac{(1.47)^2}{\pi \cdot 15 \cdot 0.048}$$



Variables Used

- a Distance from Center to Point (Millimeter)
- a₀ 2D Lift Curve Slope (1 per Radian)
- a_{C.1} Lift Curve Slope (1 per Radian)
- ARFLD Wing Aspect Ratio ELD
- ARGLD Wing Aspect Ratio GLD
- **b** Wingspan (Millimeter)
- C_{D,i,ELD} Induced Drag Coefficient ELD
- C_{D,i,GLD} Induced Drag Coefficient GLD
- C_I Lift Coefficient Origin
- C_{L.ELD} Lift Coefficient ELD
- C_{L.GLD} Lift Coefficient GLD
- e_{span} Span Efficiency Factor
- **F**_I Lift Force (Newton)
- L Lift at Distance (Newton)
- **S**₀ Reference Area Origin (Square Meter)
- V_∞ Freestream Velocity (Meter per Second)
- w Downwash (Meter per Second)
- α_i Induced Angle of Attack (Degree)
- Circulation (Square Meter per Second)
- Γ_O Circulation at Origin (Square Meter per Second)
- δ Induced Drag Factor





- ρ_∞ Freestream Density (Kilogram per Cubic Meter)
- TFW Induced Lift Slope Factor of Finite Wing





Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- Function: sqrt, sqrt(Number) Square root function
- Measurement: Length in Millimeter (mm)
 Length Unit Conversion
- Measurement: Area in Square Meter (m²)

 Area Unit Conversion
- Measurement: Speed in Meter per Second (m/s)
 Speed Unit Conversion
- Measurement: Force in Newton (N)
 Force Unit Conversion
- Measurement: Angle in Degree (°)
 Angle Unit Conversion
- Measurement: Density in Kilogram per Cubic Meter (kg/m³)
 Density Unit Conversion
- Measurement: Momentum Diffusivity in Square Meter per Second (m²/s)

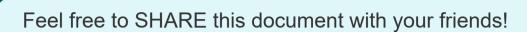
 Momentum Diffusivity Unit Conversion
- Measurement: Reciprocal Angle in 1 per Radian (rad⁻¹)
 Reciprocal Angle Unit Conversion





Check other formula lists

- Flow and Lift Distribution Formulas
- Lift Distribution Formulas G



PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

12/19/2023 | 6:55:48 AM UTC

Please leave your feedback here...

