



Tail Contribution Formulas

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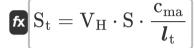




List of 19 Tail Contribution Formulas

Tail Contribution &

1) Horizontal tail area for given tail volume ratio



Open Calculator 🗗

ex
$$1.8 \mathrm{m}^2 = 1.42 \cdot 5.08 \mathrm{m}^2 \cdot rac{0.2 \mathrm{m}}{0.801511 \mathrm{m}}$$

2) Horizontal tail volume ratio

$$\mathbf{r} \mathbf{V}_{\mathrm{H}} = oldsymbol{l}_{\mathrm{t}} \cdot rac{\mathrm{S}_{\mathrm{t}}}{\mathrm{S} \cdot \mathrm{c}_{\mathrm{ma}}}$$

Open Calculator 🗗

ex
$$1.42 = 0.801511 \mathrm{m} \cdot \frac{1.8 \mathrm{m}^2}{5.08 \mathrm{m}^2 \cdot 0.2 \mathrm{m}}$$

3) Horizontal Tail Volume Ratio for given Pitching Moment Coefficient

$$V_{\mathrm{H}} = - igg(rac{\mathrm{Cm_t}}{\eta \cdot \mathrm{CT_{lift}}}igg)$$

Open Calculator

$$\left[1.413043 = -\left(rac{-0.39}{0.92\cdot 0.3}
ight)
ight]$$



4) Mean Aerodynamic Chord for given Tail Pitching Moment Coefficient

 \mathbf{f} $\mathbf{c}_{\mathrm{ma}} = rac{\overline{\mathbf{M}_{\mathrm{t}}}}{0.5 \cdot
ho_{\infty} \cdot \mathrm{V}^2 \cdot \mathrm{S} \cdot \mathrm{Cm}_{\mathrm{t}}}$

Open Calculator

-218.6

$$= \frac{-218.6644 \text{N*m}}{0.5 \cdot 1.225 \text{kg/m}^3 \cdot (30 \text{m/s})^2 \cdot 5.08 \text{m}^2 \cdot -0.39}$$

5) Pitching Moment due to Tail

fx $\mathrm{M_t} = -oldsymbol{l_t} \cdot \mathrm{L_t}$

Open Calculator

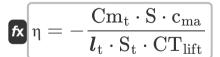
6) Tail Area for given Tail Moment Coefficient

 $\mathbf{K} \mathbf{S}_{\mathrm{t}} = -rac{\mathrm{Cm}_{\mathrm{t}}\cdot\mathrm{S}\cdot\mathrm{c}_{\mathrm{ma}}}{\eta\cdotoldsymbol{l}_{\mathrm{t}}\cdot\mathrm{CT}_{\mathrm{lift}}}$

Open Calculator

ex
$$1.791182 ext{m}^2 = -rac{-0.39 \cdot 5.08 ext{m}^2 \cdot 0.2 ext{m}}{0.92 \cdot 0.801511 ext{m} \cdot 0.3}$$

7) Tail Efficiency for given Pitching Moment Coefficient



Open Calculator 🗗

ex
$$0.915493 = -\frac{-0.39 \cdot 5.08 \text{m}^2 \cdot 0.2 \text{m}}{0.801511 \text{m} \cdot 1.8 \text{m}^2 \cdot 0.3}$$



8) Tail Efficiency for given Tail Volume Ratio

 $\eta = -igg(rac{\mathrm{Cm_t}}{\mathrm{V_H \cdot CT_{lift}}}igg)igg|$

Open Calculator

ex $0.915493 = -igg(rac{-0.39}{1.42 \cdot 0.3}igg)$

9) Tail Lift Coefficient for given Tail Volume Ratio

 $extbf{CT}_{ ext{lift}} = -igg(rac{ ext{Cm}_{ ext{t}}}{ ext{V}_{ ext{H}} \cdot ext{\eta}}igg)$

Open Calculator

 $\boxed{0.29853 = -\left(\frac{-0.39}{1.42 \cdot 0.92}\right)}$

10) Tail Lift for given Tail Pitching Moment

 $\mathbf{L_t} = -igg(rac{\mathrm{M_t}}{m{l_t}}igg)$ ex $272.8152\mathrm{N} = -igg(rac{-218.6644\mathrm{N^*m}}{0.801511\mathrm{m}}igg)$

Open Calculator 🗗

11) Tail moment arm for given horizontal tail volume ratio

$$m{l}_{
m t} = {
m V}_{
m H} \cdot {
m S} \cdot rac{{
m c}_{
m ma}}{{
m S}_{
m t}}$$

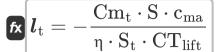
Open Calculator 🗗

ex $0.801511 \mathrm{m} = 1.42 \cdot 5.08 \mathrm{m}^2 \cdot \frac{0.2 \mathrm{m}}{1.8 \mathrm{m}^2}$





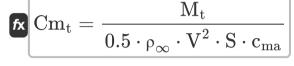
12) Tail Moment Arm for given Tail Moment Coefficient 🚰



Open Calculator

$$oxed{ex} 0.797585 \mathrm{m} = -rac{-0.39 \cdot 5.08 \mathrm{m}^2 \cdot 0.2 \mathrm{m}}{0.92 \cdot 1.8 \mathrm{m}^2 \cdot 0.3}$$

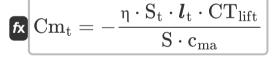
13) Tail Pitching Moment Coefficient



Open Calculator

$$= \frac{-218.6644 \text{N*m}}{0.5 \cdot 1.225 \text{kg/m}^3 \cdot (30 \text{m/s})^2 \cdot 5.08 \text{m}^2 \cdot 0.2 \text{m}}$$

14) Tail Pitching Moment Coefficient for given Tail Efficiency



Open Calculator 🗗

 $-0.39192 = -rac{0.92 \cdot 1.8 ext{m}^2 \cdot 0.801511 ext{m} \cdot 0.3}{5.08 ext{m}^2 \cdot 0.2 ext{m}}$

15) Tail Pitching Moment Coefficient for given Tail Volume Ratio

fx
$$\left[\mathrm{Cm_{t}} = -\mathrm{V_{H}} \cdot \eta \cdot \mathrm{CT_{lift}}
ight]$$

$$\texttt{ex} \ \texttt{-}0.39192 = -1.42 \cdot 0.92 \cdot 0.3$$



16) Tail Pitching Moment for given Lift Coefficient 🗗

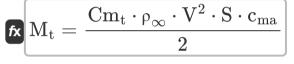
 $\mathbf{M}_{\mathrm{t}} = -rac{oldsymbol{l}_{\mathrm{t}}\cdot\mathrm{CT}_{\mathrm{lift}}\cdot
ho_{\infty}\cdot\mathrm{V}_{\mathrm{tail}}^{2}\cdot\mathrm{S}_{\mathrm{t}}}{2}$

Open Calculator

ex

 $\boxed{ -218.664465 \mathrm{N^*m} = -\frac{0.801511 \mathrm{m} \cdot 0.3 \cdot 1.225 \mathrm{kg/m^3} \cdot \left(28.72 \mathrm{m/s}\right)^2 \cdot 1.8 \mathrm{m^2}}{2} }$

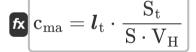
17) Tail Pitching Moment for given Moment Coefficient



Open Calculator

 $= \frac{-0.39 \cdot 1.225 \text{kg/m}^3 \cdot (30 \text{m/s})^2 \cdot 5.08 \text{m}^2 \cdot 0.2 \text{m}}{2}$

18) Wing Mean Aerodynamic Chord for given Horizontal Tail Volume Ratio



Open Calculator 🗗

ex $0.2 \mathrm{m} = 0.801511 \mathrm{m} \cdot \frac{1.8 \mathrm{m}^2}{5.08 \mathrm{m}^2 \cdot 1.42}$



19) Wing Reference Area for given Horizontal Tail Volume Ratio 🗗



Open Calculator





$$= \sum_{i=1}^{n} 5.0799999 \text{m}^2 = 0.801511 \text{m} \cdot \frac{1.8 \text{m}^2}{1.42 \cdot 0.2 \text{m}}$$



Variables Used

- C_{ma} Mean Aerodynamic Chord (Meter)
- Cmt Tail Pitching Moment Coefficient
- CT_{lift} Tail Lift Coefficient
- Lt Lift due to Tail (Newton)
- M_t Pitching Moment due to Tail (Newton Meter)
- S Reference Area (Square Meter)
- St Horizontal Tail Area (Square Meter)
- **V** Flight Velocity (Meter per Second)
- V_H Horizontal Tail Volume Ratio
- V_{tail} Velocity Tail (Meter per Second)
- η Tail Efficiency
- ρ_∞ Freestream Density (Kilogram per Cubic Meter)
- It Horizontal Tail Moment Arm (Meter)



Constants, Functions, Measurements used

- Measurement: Length in Meter (m)
 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: Density in Kilogram per Cubic Meter (kg/m³)
 Density Unit Conversion
- Measurement: Moment of Force in Newton Meter (N*m)
 Moment of Force Unit Conversion





Check other formula lists

• Tail Contribution Formulas

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