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Thrust and Power Requirements Formulas

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List of 19 Thrust and Power Requirements Formulas

Thrust and Power Requirements

1) Minimum Thrust of aircraft required

Open Calculator

fx $$T = P_{dynamic} \cdot S \cdot (C_{D,0} + C_{D,i})$$

ex $$99.2N = 10Pa \cdot 8m^2 \cdot (0.31 + 0.93)$$

2) Minimum Thrust required for given Lift Coefficient

Open Calculator

fx $$T = P_{dynamic} \cdot A \cdot \left(C_{D,0} + \left(\frac{C_L^2}{\pi \cdot e \cdot AR}\right)\right)$$

ex $$99.76029N = 10Pa \cdot 20m^2 \cdot \left(0.31 + \left(\frac{(1.1)^2}{\pi \cdot 0.51 \cdot 4}\right)\right)$$

3) Minimum Thrust required for given weight

Open Calculator

fx $$T = (P_{dynamic} \cdot A \cdot C_{D,0}) + \left(\frac{W_{body}^2}{P_{dynamic} \cdot A \cdot \pi \cdot e \cdot AR}\right)$$

ex $$100.1043N = (10Pa \cdot 20m^2 \cdot 0.31) + \left(\frac{(221N)^2}{10Pa \cdot 20m^2 \cdot \pi \cdot 0.51 \cdot 4}\right)$$

4) Power required for given aerodynamic coefficients

Open Calculator

fx $$P = W_{body} \cdot V_{\infty} \cdot \frac{C_D}{C_L}$$

ex $$3013.636W = 221N \cdot 30m/s \cdot \frac{0.5}{1.1}$$

5) Power required for given required thrust of aircraft

Open Calculator

fx $$P = V_{\infty} \cdot T$$

ex $$3000W = 30m/s \cdot 100N$$

6) Power required for given total drag force

Open Calculator

fx $$P = F_D \cdot V_{\infty}$$

ex $$2999.7W = 99.99N \cdot 30m/s$$

7) Thrust Angle for Unaccelerated Level Flight for given Drag

Open Calculator

fx $$\sigma_T = a\cos\left(\frac{F_D}{T}\right)$$

ex $$0.014142rad = a\cos\left(\frac{99.99N}{100N}\right)$$

8) Thrust Angle for Unaccelerated Level Flight for given Lift

Open Calculator

fx $$\sigma_T = a\sin\left(\frac{W_{body} - F_L}{T}\right)$$

ex $$0.01\text{rad} = a\sin\left(\frac{221\text{N} - 220\text{N}}{100\text{N}}\right)$$

9) Thrust for given coefficients of lift and drag

Open Calculator

fx $$T = C_D \cdot \frac{W_{body}}{C_L}$$

ex $$100.4545\text{N} = 0.5 \cdot \frac{221\text{N}}{1.1}$$

10) Thrust for Level and Unaccelerated Flight

Open Calculator

fx $$T = \frac{F_D}{\cos(\sigma_T)}$$

ex $$99.995\text{N} = \frac{99.99\text{N}}{\cos(0.01\text{rad})}$$

11) Thrust of aircraft required for given Lift-to-drag ratio

Open Calculator

fx $$T = \frac{W_{body}}{LD}$$

ex $$100\text{N} = \frac{221\text{N}}{2.21}$$

12) Thrust of Aircraft required for given required Power

Open Calculator

fx $$T = \frac{P}{V_\infty}$$

ex $$100\text{N} = \frac{3000\text{W}}{30\text{m/s}}$$

13) Thrust of Aircraft required for Level, Unaccelerated Flight

Open Calculator

fx $$T = P_{\text{dynamic}} \cdot A \cdot C_D$$

ex $$100\text{N} = 10\text{Pa} \cdot 20\text{m}^2 \cdot 0.5$$

14) Thrust-to-weight ratio

Open Calculator

fx $$TW = \frac{C_D}{C_L}$$

ex $$0.454545 = \frac{0.5}{1.1}$$

15) Weight of Aircraft for given Coefficients of Lift and Drag

Open Calculator

fx $$W_{\text{body}} = C_L \cdot \frac{T}{C_D}$$

ex $$220\text{N} = 1.1 \cdot \frac{100\text{N}}{0.5}$$

16) Weight of Aircraft for given Lift-to-Drag Ratio

Open Calculator

fx $$W_{body} = T \cdot LD$$

ex $$221N = 100N \cdot 2.21$$

17) Weight of aircraft for given required power

Open Calculator

fx $$W_{body} = P \cdot \frac{C_L}{V_\infty \cdot C_D}$$

ex $$220N = 3000W \cdot \frac{1.1}{30m/s \cdot 0.5}$$

18) Weight of Aircraft for Level, Unaccelerated Flight at Negligible Thrust Angle

Open Calculator

fx $$W_{body} = P_{dynamic} \cdot A \cdot C_L$$

ex $$220N = 10Pa \cdot 20m^2 \cdot 1.1$$

19) Weight of Aircraft in Level, Unaccelerated Flight

Open Calculator

fx $$W_{body} = F_L + (T \cdot \sin(\sigma_T))$$

ex $$221N = 220N + (100N \cdot \sin(0.01rad))$$

Variables Used

- **A** Area *(Square Meter)*
- **AR** Aspect Ratio of a Wing
- C_D Drag Coefficient
- $C_{D,0}$ Zero Lift Drag Coefficient
- $C_{D,i}$ Coefficient Of Drag Due to Lift
- C_L Lift Coefficient
- **e** Oswald Efficiency Factor
- F_D Drag Force *(Newton)*
- F_L Lift Force *(Newton)*
- **LD** Lift-to-Drag Ratio
- **P** Power *(Watt)*
- $P_{dynamic}$ Dynamic Pressure *(Pascal)*
- **S** Reference Area *(Square Meter)*
- **T** Thrust *(Newton)*
- **TW** Thrust-to-Weight Ratio
- V_∞ Freestream Velocity *(Meter per Second)*
- W_{body} Weight of Body *(Newton)*
- σ_T Thrust Angle *(Radian)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **acos**, acos(Number)
  The inverse cosine function, is the inverse function of the cosine function. It is the function that takes a ratio as an input and returns the angle whose cosine is equal to that ratio.
- Function: **asin**, asin(Number)
  The inverse sine function, is a trigonometric function that takes a ratio of two sides of a right triangle and outputs the angle opposite the side with the given ratio.
- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion

- Measurement: **Angle** in Radian (rad)
  Angle Unit Conversion

Check other formula lists

- **Lift and Drag Requirements Formulas**
- **Thrust and Power Requirements Formulas**

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