calculatoratoz.com
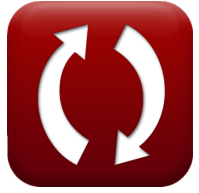
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Thrust Generation Formulas

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List of 21 Thrust Generation Formulas

Thrust Generation 🔗

1) Flight Speed given Ideal Thrust 🔗

fx $V = V_e - \dfrac{T_{ideal}}{m_a}$

ex $111\text{m/s} = 248\text{m/s} - \dfrac{479.5\text{N}}{3.5\text{kg/s}}$

2) Flight Speed given Momentum of Ambient Air 🔗

fx $V = \dfrac{M}{m_a}$

ex $111\text{m/s} = \dfrac{388.5\text{kg*m/s}}{3.5\text{kg/s}}$

3) Flight Speed given Ram Drag and Mass Flow Rate 🔗

fx $V = \dfrac{D_{ram}}{m_a}$

ex $111.1429\text{m/s} = \dfrac{389\text{N}}{3.5\text{kg/s}}$

4) Gross thrust 🔗

fx $T_G = m_a \cdot V_e$

ex $868\text{N} = 3.5\text{kg/s} \cdot 248\text{m/s}$

5) Gross Thrust Coefficient ⚙️

fx $$C_{Tg} = \frac{T_G}{F_i}$$

ex $$0.818868 = \frac{868N}{1060N}$$

6) Ideal Thrust given Effective Speed Ratio ⚙️

fx $$T_{ideal} = m_a \cdot V \cdot \left(\left(\frac{1}{\alpha} \right) - 1 \right)$$

ex $$479.6564N = 3.5kg/s \cdot 111m/s \cdot \left(\left(\frac{1}{0.4475} \right) - 1 \right)$$

7) Ideal Thrust of Jet Engine ⚙️

fx $$T_{ideal} = m_a \cdot (V_e - V)$$

ex $$479.5N = 3.5kg/s \cdot (248m/s - 111m/s)$$

8) Mass Flow given Momentum in Ambient Air ⚙️

fx $$m_a = \frac{M}{V}$$

ex $$3.5kg/s = \frac{388.5kg*m/s}{111m/s}$$

9) Mass Flow Rate given Ideal Thrust ⚙️

fx $$m_a = \frac{T_{ideal}}{V_e - V}$$

ex $$3.5kg/s = \frac{479.5N}{248m/s - 111m/s}$$

10) Mass Flow Rate given Ram Drag and Flight Speed ⎘   Open Calculator ⎘

fx $$m_a = \frac{D_{ram}}{V}$$

ex $3.504505 kg/s = \dfrac{389N}{111m/s}$

11) Momentum of Ambient Air ⎘   Open Calculator ⎘

fx $M = m_a \cdot V$

ex $388.5 kg*m/s = 3.5kg/s \cdot 111m/s$

12) Momentum Thrust ⎘   Open Calculator ⎘

fx $T_{ideal} = m_a \cdot ((1 + f) \cdot V_e - V)$

ex $487.312N = 3.5kg/s \cdot ((1 + 0.009) \cdot 248m/s - 111m/s)$

13) Ram drag ⎘   Open Calculator ⎘

fx $D_{ram} = m_a \cdot V$

ex $388.5N = 3.5kg/s \cdot 111m/s$

14) Specific thrust ⎘   Open Calculator ⎘

fx $I_{sp} = V_e - V$

ex $137m/s = 248m/s - 111m/s$

15) Specific Thrust given Effective Speed Ratio ⎘   Open Calculator ⎘

fx $I_{sp} = V_e \cdot (1 - \alpha)$

ex $137.02m/s = 248m/s \cdot (1 - 0.4475)$

16) Thrust given aircraft forward speed, velocity of exhaust ⎘   Open Calculator ⎘

fx $T_{ideal} = m_a \cdot (V_e - V)$

ex $479.5N = 3.5kg/s \cdot (248m/s - 111m/s)$

17) Thrust power 🔗

fx $\boxed{T_P = m_a \cdot V \cdot (V_e - V)}$

Open Calculator 🔗

ex $\boxed{53.2245 \text{kW} = 3.5 \text{kg/s} \cdot 111 \text{m/s} \cdot (248 \text{m/s} - 111 \text{m/s})}$

18) Thrust power specific fuel consumption 🔗

fx $\boxed{TPSFC = \dfrac{m_f}{T_P}}$

Open Calculator 🔗

ex $\boxed{2.1 \text{kg/h/kW} = \dfrac{0.0315 \text{kg/s}}{54 \text{kW}}}$

19) Thrust specific fuel consumption 🔗

fx $\boxed{TSFC = \dfrac{f_a}{I_{sp}}}$

Open Calculator 🔗

ex $\boxed{0.015764 \text{kg/h/N} = \dfrac{0.0006}{137.02 \text{m/s}}}$

20) Total Thrust given Efficiency and Enthalpy 🔗

fx

Open Calculator 🔗

$\boxed{T_{total} = m_a \cdot \left(\left(\sqrt{2 \cdot \Delta h_{nozzle} \cdot \eta_{nozzle}} \right) - V + \left(\sqrt{\eta_T \cdot \eta_{transmission} \cdot \Delta h_{turbine}} \right) \right)}$

ex $\boxed{591.9372 \text{N} = 3.5 \text{kg/s} \cdot \left(\left(\sqrt{2 \cdot 12 \text{KJ} \cdot .24} \right) - 111 \text{m/s} + \left(\sqrt{0.86 \cdot 0.97 \cdot 50 \text{KJ}} \right) \right)}$

21) Velocity after Expansion given Ideal Thrust 🔗

fx $\boxed{V_e = \dfrac{T_{ideal}}{m_a} + V}$

Open Calculator 🔗

ex $\boxed{248 \text{m/s} = \dfrac{479.5 \text{N}}{3.5 \text{kg/s}} + 111 \text{m/s}}$

Variables Used

- C_{Tg} Gross Thrust Coefficient
- D_{ram} Ram Drag *(Newton)*
- f Fuel Air Ratio
- f_a Fuel to Air Ratio
- F_i Ideal Gross Thrust *(Newton)*
- I_{sp} Specific Thrust *(Meter per Second)*
- M Momentum of Ambient Air *(Kilogram Meter per Second)*
- m_a Mass Flow Rate *(Kilogram per Second)*
- m_f Fuel Flow Rate *(Kilogram per Second)*
- T_G Gross Thrust *(Newton)*
- T_{ideal} Ideal Thrust *(Newton)*
- T_P Thrust Power *(Kilowatt)*
- T_{total} Total Thrust *(Newton)*
- $TPSFC$ Thrust Power Specific Fuel Consumption *(Kilogram per Hour per Kilowatt)*
- $TSFC$ Thrust-Specific Fuel Consumption *(Kilogram per Hour per Newton)*
- V Flight Speed *(Meter per Second)*
- V_e Exit Velocity *(Meter per Second)*
- α Effective Speed Ratio
- Δh_{nozzle} Enthalpy Drop in Nozzle *(Kilojoule)*
- $\Delta h_{turbine}$ Enthalpy Drop in Turbine *(Kilojoule)*
- η_{nozzle} Nozzle Efficiency
- η_T Turbine Efficiency
- $\eta_{transmission}$ Efficiency of Transmission

Constants, Functions, Measurements used

- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion ⬀
- Measurement: **Energy** in Kilojoule (KJ)
  Energy Unit Conversion ⬀
- Measurement: **Power** in Kilowatt (kW)
  Power Unit Conversion ⬀
- Measurement: **Force** in Newton (N)
  Force Unit Conversion ⬀
- Measurement: **Mass Flow Rate** in Kilogram per Second (kg/s)
  Mass Flow Rate Unit Conversion ⬀
- Measurement: **Momentum** in Kilogram Meter per Second (kg*m/s)
  Momentum Unit Conversion ⬀
- Measurement: **Thrust Specific Fuel Consumption** in Kilogram per Hour per Newton (kg/h/N)
  Thrust Specific Fuel Consumption Unit Conversion ⬀
- Measurement: **Specific Fuel Consumption** in Kilogram per Hour per Kilowatt (kg/h/kW)
  Specific Fuel Consumption Unit Conversion ⬀

Check other formula lists

- **Efficiency Metrics Formulas**
- **Thrust Generation Formulas**

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