# Important Weight Estimation Formulas PDF

Formulas
Examples
with Units

**List of 17**
**Important Weight Estimation Formulas**

## 1) Fuel Load from Unity Equation Formula

Evaluate Formula

Formula

$$W_f = W_{TO} - \left( W_E + W_P \right)$$

Example with Units

$$29244\,\text{kg} = 45000\,\text{kg} - \left( 8890\,\text{kg} + 6866\,\text{kg} \right)$$

## 2) Gross weight Formula

Evaluate Formula

Formula

$$W_G = W_E + W_U$$

Example with Units

$$16755\,\text{kg} = 8890\,\text{kg} + 7865\,\text{kg}$$

## 3) Landing Weight given Take Off Weight and Mission Fuel Weight Formula

Evaluate Formula

Formula

$$W_L = W_{TO} - W_f$$

Example with Units

$$16756\,\text{kg} = 45000\,\text{kg} - 28244\,\text{kg}$$

## 4) Landing Weight given Zero Fuel Weight and Reserve Fuel Weight Formula

Evaluate Formula

Formula

$$W_L = W_{ZF} + W_{RF}$$

Example with Units

$$16756\,\text{kg} = 15756\,\text{kg} + 1000\,\text{kg}$$

## 5) Maximum take off weight Formula

Evaluate Formula

Formula

$$MTOW = \frac{W_P}{1 - \left( \left( \frac{W_E}{W_{TO}} \right) + \left( \frac{W_f}{W_{TO}} \right) \right)}$$

Example with Units

$$39279.1762\,\text{kg} = \frac{6866\,\text{kg}}{1 - \left( \left( \frac{8890\,\text{kg}}{45000\,\text{kg}} \right) + \left( \frac{28244\,\text{kg}}{45000\,\text{kg}} \right) \right)}$$

## 6) Mission Fuel given Take Off, Reserve and Zero Fuel Weight Formula

Evaluate Formula

Formula

$$W_f = W_{TO} - W_{ZF} - W_{RF}$$

Example with Units

$$28244\,\text{kg} = 45000\,\text{kg} - 15756\,\text{kg} - 1000\,\text{kg}$$

## 7) Operating Empty Weight Formula

Evaluate Formula

Formula

$$W_E = W_G - W_U$$

Example with Units

$$8890\,\text{kg} = 16755\,\text{kg} - 7865\,\text{kg}$$

## 8) Operating Empty Weight considering Zero Fuel Weight Formula

Evaluate Formula

Formula

$$W_E = W_{ZF} - W_P$$

Example with Units

$$8890\,\text{kg} = 15756\,\text{kg} - 6866\,\text{kg}$$

## 9) Operating Empty Weight from Unity Equation Formula

Evaluate Formula

Formula

$$W_E = W_{TO} - \left(W_P + W_f\right)$$

Example with Units

$$9890\,\text{kg} = 45000\,\text{kg} - \left(6866\,\text{kg} + 28244\,\text{kg}\right)$$

## 10) Payload of aircraft Formula

Evaluate Formula

Formula

$$W_P = W_{ZF} - W_E$$

Example with Units

$$6866\,\text{kg} = 15756\,\text{kg} - 8890\,\text{kg}$$

## 11) Payload Weight from Unity Equation Formula

Evaluate Formula

Formula

$$W_P = W_{TO} - W_E - W_f$$

Example with Units

$$7866\,\text{kg} = 45000\,\text{kg} - 8890\,\text{kg} - 28244\,\text{kg}$$

## 12) Take Off Weight from Unity Equation Formula

Evaluate Formula

Formula

$$W_{TO} = W_E + W_P + W_f$$

Example with Units

$$44000\,\text{kg} = 8890\,\text{kg} + 6866\,\text{kg} + 28244\,\text{kg}$$

## 13) Take Off Weight given Reserve, Mission and Zero Fuel Weight Formula

Evaluate Formula

Formula

$$W_{TO} = W_{ZF} + W_{RF} + W_f$$

Example with Units

$$45000\,\text{kg} = 15756\,\text{kg} + 1000\,\text{kg} + 28244\,\text{kg}$$

## 14) Useful Load Formula

Evaluate Formula

Formula

$$W_U = W_G - W_E$$

Example with Units

$$7865\,\text{kg} = 16755\,\text{kg} - 8890\,\text{kg}$$

## 15) Zero fuel weight Formula

Evaluate Formula

Formula

$$W_{ZF} = W_E + W_P$$

Example with Units

$$15756\,\text{kg} = 8890\,\text{kg} + 6866\,\text{kg}$$

## 16) Zero Fuel Weight given Mission Fuel, Reserve and Take Off Weight Formula

Evaluate Formula

Formula

$$W_{ZF} = W_{TO} - W_f - W_{RF}$$

Example with Units

$$15756\,\text{kg} = 45000\,\text{kg} - 28244\,\text{kg} - 1000\,\text{kg}$$

## 17) Zero Fuel Weight given Reserve and Landing Weight Formula

Evaluate Formula

Formula

$$W_{ZF} = W_L - W_{RF}$$

Example with Units

$$15756\,\text{kg} = 16756\,\text{kg} - 1000\,\text{kg}$$

## Variables used in list of Weight Estimation Formulas above

- **MTOW** Maximum Take Off Weight *(Kilogram)*
- $W_E$ Operating Empty Weight *(Kilogram)*
- $W_f$ Fuel Load *(Kilogram)*
- $W_G$ Gross Weight *(Kilogram)*
- $W_L$ Landing Weight *(Kilogram)*
- $W_P$ Payload *(Kilogram)*
- $W_{RF}$ Reserve Fuel *(Kilogram)*
- $W_{TO}$ Takeoff Weight *(Kilogram)*
- $W_U$ Useful Weight *(Kilogram)*
- $W_{ZF}$ Zero Fuel Weight *(Kilogram)*

## Constants, Functions, Measurements used in list of Weight Estimation Formulas above

- Measurement: **Weight** in Kilogram (kg)
  *Weight Unit Conversion*

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