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Weight Estimation Formulas

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List of 17 Weight Estimation Formulas

Weight Estimation

1) Fuel Load from Unity Equation

$$fx \quad W_f = W_{TO} - (W_E + W_P)$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$ex \quad 29244kg = 45000kg - (8890kg + 6866kg)$$

2) Gross weight

$$fx \quad W_G = W_E + W_U$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$ex \quad 16755kg = 8890kg + 7865kg$$

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

$$fx \quad W_L = W_{TO} - W_f$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d_img.jpg\)](#)

$$ex \quad 16756kg = 45000kg - 28244kg$$

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

$$fx \quad W_L = W_{ZF} + W_{RF}$$

[Open Calculator !\[\]\(83bbbd261710c59db0214aa27b2edc0d_img.jpg\)](#)

$$ex \quad 16756kg = 15756kg + 1000kg$$



5) Maximum take off weight 

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

Open Calculator 

$$\text{ex } 39279.18\text{kg} = \frac{6866\text{kg}}{1 - \left(\left(\frac{8890\text{kg}}{45000\text{kg}} \right) + \left(\frac{28244\text{kg}}{45000\text{kg}} \right) \right)}$$

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

$$\text{fx } W_f = W_{TO} - W_{ZF} - W_{RF}$$

Open Calculator 


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

7) Operating Empty Weight 

$$\text{fx } W_E = W_G - W_U$$

Open Calculator 

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

8) Operating Empty Weight considering Zero Fuel Weight 

$$\text{fx } W_E = W_{ZF} - W_P$$

Open Calculator 

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

9) Operating Empty Weight from Unity Equation 

$$\text{fx } W_E = W_{TO} - (W_P + W_f)$$

Open Calculator 

$$\text{ex } 9890\text{kg} = 45000\text{kg} - (6866\text{kg} + 28244\text{kg})$$



10) Payload of aircraft

$$fx \quad W_P = W_{ZF} - W_E$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 6866\text{kg} = 15756\text{kg} - 8890\text{kg}$$

11) Payload Weight from Unity Equation

$$fx \quad W_P = W_{TO} - W_E - W_f$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

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

12) Take Off Weight from Unity Equation

$$fx \quad W_{TO} = W_E + W_P + W_f$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

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

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

$$fx \quad W_{TO} = W_{ZF} + W_{RF} + W_f$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

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

14) Useful Load

$$fx \quad W_U = W_G - W_E$$

[Open Calculator !\[\]\(40770d9ed6ed4f1222ebf89a1396e8b2_img.jpg\)](#)

$$ex \quad 7865\text{kg} = 16755\text{kg} - 8890\text{kg}$$



15) Zero fuel weight

$$fx \quad W_{ZF} = W_E + W_P$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$ex \quad 15756\text{kg} = 8890\text{kg} + 6866\text{kg}$$

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

$$fx \quad W_{ZF} = W_{TO} - W_f - W_{RF}$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

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

17) Zero Fuel Weight given Reserve and Landing Weight

$$fx \quad W_{ZF} = W_L - W_{RF}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$ex \quad 15756\text{kg} = 16756\text{kg} - 1000\text{kg}$$




Variables Used

- **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

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



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