Important Turning Flight Formulas PDF

Formulas
Examples
with Units

List of 13
Important Turning Flight Formulas

1) Bank angle during level turn Formula

Evaluate Formula

Formula

$$\Phi = acos\left(\frac{W}{F_L}\right)$$

Example with Units

$$0.451\,\text{rad} = acos\left(\frac{18\,\text{N}}{20\,\text{N}}\right)$$

2) Lift during level turn Formula

Evaluate Formula

Formula

$$F_L = \frac{W}{\cos\left(\Phi\right)}$$

Example with Units

$$19.9901\,\text{N} = \frac{18\,\text{N}}{\cos\left(0.45\,\text{rad}\right)}$$

3) Lift for given Load Factor Formula

Evaluate Formula

Formula

$$F_L = n \cdot W$$

Example with Units

$$19.98\,\text{N} = 1.11 \cdot 18\,\text{N}$$

4) Load factor given Lift Force and Weight of Aircraft Formula

Evaluate Formula

Formula

$$n = \frac{F_L}{W}$$

Example with Units

$$1.1111 = \frac{20\,\text{N}}{18\,\text{N}}$$

5) Load Factor given Turn Radius Formula

Evaluate Formula

Formula

$$n = \sqrt{1 + \left(\frac{V^2}{[g] \cdot R}\right)^2}$$

Example with Units

$$1.11 = \sqrt{1 + \left(\frac{200\,\text{m/s}^2}{9.8066\,\text{m/s}^2 \cdot 8466.46\,\text{m}}\right)^2}$$

6) Load Factor given Turn Rate Formula

Evaluate Formula

Formula

$$n = \sqrt{\left(V \cdot \frac{\omega}{[g]}\right)^2 + 1}$$

Example with Units

$$1.111 = \sqrt{\left(200\,\text{m/s} \cdot \frac{1.36\,\text{degree/s}}{9.8066\,\text{m/s}^2}\right)^2 + 1}$$

7) Rate of Turn Formula

Evaluate Formula

Formula

$$\omega = 1091 \cdot \frac{\tan(\Phi)}{V}$$

Example with Units

$$1.3556\,\text{degree/s} = 1091 \cdot \frac{\tan(0.45\,\text{rad})}{200\,\text{m/s}}$$

8) Turn radius Formula

Evaluate Formula

Formula

$$R = \frac{V^2}{[g] \cdot \sqrt{\left(n^2\right) - 1}}$$

Example with Units

$$8466.4578\,\text{m} = \frac{200\,\text{m/s}^2}{9.8066\,\text{m/s}^2 \cdot \sqrt{\left(1.11^2\right) - 1}}$$

9) Turn rate Formula

Evaluate Formula

Formula

$$\omega = [g] \cdot \frac{\sqrt{n^2 - 1}}{V}$$

Example with Units

$$1.3535\,\text{degree/s} = 9.8066\,\text{m/s}^2 \cdot \frac{\sqrt{1.11^2 - 1}}{200\,\text{m/s}}$$

10) Velocity for given turn radius Formula

Evaluate Formula

Formula

$$V = \sqrt{R \cdot [g] \cdot \left(\sqrt{n^2 - 1}\right)}$$

Example with Units

$$200\,\text{m/s} = \sqrt{8466.46\,\text{m} \cdot 9.8066\,\text{m/s}^2 \cdot \left(\sqrt{1.11^2 - 1}\right)}$$

11) Velocity for given turn rate Formula

Evaluate Formula

Formula

$$V = [g] \cdot \frac{\sqrt{n^2 - 1}}{\omega}$$

Example with Units

$$199.0407\,\text{m/s} = 9.8066\,\text{m/s}^2 \cdot \frac{\sqrt{1.11^2 - 1}}{1.36\,\text{degree/s}}$$

12) Weight for given Load Factor Formula

Evaluate Formula

Formula

$$W = \frac{F_L}{n}$$

Example with Units

$$18.018\,\text{N} = \frac{20\,\text{N}}{1.11}$$

13) Weight of aircraft during level turn Formula

Evaluate Formula

Formula

$$W = F_L \cdot \cos(\Phi)$$

Example with Units

$$18.0089\,\text{N} = 20\,\text{N} \cdot \cos(0.45\,\text{rad})$$

Variables used in list of Turning Flight Formulas above

- F_L Lift Force *(Newton)*
- **n** Load Factor
- **R** Turn Radius *(Meter)*
- **V** Flight Velocity *(Meter per Second)*
- **W** Aircraft Weight *(Newton)*
- **Φ** Bank Angle *(Radian)*
- **ω** Turn Rate *(Degree per Second)*

Constants, Functions, Measurements used in list of Turning Flight Formulas above

- constant(s): **[g]**, 9.80665
  Gravitational acceleration on Earth
- Functions: **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.
- Functions: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Functions: **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.
- Functions: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Radian (rad)
  Angle Unit Conversion
- Measurement: **Angular Velocity** in Degree per Second (degree/s)
  Angular Velocity Unit Conversion

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