# Aircraft Level Turn: Load Factor, Turn Radius and Rate

Load factor, turn radius, turn rate and time for a full turn of an aircraft in a steady level turn from its speed and bank angle, with the lift coefficient needed.

**Method:** Steady level turn mechanics

## Input parameters

Unit system: SI

| Parameter | Value | Unit |
|---|---|---|
| True airspeed | 198.00 | km/h |
| Bank angle | 45.000 | ° |
| Aircraft weight | 12,000 | N |
| Wing area | 16.200 | m² |
| Altitude (ISA, geopotential) | 1,000.0 | m |

## Calculated results

| Parameter | Value | Unit |
|---|---|---|
| Load factor 1/cos φ | 1.4142 | |
| Turn radius | 308.46 | m |
| Turn rate | 10.216 | °/s |
| Time for a 360° turn | 35.239 | s |
| Lift coefficient required | 0.62305 | |

**Notes for this case**

- Steady coordinated level turn: R = V²/(g tan φ) = V²/(g√(n² − 1)), ω = V/R. Check the lift coefficient against C_L,max and the load factor against the structural limit.

## Formula and method

$$n = \frac{1}{\cos\phi}, \quad R = \frac{V^2}{g\tan\phi}, \quad \omega = \frac{V}{R} = \frac{g\tan\phi}{V}$$

### Variables

| | | |
|---|---|---|
| $V$ | True airspeed | m/s |
| $\phi$ | Bank angle | rad |
| $W$ | Aircraft weight | N |
| $S$ | Wing area | m² |
| $h$ | Altitude (ISA, geopotential) | m |
| $n$ | Load factor 1/cos φ | - |
| $R$ | Turn radius | m |
| $\omega$ | Turn rate | rad/s |
| $t_{360}$ | Time for a 360° turn | s |
| $C_L$ | Lift coefficient required | - |

### Method and standards

Coordinated turn mechanics.

### Assumptions and limits

- Steady, level, coordinated turn.

## References

Steady level turn mechanics

## Report details

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|---|---|
| Report reference | FCC-ZRY9-BFRF (the same inputs always give the same reference) |
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| Calculator | Aircraft Level Turn: Load Factor, Turn Radius and Rate |
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| Release checks | 3 reference cases of this calculator, computed independently, are checked on every release |

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

### This calculator online

https://calc.firecad.com/mechanical/aerospace/aircraft-level-turn

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.