Top Speed and Top Gear Ratio from Engine Power

Maximum level-road speed where engine power at the wheels meets rolling and aerodynamic resistance, and the overall and top gear ratios that put peak power there.

Method: Road-load balance at maximum speed

Input parameters

Unit system: SI

Parameter	Value	Unit
Peak engine power	110.00	kW
Engine speed at peak power	5,500.0	rpm
Vehicle mass	1,400.0	kg
Rolling resistance coefficient	0.012000	
Drag area	0.66000	m²
Air density	1.2250	kg/m³
Rolling radius	310.00	mm
Driveline efficiency	92.000	%
Final drive ratio	3.9000	

Calculated results

Parameter	Value	Unit
Top speed	219.13	km/h
Aerodynamic drag at top speed	1,497.8	N
Rolling resistance	164.75	N
Overall ratio at top speed	2.9333	
Top gear ratio for peak power at top speed	0.75212	

Notes for this case

- Solves η·P = (f_r·mg + ½ρC_dAv²)v. Gearing top speed at peak power maximises top speed; many cars gear top longer (overdrive) for economy and reach top speed in the gear below.

Formula and method

$$\eta P_{max} = \left(f_r m g + \frac{1}{2} \rho C_d A v^2 \right) v, \quad i_t = \frac{2\pi n_P r}{v_{max}}$$

Variables

P_{max}	Peak engine power	W
n_P	Engine speed at peak power	1/s
m	Vehicle mass	kg
f_r	Rolling resistance coefficient	-
$C_d A$	Drag area	m²
ρ	Air density	kg/m³
r	Rolling radius	m
η_d	Driveline efficiency	-
i_0	Final drive ratio	-
v_{max}	Top speed	m/s

F_D	Aerodynamic drag at top speed	N
F_R	Rolling resistance	N
i_t	Overall ratio at top speed	-
i_g	Top gear ratio for peak power at top speed	-

Method and standards

Top speed balance.

Assumptions and limits

- Level road, still air.

References

Road-load balance at maximum speed

Report details

Report reference	FCC-Y5VE-97JC (the same inputs always give the same reference)
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Calculator	Top Speed and Top Gear Ratio from Engine Power
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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/automotive/transmission/top-gear-ratio-max-speed

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.