Gearbox Ratio Progression and Shift Drop

Intermediate gear ratios of an n-speed gearbox by geometric progression between first and top gear, the step, overall spread and engine speed after an upshift.

Method: Geometric gear ratio progression

Input parameters

Unit system: SI

Parameter	Value	Unit
Number of gears	6.0000	
First gear ratio	3.6000	
Top gear ratio	0.75000	
Upshift engine speed	6,000.0	rpm

Calculated results

Parameter	Value	Unit
Step between gears	1.3685	
Overall spread	4.8000	
Engine speed after upshift	4,384.3	rpm
Gear 2	2.6306	
Gear 3	1.9222	
Gear 4	1.4046	
Gear 5	1.0264	
Gear 6	0.75000	

Notes for this case

• Geometric progression i_k = i₁/φ^(k−1) gives equal engine-speed drops. Car gearboxes are usually progressive (smaller steps in the higher gears) because the tractive-force gaps matter less there; trucks stay close to geometric.

Formula and method

$$\varphi = \left(\frac{i_1}{i_n}\right)^{1/(n-1)}, \quad i_k = \frac{i_1}{\varphi^{k-1}}$$

Variables

n	Number of gears	-
i_1	First gear ratio	-
i_n	Top gear ratio	-
n_s	Upshift engine speed	1/s
φ	Step between gears	-
i_1/i_n	Overall spread	-
n_s/φ	Engine speed after upshift	1/s
i_2	Gear 2	-
i_3	Gear 3	-
i_4	Gear 4	-
i_5	Gear 5	-
i_6	Gear 6	-

i_7	Gear 7	-
i_8	Gear 8	-

Method and standards

Gear progression.

Assumptions and limits

- Geometric progression.

References

Geometric gear ratio progression

Report details

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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/gear-ratio-progression

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.