Spur Gear Geometry: Module, Pitch Diameter, Centre Distance

Pitch, tip and root diameters, circular pitch, centre distance and speed ratio of a pair of standard involute spur gears from the module and tooth numbers.

Method: ISO 53 / ISO 54 standard basic rack (addendum m, dedendum 1.25 m); Shigley's Mechanical Engineering Design (Budynas and Nisbett); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Module	4.0000	mm
Teeth on the pinion	20.000	
Teeth on the gear	60.000	
Pressure angle	20.000	°

Calculated results

Parameter	Value	Unit
Pitch diameter of the pinion m z_1	80.000	mm
Pitch diameter of the gear	240.00	mm
Centre distance $(d_1 + d_2)/2$	160.00	mm
Tip diameter of the pinion (addendum m)	88.000	mm
Root diameter of the pinion (dedendum 1.25 m)	70.000	mm
Base circle diameter of the pinion	75.175	mm
Circular pitch π m	12.566	mm
Speed ratio z_2/z_1	3.0000	

Notes for this case

- Standard full-depth teeth: addendum 1 m, dedendum 1.25 m, no profile shift.

Formula and method

$$d = mz, \quad a = \frac{m(z_1 + z_2)}{2}, \quad d_a = d + 2m, \quad d_f = d - 2.5m, \quad d_b = d\cos\phi$$

Variables

m	Module	m
z_1	Teeth on the pinion	-
z_2	Teeth on the gear	-
ϕ	Pressure angle	rad
d_1	Pitch diameter of the pinion m z_1	m
d_2	Pitch diameter of the gear	m
a	Centre distance $(d_1 + d_2)/2$	m
d_{a1}	Tip diameter of the pinion (addendum m)	m
d_{f1}	Root diameter of the pinion (dedendum 1.25 m)	m
d_{b1}	Base circle diameter of the pinion	m
p	Circular pitch π m	m
i	Speed ratio z_2/z_1	-

Method and standards

Standard involute gear geometry.

Assumptions and limits

- Standard teeth, no profile shift.

References

- ISO 53 / ISO 54 standard basic rack (addendum m, dedendum 1.25 m)
- Shigley's Mechanical Engineering Design (Budynas and Nisbett)
- ch. 13

Report details

Report reference	FCC-16E4-RR79 (the same inputs always give the same reference)
Generated	17 November 2026, 19:45 UTC
Calculator	Spur Gear Geometry: Module, Pitch Diameter, Centre Distance
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/machine-design/spur-gear-geometry

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.