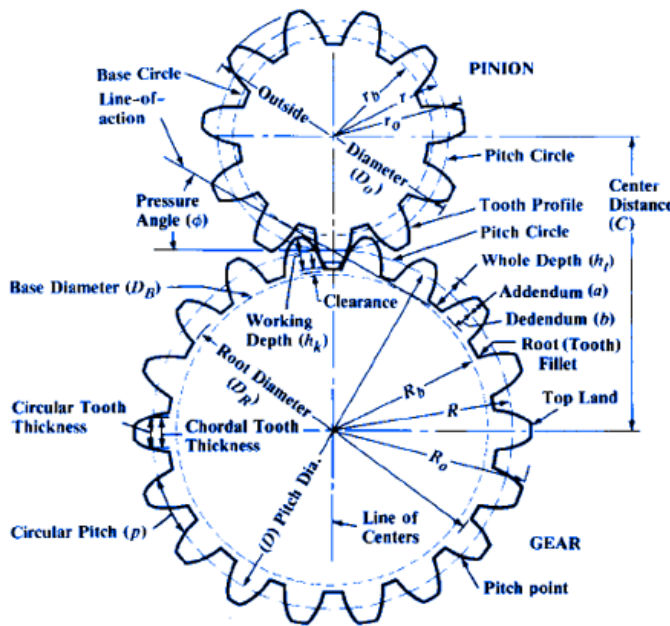


Gear Design Equations and Formula
Circular Pitches and Equivalent Diametral Pitches Table
[Gear Design and Selection Application](#)

Resources:

- [Involute Spline and Serration Universal Design Calculator](#)
- [Gear Spur Tooth Strength Equation and Calculator](#)
- [Helical Gear and Pinion Equations and Calculator](#)
- [Three Gears Ratios, Force Equations and Calculator](#)
- [Automotive Transmission Gear Ratio Equation and Calculator](#)
- [Screw Worm Gear Axial Force and Thrust Calculator](#)
- [Gear Motor Transmission Inertia Drive Calculator](#)

Spur Gear design formula for geometry, pitch, tooth clearance and critical functional data.
(Inch Units Applicable for Constants)



[Spur Gear Design Calculator](#)

Calculate	When Defined	Formula
Diametral Pitch (P)	Pitch Diameter (PD) and the Number of Teeth (N)	$P = N / PD$
Diametral Pitch (P)	Circular Pitch (p)	$P = 3.1416/p$
Diametral Pitch (P)	Outside Diameter (OD) and the Number of Teeth (N)	$P = (N+2)/OD$
Pitch Diameter (PD) .	Number of teeth (N) and the Diametral Pitch (P)	$PD = N/DP$
Outside Diameter (OD)	Number of teeth (N) and the Diametral Pitch (P)	$OD = (N+2)/DP$

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Number of Teeth (N).	Pitch Diameter (D) and the Diametral Pitch (P)	$N = PD * DP$
Addendum (a) .	Diametral Pitch (P)	$a = 1/DP$
Dedendum (d)	Whole Depth and Addendum	$d = hw - a$
Tooth Thickness (t) at the Pitch Diameter	Diametral Pitch (P)	$t = 1.5708/P$
Working Depth (WD).	Addendum	$WD = 2(a)$
Center Distance (C)	Normal Diametral Pitch (P) and the Number of Teeth in Both Gears	$C = (N1+N2)/2P$
Center Distance (C)	Pitch Diameters of both gears	$C = (PD1+PD2)/2$
Circular Pitch (p)	Diametral Pitch (P)	$p = 3.1416 / P$
Whole Depth (hw) for 20 Pitch & finer .	Diametral Pitch (P)	$hw = 2.2/P + .002$
Whole Depth (hw) for Coarser than 20 Pitch .	Diametral Pitch (P)	$hw = 2.157/P$

Equations Tooth Parts, 20-and 25-degree Involute Full-depth Teeth ANSI Coarse Pitch Spur Gear Tooth Forms ANSI B6.1

[Spur Gear Design Calculator](#)

Find	Diametral Pitch, P, Known	Circular Pitch, p, Known
Addendum	$a = 1.000 / P$	$a = 0.3183 \times p$
Dedendum (Preferred)	$b = 1.250 / P$	$b = 0.3979 \times p$
(Shaved or Ground Teeth) ^a	$b = 1.350 / P$	$b = 0.4297 \times p$
Working Depth	$hk = 2.000 / P$	$hk = 0.6366 \times p$
Whole Depth (Preferred)	$ht = 2.250 / P$	$ht = 0.7162 \times p$
(Shaved or Ground Teeth)	$ht = 2.350 / P$	$ht = 0.7480 \times p$
Clearance (Preferred) ^b	$c = 0.250 / P$	$c = 0.0796 \times p$

^a When gears are preshave cut on a gear shaper the dedendum will usually need to be increased to $1.40/P$ to allow for the higher fillet trochoid produced by the shaper cutter. This is of particular importance on gears of few teeth or if the gear blank configuration requires the use of a small diameter shaper cutter, in which case the dedendum may need to be increased to as much as $1.45/P$. This should be avoided on highly loaded gears where the consequently reduced J factor will increase gear tooth stress excessively.

^b A minimum clearance of $0.157/P$ may be used for the basic 20-degree and 25-degree pressure angle rack in the case of shallow root sections and use of existing hobs or cutters.

Helical Gear

Calculate	When Defined	Formula

Normal D.P. (Pn)	Transverse D.P.(P) and the Helix Angle (A)	$P_n = P / \cos A$
Normal D.P. (Pn)	Number of teeth (N) and the Helix Angle (A)	$P_n = N / (D \times \cos A)$
Pitch Diameter (D)	Number of teeth (N), the Normal Diametral Pitch and the Helix Angle (A)	$D = N / (P_n \times \cos A)$
Outside Diameter (OD)	Pitch Diameter (D) and the Addendum (a)	$OD = D + (2 \times a)$
Outside Diameter (OD)	Normal Diametral Pitch (P) and the Pitch Diameter (D)	$OD = D + 2/P_n$
Helix Angle (A) for Parallel Shaft Drive	Number of Teeth (N), Pitch Diameter (D) and the Diametral Pitch (P)	$\cos A = N / (P_n \times D)$
Addendum (a)	Normal Diametral Pitch (Pn)	$a = 1 / P_n$
Lead (L)	Pitch Diameter (D) and Pitch Helix Angle	$L = (\pi \times D) / \tan$

Circular Pitches and Equivalent Diametral Pitches Table

Circular Pitch	Diametral Pitch	Module	Arc Thickness of Tooth on Pitch Line	Addendum	Working Depth of Tooth	Dedendum or Depth of Space Below Pitch Line	Whole Depth of Tooth
4	0.7854	32.3402	2.0000	1.2732	2.5464	1.4732	2.7464
3 - 1/2	0.8976	28.2581	1.7500	1.1140	2.2281	1.2890	2.4031
3	1.0472	24.2552	1.5000	0.9549	1.9098	1.1049	2.0598
2 - 3/4	1.1424	22.2339	1.3750	0.8753	1.7506	1.0128	1.8881
2 - 1/2	1.2566	20.2117	1.2500	0.7957	1.5915	0.9207	1.7165
2 - 1/4	1.3963	18.1913	1.1250	0.7162	1.4323	0.8287	1.5448
2	1.5708	16.1701	1.0000	0.6366	1.2732	0.7366	1.3732
1 - 7/8	1.6755	15.1595	0.9375	0.5968	1.1937	0.6906	1.2874
1 - 3/4	1.7952	14.1488	0.8750	0.5570	1.1141	0.6445	1.2016
1 - 5/8	1.9333	13.1382	0.8125	0.5173	1.0345	0.5985	1.1158
1 - 1/2	2.0944	12.1276	0.7500	0.4775	0.9549	0.5525	1.0299
1 - 7/16	2.1855	11.6223	0.7187	0.4576	0.9151	0.5294	0.9870
1 - 3/8	2.2848	11.1169	0.6875	0.4377	0.8754	0.5064	0.9441
1 - 5/16	2.3936	10.6116	0.6562	0.4178	0.8356	0.4834	0.9012
1 - 1/4	2.5133	10.1062	0.6250	0.3979	0.7958	0.4604	0.8583
1 - 3/16	2.6456	9.6010	0.5937	0.3780	0.7560	0.4374	0.8154
1 - 1/8	2.7925	9.0958	0.5625	0.3581	0.7162	0.4143	0.7724
1 - 1/16	2.9568	8.5904	0.5312	0.3382	0.6764	0.3913	0.7295
1	3.1416	8.0851	0.5000	0.3183	0.6366	0.3683	0.6866
15/16	3.3510	7.5798	0.4687	0.2984	0.5968	0.3453	0.6437
7/8	3.5904	7.0744	0.4375	0.2785	0.5570	0.3223	0.6007
13/16	3.8666	6.5692	0.4062	0.2586	0.5173	0.2993	0.5579
3/4	4.1888	6.0639	0.3750	0.2387	0.4775	0.2762	0.5150
11/16	4.5696	5.5586	0.3437	0.2189	0.4377	0.2532	0.4720

2/3	4.7124	5.3903	0.3333	0.2122	0.4244	0.2455	0.4577
5/8	5.0265	5.0532	0.3125	0.1989	0.3979	0.2301	0.4291
9/16	5.5851	4.5479	0.2812	0.1790	0.3581	0.2071	0.3862
1/2	6.2832	4.0426	0.2500	0.1592	0.3183	0.1842	0.3433
7/16	7.1808	3.5373	0.2187	0.1393	0.2785	0.1611	0.3003
2/5	7.8540	3.2340	0.2000	0.1273	0.2546	0.1473	0.2746
3/8	8.3776	3.0319	0.1875	0.1194	0.2387	0.1381	0.2575
1/3	9.4248	2.6947	0.1666	0.1061	0.2122	0.1228	0.2289
5/16	10.0531	2.5266	0.1562	0.0995	0.1989	0.1151	0.2146
2/7	10.9956	2.3100	0.1429	0.0909	0.1819	0.1052	0.1962
1/4	12.5664	2.0213	0.1250	0.0796	0.1591	0.0921	0.1716
2/9	14.1372	1.7967	0.1111	0.0707	0.1415	0.0818	0.1526
1/5	15.7080	1.6170	0.1000	0.0637	0.1273	0.0737	0.1373
3/16	16.7552	1.5160	0.0937	0.0597	0.1194	0.0690	0.1287
1/6	18.8496	.5053	0.0833	0.0531	0.1061	0.0614	0.1144

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