

CLASS 11 MATHEMATICS — FORMULA SHEET

Chapter 3 : Trigonometric Functions (NCERT)

3.1 Angles & Measurement

Concept	Formula
Radian–degree relation	π radian = 180° ; 1 radian = $57^\circ 16'$ approx
Degree to radian	radian = $(\pi/180) \times$ degree
Radian to degree	degree = $(180/\pi) \times$ radian
Arc length	$l = r \theta$ (θ in radians)
Area of sector	$A = \frac{1}{2} r^2 \theta = \frac{1}{2} l r$
Angular relation	$\theta = l / r$

3.2 Trigonometric Ratios & Standard Values

Angle	sin	cos	tan
0°	0	1	0
$30^\circ (\pi/6)$	$1/2$	$\sqrt{3}/2$	$1/\sqrt{3}$
$45^\circ (\pi/4)$	$1/\sqrt{2}$	$1/\sqrt{2}$	1
$60^\circ (\pi/3)$	$\sqrt{3}/2$	$1/2$	$\sqrt{3}$
$90^\circ (\pi/2)$	1	0	not defined
$180^\circ (\pi)$	0	-1	0
$270^\circ (3\pi/2)$	-1	0	not defined
$360^\circ (2\pi)$	0	1	0

3.3 Fundamental Identities & Reciprocals

Identity	Formula
Reciprocals	$\operatorname{cosec} \theta = 1/\sin \theta$; $\sec \theta = 1/\cos \theta$; $\cot \theta = 1/\tan \theta$
Quotient	$\tan \theta = \sin \theta / \cos \theta$; $\cot \theta = \cos \theta / \sin \theta$
Pythagorean 1	$\sin^2 \theta + \cos^2 \theta = 1$
Pythagorean 2	$1 + \tan^2 \theta = \sec^2 \theta$
Pythagorean 3	$1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$
Range of sin & cos	$-1 \leq \sin \theta \leq 1$; $-1 \leq \cos \theta \leq 1$

3.4 Signs & Allied (Related) Angles

Concept	Rule
ASTC rule (quadrants I-IV)	I: All +ve ; II: Sin +ve ; III: Tan +ve ; IV: Cos +ve
Even/odd (negative angle)	$\sin(-\theta) = -\sin \theta$; $\cos(-\theta) = \cos \theta$; $\tan(-\theta) = -\tan \theta$

Concept	Rule
$90^\circ \pm \theta$ (co-ratios flip)	$\sin(90^\circ - \theta) = \cos \theta$; $\cos(90^\circ - \theta) = \sin \theta$; $\tan(90^\circ - \theta) = \cot \theta$
$180^\circ \pm \theta$ (no flip)	$\sin(180^\circ - \theta) = \sin \theta$; $\cos(180^\circ - \theta) = -\cos \theta$
$360^\circ \pm \theta$ / periodicity	$\sin(2\pi + \theta) = \sin \theta$ etc. (period 2π for sin, cos)
Period of functions	sin, cos, sec, cosec $\rightarrow 2\pi$; tan, cot $\rightarrow \pi$

3.5 Sum & Difference Formulas

Formula	Expression
$\sin(A \pm B)$	$\sin A \cos B \pm \cos A \sin B$
$\cos(A \pm B)$	$\cos A \cos B \mp \sin A \sin B$
$\tan(A \pm B)$	$(\tan A \pm \tan B) \div (1 \mp \tan A \tan B)$
$\cot(A \pm B)$	$(\cot A \cot B \mp 1) \div (\cot B \pm \cot A)$
$2 \sin A \cos B$	$\sin(A+B) + \sin(A-B)$
$2 \cos A \sin B$	$\sin(A+B) - \sin(A-B)$
$2 \cos A \cos B$	$\cos(A+B) + \cos(A-B)$
$2 \sin A \sin B$	$\cos(A-B) - \cos(A+B)$

3.6 Sum-to-Product (C-D) Formulas

Formula	Expression
$\sin C + \sin D$	$2 \sin((C+D)/2) \cos((C-D)/2)$
$\sin C - \sin D$	$2 \cos((C+D)/2) \sin((C-D)/2)$
$\cos C + \cos D$	$2 \cos((C+D)/2) \cos((C-D)/2)$
$\cos C - \cos D$	$-2 \sin((C+D)/2) \sin((C-D)/2)$

3.7 Multiple & Sub-Multiple Angle Formulas

Formula	Expression
$\sin 2A$	$2 \sin A \cos A = 2 \tan A \div (1 + \tan^2 A)$
$\cos 2A$	$\cos^2 A - \sin^2 A = 1 - 2\sin^2 A = 2\cos^2 A - 1 = (1 - \tan^2 A)/(1 + \tan^2 A)$
$\tan 2A$	$2 \tan A \div (1 - \tan^2 A)$
$\sin 3A$	$3 \sin A - 4 \sin^3 A$
$\cos 3A$	$4 \cos^3 A - 3 \cos A$
$\tan 3A$	$(3 \tan A - \tan^3 A) \div (1 - 3 \tan^2 A)$
Half-angle: $\sin^2(A/2)$	$(1 - \cos A) \div 2$
Half-angle: $\cos^2(A/2)$	$(1 + \cos A) \div 2$

3.8 Trigonometric Equations (General Solutions)

Equation	General Solution
$\sin \theta = 0$	$\theta = n\pi, n \in \mathbb{Z}$
$\cos \theta = 0$	$\theta = (2n+1)\pi/2, n \in \mathbb{Z}$
$\tan \theta = 0$	$\theta = n\pi, n \in \mathbb{Z}$
$\sin \theta = \sin \alpha$	$\theta = n\pi + (-1)^n \alpha$
$\cos \theta = \cos \alpha$	$\theta = 2n\pi \pm \alpha$
$\tan \theta = \tan \alpha$	$\theta = n\pi + \alpha$
$\sin^2 \theta = \sin^2 \alpha$ (etc.)	$\theta = n\pi \pm \alpha$

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ASTC	'All Silver Tea Cups' → Quadrant I All, II Sin, III Tan, IV Cos are positive.
Standard values	sin: 0, $\frac{1}{2}$, $\frac{1}{\sqrt{2}}$, $\frac{\sqrt{3}}{2}$, 1 for 0-30-45-60-90 ; cos is the reverse order.
Periods	sin, cos, sec, cosec → 2π ; tan, cot → π .
sin(A+B)	'Sin = sin cos + cos sin' ; cos(A+B) = 'cos cos - sin sin' (sign flips for cos).
cos 2A trio	Three forms: $1-2\sin^2 A$, $2\cos^2 A-1$, $\cos^2 A-\sin^2 A$ — pick what's useful.
3A formulas	$\sin 3A = 3\sin A - 4\sin^3 A$; $\cos 3A = 4\cos^3 A - 3\cos A$ (note the swap of 3 & 4).
General solution	sin → $n\pi + (-1)^n \alpha$; cos → $2n\pi \pm \alpha$; tan → $n\pi + \alpha$.
Co-functions at 90°	$90^\circ \pm \theta$ turns $\sin \leftrightarrow \cos$, $\tan \leftrightarrow \cot$, $\sec \leftrightarrow \csc$.