

Trigonometric Functions — Assignment 2

Class 11 Maths · Higher-difficulty challenge set + integrated problems · Answer key included · Narayan Gurukul Academy

Instructions: (1) Attempt all questions; start with the topic-wise challenge set, then attempt the integrated (multi-topic) problems.
(2) Give all answers with correct SI units. $g = 10 \text{ m/s}^2$ unless stated.
(3) A final answer key is provided at the end — try the full set before checking it.

Part A — Topic-wise challenge questions

Angles and Degree–Radian Conversion

1. Convert $40^\circ 20'$ into radian measure.
2. Convert 2 radians into degree measure (use $\pi = 22/7$).
3. Convert 1000° and $-47^\circ 30'$ into radian measure.

The Six Ratios and Quadrant Signs

1. Find the values of $\sin 45^\circ$, $\cos 45^\circ$ and $\tan 45^\circ$.
2. State the signs of the trigonometric functions in the four quadrants.
3. Find the values of $\sin 150^\circ$, $\cos 210^\circ$ and $\tan 300^\circ$.

Basic Trigonometric Identities

1. Prove that $\sin^2 x + \cos^2 x = 1$ using a right triangle.
2. If $\tan x = 3/4$, find $\sin x$ and $\cos x$.
3. Prove that $(1 + \tan x)/(1 + \cot x) = \tan x$, for $x \neq 0$.

Compound, Double and Half-Angle Formulas

1. Find the value of $\sin 75^\circ$ using $\sin(A + B)$.
2. Find the value of $\cos 15^\circ$ using a compound angle formula.
3. Prove that $\sin 2A = 2 \tan A/(1 + \tan^2 A)$ and $\cos 2A = (1 - \tan^2 A)/(1 + \tan^2 A)$.

Sum-to-Product and Product-to-Sum

1. Express $\sin 5x + \sin 3x$ as a product.
2. Express $\cos 4x - \cos 2x$ as a product.
3. Prove that $(\sin 5x + \sin 3x)/(\cos 5x + \cos 3x) = \tan 4x$.

Trigonometric Equations and General Solutions

1. Find the general solution of $\sin x = 1/2$.
2. Find the general solution of $\cos x = -1/2$.
3. Find the general solution of $\sin 2x - \sin 4x + \sin 6x = 0$.

Part B — Integrated problems (multi-topic)

1. Convert $40^\circ 20'$ into radian measure.
2. Find the value of $\sin 75^\circ$ using $\sin(A + B)$.
3. Prove that $(1 + \tan x)/(1 + \cot x) = \tan x$, for $x \neq 0$.
4. Prove that $(\sin 5x + \sin 3x)/(\cos 5x + \cos 3x) = \tan 4x$.
5. Find the general solution of $\sin x = 1/2$.

Answer Key**Angles and Degree–Radian Conversion**

$40^\circ 20' = 121\pi/540$ radians. $2 \text{ rad} = 2 \times 57^\circ 16' \approx 114^\circ 35'$. $1000^\circ = 50\pi/9 \text{ rad}$; $-47^\circ 30' = -19\pi/72 \text{ rad}$.

The Six Ratios and Quadrant Signs

$\sin 45^\circ = \cos 45^\circ = 1/\sqrt{2}$, $\tan 45^\circ = 1$. Quadrant I: all +; II: $\sin$, $\csc$ +; III: $\tan$, $\cot$ +; IV: $\cos$, $\sec$ +. $\sin 150^\circ = 1/2$, $\cos 210^\circ = -\sqrt{3}/2$, $\tan 300^\circ = -\sqrt{3}$.

Basic Trigonometric Identities

Pythagoras gives $\sin^2 x + \cos^2 x = 1$. $\tan x = 3/4 \Rightarrow \sin x = 3/5$, $\cos x = 4/5$. $(1 + \tan x)/(1 + \cot x) = (1 + \tan x)/(1 + 1/\tan x) = \tan x$.

Compound, Double and Half-Angle Formulas

$\sin 75^\circ = (\sqrt{6} + \sqrt{2})/4$. $\cos 15^\circ = (\sqrt{6} + \sqrt{2})/4$. Double-angle forms derived from $\sin 2A$ and $\cos 2A$ by dividing by $\cos^2 A$.

Sum-to-Product and Product-to-Sum

$\sin 5x + \sin 3x = 2 \sin 4x \cos x$. $\cos 4x - \cos 2x = -2 \sin 3x \sin x$. Ratio = $\tan 4x$.

Trigonometric Equations and General Solutions

$\sin x = 1/2 \Rightarrow x = n\pi + (-1)^n \pi/6$. $\cos x = -1/2 \Rightarrow x = 2n\pi \pm 2\pi/3$. $\sin 2x - \sin 4x + \sin 6x = 0$ gives $x = n\pi/4$ or $x = n\pi \pm \pi/6$.

Integrated problems

1: $121\pi/540$. 2: $(\sqrt{6} + \sqrt{2})/4$. 3: $\tan x$. 4: $\tan 4x$. 5: $x = n\pi + (-1)^n \pi/6$, $n \in \mathbb{Z}$.