

50 multiple-choice questions

Question 1 (Level 1) — *Degrees in a right angle*

How many degrees are in a right angle?

- (A) 90°
- (B) 180°
- (C) 45°
- (D) 360°

Question 2 (Level 1) — *Evaluate*

What is $\sin 30^\circ$?

- (A) $\frac{1}{2}$
- (B) $\frac{\sqrt{3}}{2}$
- (C) $\frac{\sqrt{2}}{2}$
- (D) 1

Question 3 (Level 1) — *Evaluate*

What is $\cos 60^\circ$?

- (A) $\frac{1}{2}$
- (B) $\frac{\sqrt{3}}{2}$
- (C) 0
- (D) 1

Question 4 (Level 1) — *Evaluate*

What is $\tan 45^\circ$?

- (A) 1
- (B) 0
- (C) $\frac{1}{2}$
- (D) $\sqrt{2}$

Question 5 (Level 1) — *Convert degrees to radians*

Convert 180° to radians.

- (A) π
- (B) 2π

(C) $\frac{\pi}{2}$

(D) $\frac{\pi}{4}$

Question 6 (Level 1) — *Period of*What is the period of $y = \sin x$?

(A) 2π

(B) π

(C) $\frac{\pi}{2}$

(D) 4π

Question 7 (Level 1) — *Amplitude of*What is the amplitude of $y = \sin x$?

(A) 1

(B) 2

(C) 0

(D) $\frac{1}{2}$

Question 8 (Level 1) — *Value of*What is $\sin 0$?

(A) 0

(B) 1

(C) -1

(D) $\frac{1}{2}$

Question 9 (Level 1) — *Value of*What is $\cos 0$?

(A) 1

(B) 0

(C) -1

(D) $\frac{1}{2}$

Question 10 (Level 1) — *Convert to radians*Convert 90° to radians.

(A) $\frac{\pi}{2}$

- (B) π
- (C) $\frac{\pi}{4}$
- (D) 2π

Question 11 (Level 2) — *Convert to degrees*

Convert $\frac{\pi}{3}$ radians to degrees.

- (A) 60°
- (B) 30°
- (C) 120°
- (D) 90°

Question 12 (Level 2) — *Evaluate*

Evaluate $\sin \frac{\pi}{4}$.

- (A) $\frac{\sqrt{2}}{2}$
- (B) $\frac{1}{2}$
- (C) $\frac{\sqrt{3}}{2}$
- (D) 1

Question 13 (Level 2) — *Amplitude of transformed sine*

What is the amplitude of $y = 3 \sin x$?

- (A) 3
- (B) 1
- (C) 6
- (D) $\frac{1}{3}$

Question 14 (Level 2) — *Period of*

What is the period of $y = \cos 2x$?

- (A) π
- (B) 2π
- (C) 4π
- (D) $\frac{\pi}{2}$

Question 15 (Level 2) — *Evaluate*

Evaluate $\cos \frac{\pi}{3}$.

- (A) $\frac{1}{2}$
- (B) $\frac{\sqrt{3}}{2}$
- (C) $\frac{\sqrt{2}}{2}$
- (D) 0

Question 16 (Level 2) — *Range of*

What is the range of $y = \sin x$?

- (A) $[-1, 1]$
- (B) $[0, 1]$
- (C) $(-\infty, \infty)$
- (D) $[-2, 2]$

Question 17 (Level 2) — *Evaluate*

Evaluate $\tan \frac{\pi}{3}$.

- (A) $\sqrt{3}$
- (B) $\frac{1}{\sqrt{3}}$
- (C) 1
- (D) $\frac{\sqrt{3}}{2}$

Question 18 (Level 2) — *Quadrant signs*

In which quadrant is $\sin \theta > 0$ and $\cos \theta < 0$?

- (A) Quadrant 2
- (B) Quadrant 1
- (C) Quadrant 3
- (D) Quadrant 4

Question 19 (Level 2) — *Period of*

What is the period of $y = \tan x$?

- (A) π
- (B) 2π
- (C) $\frac{\pi}{2}$
- (D) 4π

Question 20 (Level 2) — *Evaluate*Evaluate $\sin \frac{\pi}{6}$.

- (A) $\frac{1}{2}$
- (B) $\frac{\sqrt{3}}{2}$
- (C) $\frac{\sqrt{2}}{2}$
- (D) $\frac{1}{\sqrt{3}}$

Question 21 (Level 3) — *Evaluate*Evaluate $\sin \frac{2\pi}{3}$.

- (A) $\frac{\sqrt{3}}{2}$
- (B) $-\frac{\sqrt{3}}{2}$
- (C) $\frac{1}{2}$
- (D) $-\frac{1}{2}$

Question 22 (Level 3) — *Evaluate*Evaluate $\cos \frac{3\pi}{4}$.

- (A) $-\frac{\sqrt{2}}{2}$
- (B) $\frac{\sqrt{2}}{2}$
- (C) $-\frac{1}{2}$
- (D) $-\frac{\sqrt{3}}{2}$

Question 23 (Level 3) — *Solve basic trig equation*Solve $\sin x = \frac{1}{2}$ for $0 \leq x \leq 2\pi$.

- (A) $x = \frac{\pi}{6}$ or $x = \frac{5\pi}{6}$
- (B) $x = \frac{\pi}{3}$ or $x = \frac{2\pi}{3}$
- (C) $x = \frac{\pi}{6}$ only
- (D) $x = \frac{\pi}{6}$ or $x = \frac{7\pi}{6}$

Question 24 (Level 3) — *Pythagorean identity*If $\sin \theta = \frac{3}{5}$ and θ is in Q1, find $\cos \theta$.

- (A) $\frac{4}{5}$
- (B) $\frac{3}{4}$
- (C) $-\frac{4}{5}$

(D) $\frac{5}{4}$

Question 25 (Level 3) — *Amplitude and period*

State the amplitude and period of $y = 4 \sin(3x)$.

(A) Amplitude 4, period $\frac{2\pi}{3}$

(B) Amplitude 3, period $\frac{2\pi}{4}$

(C) Amplitude 4, period 3π

(D) Amplitude 4, period $\frac{\pi}{3}$

Question 26 (Level 3) — *Solve*

Solve $\cos x = -\frac{1}{2}$ for $0 \leq x \leq 2\pi$.

(A) $x = \frac{2\pi}{3}$ or $x = \frac{4\pi}{3}$

(B) $x = \frac{\pi}{3}$ or $x = \frac{5\pi}{3}$

(C) $x = \frac{2\pi}{3}$ only

(D) $x = \frac{\pi}{3}$ or $x = \frac{4\pi}{3}$

Question 27 (Level 3) — *Evaluate*

Evaluate $\tan \frac{5\pi}{4}$.

(A) 1

(B) -1

(C) $\sqrt{2}$

(D) 0

Question 28 (Level 3) — *Phase shift identification*

What is the phase shift of $y = \sin\left(x - \frac{\pi}{4}\right)$?

(A) $\frac{\pi}{4}$ to the right

(B) $\frac{\pi}{4}$ to the left

(C) $\frac{\pi}{4}$ upward

(D) $\frac{\pi}{2}$ to the right

Question 29 (Level 3) — *Solve*

Solve $\tan x = 1$ for $0 \leq x \leq 2\pi$.

(A) $x = \frac{\pi}{4}$ or $x = \frac{5\pi}{4}$

(B) $x = \frac{\pi}{4}$ only

(C) $x = \frac{\pi}{4}$ or $x = \frac{3\pi}{4}$

(D) $x = \frac{\pi}{4}$ or $x = \frac{7\pi}{4}$

Question 30 (Level 3) — *Range of transformed cosine*Find the range of $y = 2 \cos x + 3$.

(A) $[1, 5]$

(B) $[-1, 5]$

(C) $[3, 5]$

(D) $[-2, 2]$

Question 31 (Level 4) — *Solve*Solve $2 \sin x = \sqrt{3}$ for $0 \leq x \leq 2\pi$.

(A) $x = \frac{\pi}{3}$ or $x = \frac{2\pi}{3}$

(B) $x = \frac{\pi}{6}$ or $x = \frac{5\pi}{6}$

(C) $x = \frac{\pi}{3}$ only

(D) $x = \frac{\pi}{3}$ or $x = \frac{4\pi}{3}$

Question 32 (Level 4) — *Solve*Find all solutions of $\cos 2x = \frac{1}{2}$ for $0 \leq x \leq 2\pi$.

(A) $x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$

(B) $x = \frac{\pi}{3}, \frac{5\pi}{3}$

(C) $x = \frac{\pi}{6}, \frac{5\pi}{6}$

(D) $x = \frac{\pi}{6}, \frac{11\pi}{6}$

Question 33 (Level 4) — *Double angle formula*If $\sin \theta = \frac{3}{5}$ with $\theta \in (0, \frac{\pi}{2})$, find $\sin 2\theta$.

(A) $\frac{24}{25}$

(B) $\frac{6}{5}$

(C) $\frac{12}{25}$

(D) $\frac{7}{25}$

Question 34 (Level 4) — *Graph equation from description*A sine function has amplitude 2, period π , and a phase shift of $\frac{\pi}{6}$ to the right. Write its equation.

(A) $y = 2 \sin \left(2 \left(x - \frac{\pi}{6} \right) \right)$

- (B) $y = 2 \sin \left(x - \frac{\pi}{6} \right)$
- (C) $y = 2 \sin \left(\pi \left(x - \frac{\pi}{6} \right) \right)$
- (D) $y = 2 \sin \left(2x - \frac{\pi}{6} \right)$

Question 35 (Level 4) — *Trig identity simplification*

Simplify $\frac{\sin^2 x}{1 - \cos x}$.

- (A) $1 + \cos x$
- (B) $1 - \cos x$
- (C) $\sin x$
- (D) $\cos^2 x$

Question 36 (Level 4) — *Solve*

Solve $2 \cos^2 x - 1 = 0$ for $0 \leq x \leq 2\pi$.

- (A) $x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$
- (B) $x = \frac{\pi}{4}, \frac{7\pi}{4}$
- (C) $x = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$
- (D) $x = 0, \pi$

Question 37 (Level 4) — *Derivative of*

Find $\frac{d}{dx}[\sin(3x + 1)]$.

- (A) $3 \cos(3x + 1)$
- (B) $\cos(3x + 1)$
- (C) $-3 \cos(3x + 1)$
- (D) $3 \sin(3x + 1)$

Question 38 (Level 4) — *Complementary relationship*

Simplify $\sin \left(\frac{\pi}{2} - x \right)$.

- (A) $\cos x$
- (B) $-\cos x$
- (C) $\sin x$
- (D) $-\sin x$

Question 39 (Level 4) — *Cosine rule application*

In a triangle with sides $a = 5$, $b = 7$, and included angle $C = 60^\circ$, find c .

- (A) $\sqrt{39}$
- (B) $\sqrt{74}$
- (C) $\sqrt{109}$
- (D) $\sqrt{34}$

Question 40 (Level 4) — *Find given*

If $\cos \theta = \frac{1}{3}$, find $\cos 2\theta$.

- (A) $-\frac{7}{9}$
- (B) $\frac{2}{3}$
- (C) $\frac{7}{9}$
- (D) $-\frac{2}{9}$

Question 41 (Level 5) — *Solve trig equation with substitution*

Solve $2\sin^2 x - 3\sin x + 1 = 0$ for $0 \leq x \leq 2\pi$.

- (A) $x = \frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}$
- (B) $x = \frac{\pi}{6}, \frac{5\pi}{6}$
- (C) $x = \frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}$
- (D) $x = \frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}, \frac{3\pi}{2}$

Question 42 (Level 5) — *Integral of*

Evaluate $\int_0^\pi \cos^2 x \, dx$.

- (A) $\frac{\pi}{2}$
- (B) π
- (C) 0
- (D) $\frac{\pi}{4}$

Question 43 (Level 5) — *Solve*

Solve $\sin x + \cos x = 1$ for $0 \leq x \leq 2\pi$.

- (A) $x = 0$ or $x = \frac{\pi}{2}$
- (B) $x = 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}$
- (C) $x = \frac{\pi}{4}$ only
- (D) $x = 0, \frac{\pi}{4}, \frac{\pi}{2}$

Question 44 (Level 5) — *Derivative of*

Find $\frac{d}{dx}[\tan(2x)]$.

- (A) $2 \sec^2(2x)$
- (B) $\sec^2(2x)$
- (C) $2 \tan(2x)$
- (D) $2 \cos^2(2x)$

Question 45 (Level 5) — *Number of solutions*

How many solutions does $\sin x = \frac{x}{10}$ have for $x \in [-10, 10]$?

- (A) 7
- (B) 5
- (C) 3
- (D) 11

Question 46 (Level 5) — *Exact value with addition formula*

Find the exact value of $\cos 75^\circ$.

- (A) $\frac{\sqrt{6}-\sqrt{2}}{4}$
- (B) $\frac{\sqrt{6}+\sqrt{2}}{4}$
- (C) $\frac{\sqrt{3}-1}{4}$
- (D) $\frac{\sqrt{2}-\sqrt{6}}{4}$

Question 47 (Level 5) — *Area under sine curve*

Find $\int_0^\pi \sin x \, dx$.

- (A) 2
- (B) 0
- (C) 1
- (D) π

Question 48 (Level 5) — *Prove a trig identity*

Which expression equals $\frac{\tan x + \cot x}{1}$?

- (A) $\frac{2}{\sin 2x}$
- (B) $\frac{1}{\sin 2x}$
- (C) $2 \sin 2x$
- (D) $\sec x \csc x$

Question 49 (Level 5) — *Solve*

Find all solutions of $\sin 3x = \sin x$ for $0 \leq x \leq \pi$.

- (A) $x = 0, \frac{\pi}{4}, \frac{3\pi}{4}, \pi$
- (B) $x = 0, \frac{\pi}{2}, \pi$
- (C) $x = \frac{\pi}{4}, \frac{\pi}{2}, \frac{3\pi}{4}$
- (D) $x = 0, \frac{\pi}{3}, \frac{2\pi}{3}, \pi$

Question 50 (Level 5) — *Maximum value of combined function*

Find the maximum value of $f(x) = 3 \sin x + 4 \cos x$.

- (A) 5
- (B) 7
- (C) $\sqrt{7}$
- (D) 4

Solutions

Q1: (A)

A right angle = 90° .

Q2: (A)

$$\sin 30^\circ = \frac{1}{2}.$$

Q3: (A)

$$\cos 60^\circ = \frac{1}{2}.$$

Q4: (A)

$$\tan 45^\circ = 1.$$

Q5: (A)

$$180^\circ = \pi \text{ radians.}$$

Q6: (A)

The period of $\sin x$ is 2π (or 360°).

Q7: (A)

The amplitude of $\sin x$ is 1.

Q8: (A)

$$\sin 0 = 0.$$

Q9: (A)

$$\cos 0 = 1.$$

Q10: (A)

$$90^\circ = \frac{\pi}{2} \text{ radians.}$$

Q11: (A)

$$\frac{\pi}{3} \times \frac{180^\circ}{\pi} = 60^\circ.$$

Q12: (A)

$$\sin \frac{\pi}{4} = \frac{\sqrt{2}}{2}.$$

Q13: (A)

$$\text{Amplitude} = |3| = 3.$$

Q14: (A)

$$\text{Period} = \frac{2\pi}{2} = \pi.$$

Q15: (A)

$$\cos \frac{\pi}{3} = \frac{1}{2}.$$

Q16: (A)

$$\text{Range: } [-1, 1].$$

Q17: (A)

$$\tan \frac{\pi}{3} = \sqrt{3}.$$

Q18: (A)

Both conditions hold in Quadrant 2.

Q19: (A)

The period of $\tan x$ is π .

Q20: (A)

$$\sin \frac{\pi}{6} = \frac{1}{2}.$$

Q21: (A)

$$\sin \frac{2\pi}{3} = \sin \frac{\pi}{3} = \frac{\sqrt{3}}{2}.$$

Q22: (A)

$$\cos \frac{3\pi}{4} = -\cos \frac{\pi}{4} = -\frac{\sqrt{2}}{2}.$$

Q23: (A)

$$x = \frac{\pi}{6} \text{ or } x = \frac{5\pi}{6}.$$

Q24: (A)

$$\cos^2 \theta = 1 - \frac{9}{25} = \frac{16}{25}. \text{ In Q1, } \cos \theta = \frac{4}{5}.$$

Q25: (A)

Amplitude = 4, period = $\frac{2\pi}{3}$.

Q26: (A)

$$x = \pi - \frac{\pi}{3} = \frac{2\pi}{3} \text{ or } x = \pi + \frac{\pi}{3} = \frac{4\pi}{3}.$$

Q27: (A)

$$\tan \frac{5\pi}{4} = \tan \frac{\pi}{4} = 1.$$

Q28: (A)

Phase shift: $\frac{\pi}{4}$ to the right.

Q29: (A)

$$x = \frac{\pi}{4} \text{ or } x = \frac{\pi}{4} + \pi = \frac{5\pi}{4}.$$

Q30: (A)

$$2 \cos x + 3 \in [-2 + 3, 2 + 3] = [1, 5].$$

Q31: (A)

$$x = \frac{\pi}{3} \text{ or } x = \frac{2\pi}{3}.$$

Q32: (A)

$$2x = \frac{\pi}{3}, \frac{5\pi}{3}, \frac{7\pi}{3}, \frac{11\pi}{3}. \text{ So } x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}.$$

Q33: (A)

$$\sin 2\theta = 2 \times \frac{3}{5} \times \frac{4}{5} = \frac{24}{25}.$$

Q34: (A)

$$n = \frac{2\pi}{\pi} = 2. \text{ Equation: } y = 2 \sin \left(2 \left(x - \frac{\pi}{6} \right) \right).$$

Q35: (A)

$$\frac{(1-\cos x)(1+\cos x)}{1-\cos x} = 1 + \cos x \text{ (for } \cos x \neq 1).$$

Q36: (A)

$$\cos x = \frac{\sqrt{2}}{2}: x = \frac{\pi}{4}, \frac{7\pi}{4}. \cos x = -\frac{\sqrt{2}}{2}: x = \frac{3\pi}{4}, \frac{5\pi}{4}.$$

Q37: (A)

$$\frac{d}{dx} [\sin(3x+1)] = 3 \cos(3x+1).$$

Q38: (A)

$$\sin \left(\frac{\pi}{2} - x \right) = \cos x.$$

Q39: (A)

$$c^2 = 25 + 49 - 2(5)(7) \cos 60^\circ = 74 - 70 \times \frac{1}{2} = 74 - 35 = 39. \ c = \sqrt{39}.$$

Q40: (A)

$$\cos 2\theta = 2 \left(\frac{1}{3} \right)^2 - 1 = \frac{2}{9} - 1 = -\frac{7}{9}.$$

Q41: (A)

$$(2u-1)(u-1) = 0. \ u = \frac{1}{2}: x = \frac{\pi}{6}, \frac{5\pi}{6}. \ u = 1: x = \frac{\pi}{2}.$$

Q42: (A)

$$\int_0^\pi \frac{1+\cos 2x}{2} dx = \frac{1}{2} \left[x + \frac{\sin 2x}{2} \right]_0^\pi = \frac{1}{2}(\pi + 0) = \frac{\pi}{2}.$$

Q43: (A)

$\sin 2x = 0 \Rightarrow 2x = 0, \pi, 2\pi, 3\pi, 4\pi$, so $x = 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}, 2\pi$. Checking: $x = 0$: $0 + 1 = 1 \checkmark$.
 $x = \frac{\pi}{2}$: $1 + 0 = 1 \checkmark$. $x = \pi$: $0 - 1 = -1$. $x = \frac{3\pi}{2}$: $-1 + 0 = -1$. Solutions: $x = 0, \frac{\pi}{2}$ (and 2π).

Q44: (A)

$$\frac{d}{dx} [\tan(2x)] = 2 \sec^2(2x).$$

Q45: (A)

The line goes from $(-10, -1)$ to $(10, 1)$. Within $[-10, 10]$, $\sin x$ completes about $\frac{20}{2\pi} \approx 3.18$ full cycles. Counting intersections: $x = 0$ is one; there are 3 positive pairs and 3 negative pairs, giving $\boxed{7}$ solutions.

Q46: (A)

$$\cos 75^\circ = \cos 45^\circ \cos 30^\circ - \sin 45^\circ \sin 30^\circ = \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{3}}{2} - \frac{\sqrt{2}}{2} \cdot \frac{1}{2} = \frac{\sqrt{6}-\sqrt{2}}{4}.$$

Q47: (A)

$$\int_0^\pi \sin x \, dx = [-\cos x]_0^\pi = -\cos \pi - (-\cos 0) = -(-1) + 1 = 2.$$

Q48: (A)

$$\tan x + \cot x = \frac{1}{\sin x \cos x} = \frac{2}{\sin 2x}.$$

Q49: (A)

Case 1: $2x = 2k\pi \Rightarrow x = k\pi$. For $[0, \pi]$: $x = 0, \pi$. Case 2: $4x = \pi + 2k\pi \Rightarrow x = \frac{\pi(1+2k)}{4}$.
For $[0, \pi]$: $x = \frac{\pi}{4}, \frac{3\pi}{4}$. Solutions: $x = 0, \frac{\pi}{4}, \frac{3\pi}{4}, \pi$.

Q50: (A)

$R = \sqrt{9 + 16} = \sqrt{25} = 5$. Maximum value is 5.