

Trigonometry up to Transformations

MCQ Test, Set 03

Time: 30 minutes

Maximum marks: 25

Name: _____ Class: _____ Date: _____

- There are 25 questions. Each has exactly one correct answer: choose A, B, C or D.
- Each correct answer carries 1 mark. There is no negative marking.
- The key sheet and worked solutions are at the end of this test.

- If $\sin \theta = \frac{15}{17}$ and θ is acute, then $\cot \theta =$
A. $\frac{8}{17}$ **B.** $\frac{17}{8}$ **C.** $\frac{8}{15}$ **D.** $\frac{15}{8}$
- 270° in grades is
A. 330^g **B.** 243^g **C.** 270^g **D.** 300^g
- The sign of $\sin 100^\circ \cos 200^\circ \tan 300^\circ$ is
A. positive **B.** not defined **C.** negative **D.** zero
- $\csc 30^\circ + \sec 60^\circ =$
A. 3 **B.** 4 **C.** $\frac{4\sqrt{3}}{3}$ **D.** 1
- $\csc(180^\circ + \theta) =$
A. $\csc \theta$ **B.** $\sec \theta$
C. $-\sec \theta$ **D.** $-\csc \theta$
- $\sin 810^\circ + \cos 900^\circ =$
A. 2 **B.** 0 **C.** -2 **D.** 1
- The domain of $\tan x$ is
A. $R - \{(2n+1)\frac{\pi}{2} : n \in Z\}$ **B.** $R - \{n\pi : n \in Z\}$
C. R **D.** $[-1, 1]$
- The values $\cos 1, \cos 2, \cos 3$ (angles in radians) satisfy
A. $\cos 3 > \cos 2 > \cos 1$ **B.** $\cos 2 > \cos 1 > \cos 3$
C. $\cos 1 > \cos 3 > \cos 2$ **D.** $\cos 1 > \cos 2 > \cos 3$
- If $\sin 3A = \cos(A - 26^\circ)$, where $3A$ is acute, then $A =$
A. 32° **B.** 58° **C.** 16° **D.** 29°
- $\frac{\sin^4 \theta + \cos^4 \theta - 1}{\sin^6 \theta + \cos^6 \theta - 1} =$
A. 1 **B.** $\frac{1}{3}$ **C.** $\frac{2}{3}$ **D.** $\frac{3}{2}$

11. The least value of $16 \tan^2 \theta + \cot^2 \theta$ is

A. 2

B. 17

C. 8

D. 4

12. $\cos 105^\circ =$

A. $\frac{\sqrt{3}-1}{2\sqrt{2}}$

B. $\frac{\sqrt{3}+1}{2\sqrt{2}}$

C. $-\frac{\sqrt{3}+1}{2\sqrt{2}}$

D. $\frac{1-\sqrt{3}}{2\sqrt{2}}$

13. $\frac{\cos 12^\circ + \sin 12^\circ}{\cos 12^\circ - \sin 12^\circ} =$

A. $\tan 57^\circ$

B. $\tan 24^\circ$

C. $\tan 12^\circ$

D. $\tan 33^\circ$

14. $\cos^2 37\frac{1}{2}^\circ - \sin^2 7\frac{1}{2}^\circ =$

A. $\frac{1}{2\sqrt{2}}$

B. $\frac{\sqrt{3}}{2\sqrt{2}}$

C. $\frac{\sqrt{3}}{2}$

D. $\frac{1}{2}$

15. If $A + B + C = 90^\circ$, then $\tan A \tan B + \tan B \tan C + \tan C \tan A =$

A. -1

B. $\tan A \tan B \tan C$

C. 1

D. 0

16. $(1 - \cot 29^\circ)(1 - \cot 16^\circ) =$

A. -2

B. 2

C. 1

D. 0

17. $\cos^2 15^\circ - \sin^2 15^\circ =$

A. $\frac{\sqrt{3}}{2}$

B. $\frac{1}{\sqrt{2}}$

C. $\frac{1}{2}$

D. 1

18. $3 \sin 20^\circ - 4 \sin^3 20^\circ =$

A. $\sqrt{3}$

B. $\sin 20^\circ$

C. $\frac{\sqrt{3}}{2}$

D. $\frac{1}{2}$

19. $\cos 144^\circ =$

A. $\frac{\sqrt{5}+1}{4}$

B. $-\frac{\sqrt{5}-1}{4}$

C. $-\frac{\sqrt{5}+1}{4}$

D. $\frac{\sqrt{5}-1}{4}$

20. $\tan 10^\circ(1 + \sec 20^\circ) =$

A. $\tan 20^\circ$

B. $\tan 40^\circ$

C. $\tan 10^\circ$

D. $\cot 20^\circ$

21. $\cos \frac{2\pi}{13} + \cos \frac{4\pi}{13} + \cos \frac{6\pi}{13} + \dots + \cos \frac{12\pi}{13} =$

A. $-\frac{1}{2}$

B. -1

C. 0

D. $\frac{1}{2}$

22. $\sin^2 20^\circ + \sin^2 40^\circ + \sin^2 80^\circ =$

A. $\frac{3}{4}$

B. 2

C. 1

D. $\frac{3}{2}$

23. If $\frac{x}{y} = \frac{\sin A}{\sin B}$, then $\frac{x+y}{x-y} =$

- A. $\frac{\cos \frac{A+B}{2}}{\cos \frac{A-B}{2}}$
B. $\frac{\tan \frac{A+B}{2}}{\tan \frac{A-B}{2}}$
C. $\frac{\tan \frac{A-B}{2}}{\tan \frac{A+B}{2}}$
D. $\frac{\sin(A+B)}{\sin(A-B)}$
-

24. $\frac{\sin 7x + \sin 3x}{\cos 7x + \cos 3x} =$

- A. $\cot 5x$ B. $\tan 10x$ C. $\tan 5x$ D. $\tan 2x$
-

25. The period of $\cos^4 x$ is

- A. 4π B. π C. $\frac{\pi}{2}$ D. 2π
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Key sheet

1. C	2. D	3. A	4. B	5. D
6. B	7. A	8. D	9. D	10. C
11. C	12. D	13. A	14. B	15. C
16. B	17. A	18. C	19. C	20. A
21. A	22. D	23. B	24. C	25. B

Solutions

1. If $\sin \theta = \frac{15}{17}$ and θ is acute, then $\cot \theta =$

$$\sin \theta = \frac{\text{opp}}{\text{hyp}} = \frac{15}{17}: \text{ take opp} = 15, \text{ hyp} = 17$$

$$\text{adj} = \sqrt{17^2 - 15^2} = \sqrt{64} = 8$$

$$\cot \theta = \frac{\text{adj}}{\text{opp}} = \frac{8}{15}$$

Ans: (C) $\frac{8}{15}$

2. 270° in grades is

$$1^\circ = \frac{10^g}{9}$$

$$270^\circ = 270 \times \frac{10}{9} = 300^g$$

Ans: (D) 300^g

3. The sign of $\sin 100^\circ \cos 200^\circ \tan 300^\circ$ is

$$100^\circ \in \text{II}_Q \Rightarrow \sin 100^\circ \text{ is +ve}$$

$$200^\circ \in \text{III}_Q \Rightarrow \cos 200^\circ \text{ is -ve}$$

$$300^\circ \in \text{IV}_Q \Rightarrow \tan 300^\circ \text{ is -ve}$$

So the product is positive

Ans: (A) positive

4. $\csc 30^\circ + \sec 60^\circ =$

$$\csc 30^\circ = \frac{1}{\sin 30^\circ} = 2, \sec 60^\circ = \frac{1}{\cos 60^\circ} = 2$$
$$= 4$$

Ans: (B) 4

5. $\csc(180^\circ + \theta) =$

$180^\circ + \theta$ is of the form $180^\circ \pm \theta$ or $360^\circ \pm \theta$, so $\csc$ does not change

For acute θ , $180^\circ + \theta \in \text{III}_Q$, where $\csc$ is -ve

$$\therefore \csc(180^\circ + \theta) = -\csc \theta$$

Ans: (D) $-\csc \theta$

6. $\sin 810^\circ + \cos 900^\circ =$

$$\sin 810^\circ = \sin(720^\circ + 90^\circ) = \sin 90^\circ = 1$$

$$\cos 900^\circ = \cos(720^\circ + 180^\circ) = \cos 180^\circ = -1$$

$$1 + (-1)$$

$$= 0$$

Ans: (B) 0

7. The domain of $\tan x$ is

$$\tan x = \frac{\sin x}{\cos x} \text{ needs } \cos x \neq 0$$

$$\cos x = 0 \Rightarrow x = (2n + 1)\frac{\pi}{2}$$

Ans: (A) $R - \{(2n + 1)\frac{\pi}{2} : n \in Z\}$

8. The values $\cos 1$, $\cos 2$, $\cos 3$ (angles in radians) satisfy

$$1 \approx 57^\circ, 2 \approx 114^\circ, 3 \approx 171^\circ$$

From the graph, $\cos x$ decreases from 0° to 180°

$$\therefore \cos 1 > \cos 2 > \cos 3$$

Ans: (D) $\cos 1 > \cos 2 > \cos 3$

9. If $\sin 3A = \cos(A - 26^\circ)$, where $3A$ is acute, then $A =$

$$\sin 3A = \cos(A - 26^\circ) \Rightarrow 3A + (A - 26^\circ) = 90^\circ$$

$$4A = 116^\circ \Rightarrow A = 29^\circ$$

Ans: (D) 29°

10. $\frac{\sin^4 \theta + \cos^4 \theta - 1}{\sin^6 \theta + \cos^6 \theta - 1} =$

$$\text{Numerator} = -2 \sin^2 \theta \cos^2 \theta, \text{ denominator} = -3 \sin^2 \theta \cos^2 \theta$$

$$\text{Ratio} = \frac{2}{3}$$

Ans: (C) $\frac{2}{3}$

11. The least value of $16 \tan^2 \theta + \cot^2 \theta$ is

Consider $16 \tan^2 \theta$ and $\cot^2 \theta$; both are +ve

$$\text{A.M} \geq \text{G.M: } \frac{16 \tan^2 \theta + \cot^2 \theta}{2} \geq \sqrt{16 \tan^2 \theta \cdot \cot^2 \theta} = \sqrt{16} = 4$$

$$\Rightarrow 16 \tan^2 \theta + \cot^2 \theta \geq 8; \text{ equality when } \tan^2 \theta = \frac{1}{4}$$

Ans: (C) 8

12. $\cos 105^\circ =$

$$\cos(60^\circ + 45^\circ) = \cos 60^\circ \cos 45^\circ - \sin 60^\circ \sin 45^\circ$$

$$= \frac{1}{2\sqrt{2}} - \frac{\sqrt{3}}{2\sqrt{2}} = \frac{1-\sqrt{3}}{2\sqrt{2}}$$

Ans: (D) $\frac{1-\sqrt{3}}{2\sqrt{2}}$

13. $\frac{\cos 12^\circ + \sin 12^\circ}{\cos 12^\circ - \sin 12^\circ} =$

$$\frac{\cos \theta + \sin \theta}{\cos \theta - \sin \theta} = \frac{1 + \tan \theta}{1 - \tan \theta} = \tan(45^\circ + \theta)$$

$$= \tan(45^\circ + 12^\circ) = \tan 57^\circ$$

Ans: (A) $\tan 57^\circ$

14. $\cos^2 37\frac{1}{2}^\circ - \sin^2 7\frac{1}{2}^\circ =$

$$= \cos 45^\circ \cos 30^\circ = \frac{1}{\sqrt{2}} \cdot \frac{\sqrt{3}}{2}$$

Ans: (B) $\frac{\sqrt{3}}{2\sqrt{2}}$

15. If $A + B + C = 90^\circ$, then $\tan A \tan B + \tan B \tan C + \tan C \tan A =$

$$A + B = 90^\circ - C \Rightarrow \cot(A + B) = \tan C$$

$$\frac{1 - \tan A \tan B}{\tan A + \tan B} = \tan C \Rightarrow \Sigma \tan A \tan B = 1$$

Ans: (C) 1

16. $(1 - \cot 29^\circ)(1 - \cot 16^\circ) =$
 $29^\circ + 16^\circ = 45^\circ \Rightarrow (1 - \cot A)(1 - \cot B) = 2$
Ans: (B) 2

17. $\cos^2 15^\circ - \sin^2 15^\circ =$
 $\cos^2 A - \sin^2 A = \cos 2A$
 $= \cos 30^\circ = \frac{\sqrt{3}}{2}$
Ans: (A) $\frac{\sqrt{3}}{2}$

18. $3 \sin 20^\circ - 4 \sin^3 20^\circ =$
 $3 \sin A - 4 \sin^3 A = \sin 3A$
 $= \sin 60^\circ = \frac{\sqrt{3}}{2}$
Ans: (C) $\frac{\sqrt{3}}{2}$

19. $\cos 144^\circ =$
 $\cos 144^\circ = \cos(180^\circ - 36^\circ) = -\cos 36^\circ = -\frac{\sqrt{5}+1}{4}$
Ans: (C) $-\frac{\sqrt{5}+1}{4}$

20. $\tan 10^\circ(1 + \sec 20^\circ) =$
 $\tan \frac{\theta}{2}(1 + \sec \theta) = \tan \theta$ with $\theta = 20^\circ$
Ans: (A) $\tan 20^\circ$

21. $\cos \frac{2\pi}{13} + \cos \frac{4\pi}{13} + \cos \frac{6\pi}{13} + \dots + \cos \frac{12\pi}{13} =$
 $n = 6, d = \frac{2\pi}{13}$: sum $= \frac{\cos \frac{7\pi}{13} \sin \frac{6\pi}{13}}{\sin \frac{\pi}{13}} = -\frac{\sin \frac{12\pi}{13}}{2 \sin \frac{\pi}{13}} = -\frac{1}{2}$
Ans: (A) $-\frac{1}{2}$

22. $\sin^2 20^\circ + \sin^2 40^\circ + \sin^2 80^\circ =$
 $\sin^2 \theta + \sin^2(60^\circ + \theta) + \sin^2(60^\circ - \theta) = \frac{3}{2}$ with $\theta = 20^\circ$
Ans: (D) $\frac{3}{2}$

23. If $\frac{x}{y} = \frac{\sin A}{\sin B}$, then $\frac{x+y}{x-y} =$
 Componendo and dividendo: $\frac{x+y}{x-y} = \frac{\sin A + \sin B}{\sin A - \sin B}$
 $= \frac{2 \sin \frac{A+B}{2} \cos \frac{A-B}{2}}{2 \cos \frac{A+B}{2} \sin \frac{A-B}{2}} = \frac{\tan \frac{A+B}{2}}{\tan \frac{A-B}{2}}$
Ans: (B) $\frac{\tan \frac{A+B}{2}}{\tan \frac{A-B}{2}}$

24. $\frac{\sin 7x + \sin 3x}{\cos 7x + \cos 3x} =$
 $= \frac{2 \sin 5x \cos 2x}{2 \cos 5x \cos 2x} = \tan 5x$
Ans: (C) $\tan 5x$

25. The period of $\cos^4 x$ is
 $\cos^n x$ with n even has period π
 $(\cos^4(x + \pi)) = (-\cos x)^4 = \cos^4 x$
Ans: (B) π
