

Trigonometry MCQs for Entry Test - Exercise 9.4

Introduction

This document contains 20 multiple-choice questions based on Exercise 9.4 of the trigonometry chapter, designed for entry test preparation. Each question tests concepts such as proving trigonometric identities, using fundamental, double-angle, and higher-power identities, and rationalizing trigonometric expressions. Solutions with detailed explanations are provided at the end. Domain restrictions are noted where applicable.

Multiple-Choice Questions

1. Which expression is equivalent to $\tan \theta + \cot \theta$?
A) $\sec \theta \csc \theta$
B) $\sin \theta \cos \theta$
C) $\sec^2 \theta + \csc^2 \theta$
D) $\tan^2 \theta + \cot^2 \theta$
2. What is the simplified form of $\sec \theta \csc \theta \sin \theta \cos \theta$?
A) 0
B) 1
C) $\sin \theta \cos \theta$
D) $\sec \theta \csc \theta$
3. Which identity holds for $\cos \theta + \tan \theta \sin \theta$?
A) $\csc \theta$
B) $\sec \theta$
C) $\tan \theta$
D) $\cot \theta$
4. Simplify $\csc \theta + \tan \theta \sec \theta$.
A) $\csc \theta \sec^2 \theta$
B) $\sec \theta \csc^2 \theta$
C) $\tan \theta \csc \theta$
D) $\cot \theta \sec \theta$

5. What is $\sec^2 \theta - \csc^2 \theta$ equal to?
- A) $\tan^2 \theta - \cot^2 \theta$
 - B) $\sin^2 \theta - \cos^2 \theta$
 - C) $\sec^2 \theta + \csc^2 \theta$
 - D) 1
6. Which expression equals $\cot^2 \theta - \cos^2 \theta$?
- A) $\cot^2 \theta \cos^2 \theta$
 - B) $\csc^2 \theta \cos^2 \theta$
 - C) $\tan^2 \theta \sin^2 \theta$
 - D) $\sec^2 \theta \sin^2 \theta$
7. What is the result of $(\sec \theta + \tan \theta)(\sec \theta - \tan \theta)$?
- A) 0
 - B) 1
 - C) $\sec^2 \theta$
 - D) $\tan^2 \theta$
8. Which identity is true for $2 \cos^2 \theta - 1$?
- A) $1 - 2 \sin^2 \theta$
 - B) $2 \sin^2 \theta - 1$
 - C) $\cos^2 \theta + \sin^2 \theta$
 - D) $\tan^2 \theta - 1$
9. Simplify $\cos^2 \theta - \sin^2 \theta$.
- A) $\frac{1 - \tan^2 \theta}{1 + \tan^2 \theta}$
 - B) $\frac{\tan^2 \theta - 1}{\tan^2 \theta + 1}$
 - C) $\sin^2 \theta - \cos^2 \theta$
 - D) $\sec^2 \theta - \csc^2 \theta$
10. What is $\frac{\cos \theta - \sin \theta}{\cos \theta + \sin \theta}$ equal to?
- A) $\frac{\cot \theta - 1}{\cot \theta + 1}$
 - B) $\frac{\tan \theta - 1}{\tan \theta + 1}$
 - C) $\cot \theta + 1$
 - D) $\tan \theta - 1$
11. Simplify $\frac{\sin \theta}{1 + \cos \theta} + \cot \theta$.
- A) $\sec \theta$
 - B) $\csc \theta$

C) $\tan \theta$

D) $\cot \theta$

12. What is $\frac{\cot^2 \theta - 1}{1 + \cot^2 \theta}$ equivalent to?

A) $2 \sin^2 \theta - 1$

B) $2 \cos^2 \theta - 1$

C) $1 - 2 \cos^2 \theta$

D) $1 - 2 \sin^2 \theta$

13. Which expression equals $\frac{1 + \cos \theta}{1 - \cos \theta}$?

A) $(\csc \theta + \cot \theta)^2$

B) $(\sec \theta + \tan \theta)^2$

C) $\csc \theta - \cot \theta$

D) $\sec \theta - \tan \theta$

14. Simplify $(\sec \theta - \tan \theta)^2$.

A) $\frac{1 + \sin \theta}{1 - \sin \theta}$

B) $\frac{1 - \sin \theta}{1 + \sin \theta}$

C) $\frac{\sin \theta - 1}{\sin \theta + 1}$

D) $\frac{\sin \theta + 1}{\sin \theta - 1}$

15. What is $\frac{2 \tan \theta}{1 + \tan^2 \theta}$ equal to?

A) $\sin 2\theta$

B) $\cos 2\theta$

C) $\tan 2\theta$

D) $\cot 2\theta$

16. Simplify $\frac{1 - \sin \theta}{\cos \theta}$.

A) $\frac{\cos \theta}{1 + \sin \theta}$

B) $\frac{\sin \theta}{1 + \cos \theta}$

C) $\frac{\cos \theta}{1 - \sin \theta}$

D) $\frac{\sin \theta}{1 - \cos \theta}$

17. What is $(\tan \theta + \cot \theta)^2$ equivalent to?

A) $\sec^2 \theta + \csc^2 \theta$

B) $\sec^2 \theta \csc^2 \theta$

C) $\tan^2 \theta + \cot^2 \theta$

D) $\sin^2 \theta + \cos^2 \theta$

18. Simplify $\frac{\tan \theta + \sec \theta - 1}{\tan \theta - \sec \theta + 1}$.

- A) $\tan \theta - \sec \theta$
- B) $\sec \theta + \tan \theta$
- C) $\csc \theta + \cot \theta$
- D) $\cot \theta - \csc \theta$

19. What is $\frac{1}{\csc \theta - \cot \theta} - \frac{1}{\sin \theta}$?

- A) $\cot \theta$
- B) $\tan \theta$
- C) $\csc \theta$
- D) $\sec \theta$

20. Simplify $\sin^6 \theta + \cos^6 \theta$.

- A) $1 - 3 \sin^2 \theta \cos^2 \theta$
- B) $1 + 3 \sin^2 \theta \cos^2 \theta$
- C) $\sin^2 \theta + \cos^2 \theta$
- D) $3 \sin^2 \theta \cos^2 \theta$

Solutions and Explanations

1. Solution to Question 1:

$$\tan \theta + \cot \theta = \frac{\sin \theta}{\cos \theta} + \frac{\cos \theta}{\sin \theta} = \frac{\sin^2 \theta + \cos^2 \theta}{\sin \theta \cos \theta} = \frac{1}{\sin \theta \cos \theta} = \sec \theta \csc \theta$$

Answer: A) $\sec \theta \csc \theta$

2. Solution to Question 2:

$$\sec \theta \csc \theta \sin \theta \cos \theta = \frac{1}{\cos \theta} \cdot \frac{1}{\sin \theta} \cdot \sin \theta \cos \theta = 1$$

Answer: B) 1

3. Solution to Question 3:

$$\cos \theta + \tan \theta \sin \theta = \cos \theta + \frac{\sin \theta}{\cos \theta} \cdot \sin \theta = \frac{\cos^2 \theta + \sin^2 \theta}{\cos \theta} = \frac{1}{\cos \theta} = \sec \theta$$

Answer: B) $\sec \theta$

4. Solution to Question 4:

$$\csc \theta + \tan \theta \sec \theta = \frac{1}{\sin \theta} + \frac{\sin \theta}{\cos \theta} \cdot \frac{1}{\cos \theta} = \frac{\cos^2 \theta + \sin^2 \theta}{\sin \theta \cos^2 \theta} = \frac{1}{\sin \theta \cos^2 \theta} = \csc \theta \sec^2 \theta$$

Answer: A) $\csc \theta \sec^2 \theta$

5. Solution to Question 5:

$$\sec^2 \theta - \csc^2 \theta = (1 + \tan^2 \theta) - (1 + \cot^2 \theta) = \tan^2 \theta - \cot^2 \theta$$

Answer: A) $\tan^2 \theta - \cot^2 \theta$

6. Solution to Question 6:

$$\cot^2 \theta - \cos^2 \theta = \frac{\cos^2 \theta}{\sin^2 \theta} - \cos^2 \theta = \frac{\cos^2 \theta (1 - \sin^2 \theta)}{\sin^2 \theta} = \frac{\cos^2 \theta \cos^2 \theta}{\sin^2 \theta} = \cot^2 \theta \cos^2 \theta$$

Answer: A) $\cot^2 \theta \cos^2 \theta$

7. Solution to Question 7:

$$(\sec \theta + \tan \theta)(\sec \theta - \tan \theta) = \sec^2 \theta - \tan^2 \theta = 1 + \tan^2 \theta - \tan^2 \theta = 1$$

Answer: B) 1

8. Solution to Question 8:

$$2 \cos^2 \theta - 1 = 2(1 - \sin^2 \theta) - 1 = 2 - 2 \sin^2 \theta - 1 = 1 - 2 \sin^2 \theta$$

Answer: A) $1 - 2 \sin^2 \theta$

9. Solution to Question 9:

$$\cos^2 \theta - \sin^2 \theta = \frac{\cos^2 \theta - \sin^2 \theta}{\cos^2 \theta + \sin^2 \theta} = \frac{1 - \frac{\sin^2 \theta}{\cos^2 \theta}}{1 + \frac{\sin^2 \theta}{\cos^2 \theta}} = \frac{1 - \tan^2 \theta}{1 + \tan^2 \theta}$$

Answer: A) $\frac{1 - \tan^2 \theta}{1 + \tan^2 \theta}$

10. Solution to Question 10:

$$\frac{\cos \theta - \sin \theta}{\cos \theta + \sin \theta} = \frac{\frac{\cos \theta}{\sin \theta} - 1}{\frac{\cos \theta}{\sin \theta} + 1} = \frac{\cot \theta - 1}{\cot \theta + 1}$$

Answer: A) $\frac{\cot \theta - 1}{\cot \theta + 1}$

11. Solution to Question 11:

$$\frac{\sin \theta}{1 + \cos \theta} + \cot \theta = \frac{\sin \theta}{1 + \cos \theta} + \frac{\cos \theta}{\sin \theta} = \frac{\sin^2 \theta + \cos \theta (1 + \cos \theta)}{\sin \theta (1 + \cos \theta)} = \frac{1 + \cos \theta}{\sin \theta (1 + \cos \theta)} = \frac{1}{\sin \theta} = \csc \theta$$

Answer: B) $\csc \theta$

12. Solution to Question 12:

$$\frac{\cot^2 \theta - 1}{1 + \cot^2 \theta} = \frac{\frac{\cos^2 \theta}{\sin^2 \theta} - 1}{\frac{\sin^2 \theta + \cos^2 \theta}{\sin^2 \theta}} = \frac{\cos^2 \theta - \sin^2 \theta}{\sin^2 \theta} \cdot \sin^2 \theta = \cos^2 \theta - \sin^2 \theta = 2 \cos^2 \theta - 1$$

Answer: B) $2 \cos^2 \theta - 1$

13. **Solution to Question 13:**

$$\frac{1 + \cos \theta}{1 - \cos \theta} = \frac{(1 + \cos \theta)^2}{(1 - \cos \theta)(1 + \cos \theta)} = \frac{(1 + \cos \theta)^2}{1 - \cos^2 \theta} = \frac{(1 + \cos \theta)^2}{\sin^2 \theta} = \left(\frac{1 + \cos \theta}{\sin \theta} \right)^2 = (\csc \theta + \cot \theta)^2$$

Answer: A) $(\csc \theta + \cot \theta)^2$

14. **Solution to Question 14:**

$$(\sec \theta - \tan \theta)^2 = \left(\frac{1}{\cos \theta} - \frac{\sin \theta}{\cos \theta} \right)^2 = \frac{(1 - \sin \theta)^2}{\cos^2 \theta} = \frac{(1 - \sin \theta)^2}{1 - \sin^2 \theta} = \frac{(1 - \sin \theta)^2}{(1 - \sin \theta)(1 + \sin \theta)} = \frac{1 - \sin \theta}{1 + \sin \theta}$$

Answer: B) $\frac{1 - \sin \theta}{1 + \sin \theta}$

15. **Solution to Question 15:**

$$\frac{2 \tan \theta}{1 + \tan^2 \theta} = \frac{2 \frac{\sin \theta}{\cos \theta}}{1 + \frac{\sin^2 \theta}{\cos^2 \theta}} = \frac{\frac{2 \sin \theta}{\cos \theta}}{\frac{\cos^2 \theta + \sin^2 \theta}{\cos^2 \theta}} = 2 \sin \theta \cos \theta = \sin 2\theta$$

Answer: A) $\sin 2\theta$

16. **Solution to Question 16:**

$$\frac{1 - \sin \theta}{\cos \theta} \cdot \frac{1 + \sin \theta}{1 + \sin \theta} = \frac{1 - \sin^2 \theta}{\cos \theta(1 + \sin \theta)} = \frac{\cos^2 \theta}{\cos \theta(1 + \sin \theta)} = \frac{\cos \theta}{1 + \sin \theta}$$

Answer: A) $\frac{\cos \theta}{1 + \sin \theta}$

17. **Solution to Question 17:**

$$(\tan \theta + \cot \theta)^2 = \left(\frac{\sin \theta}{\cos \theta} + \frac{\cos \theta}{\sin \theta} \right)^2 = \left(\frac{\sin^2 \theta + \cos^2 \theta}{\sin \theta \cos \theta} \right)^2 = \frac{1}{\sin^2 \theta \cos^2 \theta} = \sec^2 \theta \csc^2 \theta$$

Answer: B) $\sec^2 \theta \csc^2 \theta$

18. **Solution to Question 18:**

$$\frac{\tan \theta + \sec \theta - 1}{\tan \theta - \sec \theta + 1} = \frac{\tan \theta + \sec \theta - (\sec^2 \theta - \tan^2 \theta)}{\tan \theta - \sec \theta + 1} = \frac{(\sec \theta + \tan \theta)(1 - \sec \theta + \tan \theta)}{\tan \theta - \sec \theta + 1} = \sec \theta + \tan \theta$$

Answer: B) $\sec \theta + \tan \theta$

19. **Solution to Question 19:**

$$\frac{1}{\csc \theta - \cot \theta} - \frac{1}{\sin \theta} = \frac{\sin \theta}{1 - \cos \theta} - \frac{1}{\sin \theta} = \frac{\sin^2 \theta - (1 - \cos \theta)}{\sin \theta(1 - \cos \theta)} = \frac{\cos \theta}{\sin \theta} = \cot \theta$$

Answer: A) $\cot \theta$

20. **Solution to Question 20:**

$$\sin^6 \theta + \cos^6 \theta = (\sin^2 \theta)^3 + (\cos^2 \theta)^3 = (\sin^2 \theta + \cos^2 \theta)((\sin^2 \theta)^2 + (\cos^2 \theta)^2 - \sin^2 \theta \cos^2 \theta) = 1 - 3 \sin^2 \theta \cos^2 \theta$$

Answer: A) $1 - 3 \sin^2 \theta \cos^2 \theta$