Trigonometric Identities MCQs for Entry Test - Exercise 10.4

Introduction

This document contains 20 multiple-choice questions based on Exercise 10.4 of the trigonometry chapter, designed for entry test preparation. Each question tests concepts such as product-to-sum identities, sum-to-product identities, proofs of trigonometric identities, and specific angle applications. Solutions with detailed explanations are provided at the end.

Multiple-Choice Questions

1. **Express** $2\sin 3\theta\cos\theta$ **as a sum.**

   A) $\sin 4\theta + \sin 2\theta$

   B) $\sin 4\theta - \sin 2\theta$

   C) $\cos 4\theta + \cos 2\theta$

   D) $\cos 4\theta - \cos 2\theta$

2. **Express** $2\cos 5\theta\sin 3\theta$ **as a sum.**

   A) $\sin 8\theta + \sin 2\theta$

   B) $\sin 8\theta - \sin 2\theta$

   C) $\cos 8\theta + \cos 2\theta$

   D) $\cos 8\theta - \cos 2\theta$

3. **What is** $\sin 5\theta\cos 2\theta$**?**

   A) $\frac{1}{2}[\sin 7\theta + \sin 3\theta]$

   B) $\frac{1}{2}[\sin 7\theta - \sin 3\theta]$

   C) $\frac{1}{2}[\cos 7\theta + \cos 3\theta]$

   D) $\frac{1}{2}[\cos 7\theta - \cos 3\theta]$

4. **Express** $2\sin 7\theta\sin 2\theta$ **as a sum.**

   A) $\cos 9\theta - \cos 5\theta$

   B) $\cos 5\theta - \cos 9\theta$

C) $\sin 9\theta + \sin 5\theta$

D) $\sin 9\theta - \sin 5\theta$

5. **What is** $\cos(x+y)\sin(x-y)$**?**

A) $\frac{1}{2}[\sin 2x + \sin 2y]$

B) $\frac{1}{2}[\sin 2x - \sin 2y]$

C) $\frac{1}{2}[\cos 2x + \cos 2y]$

D) $\frac{1}{2}[\cos 2x - \cos 2y]$

6. **Express** $\cos(2x+30°)\cos(2x-30°)$**.**

A) $\frac{1}{2}[\cos 4x + \cos 60°]$

B) $\frac{1}{2}[\cos 4x - \cos 60°]$

C) $\frac{1}{2}[\sin 4x + \sin 60°]$

D) $\frac{1}{2}[\sin 4x - \sin 60°]$

7. **What is** $\sin 12° \sin 46°$**?**

A) $\frac{1}{2}[\cos 58° - \cos 34°]$

B) $\frac{-1}{2}[\cos 58° - \cos 34°]$

C) $\frac{1}{2}[\sin 58° - \sin 34°]$

D) $\frac{-1}{2}[\sin 58° - \sin 34°]$

8. **Express** $\sin(x+45°)\sin(x-45°)$**.**

A) $\frac{1}{2}[\cos 2x - \cos 90°]$

B) $\frac{-1}{2}[\cos 2x - \cos 90°]$

C) $\frac{1}{2}[\sin 2x - \sin 90°]$

D) $\frac{-1}{2}[\sin 2x - \sin 90°]$

9. **Express** $\sin 5\theta + \sin 3\theta$ **as a product.**

A) $2\sin 4\theta \cos\theta$

B) $2\cos 4\theta \sin\theta$

C) $2\sin 4\theta \sin\theta$

D) $2\cos 4\theta \cos\theta$

10. **What is** $\sin 8\theta - \sin 4\theta$**?**

A) $2\sin 6\theta \cos 2\theta$

B) $2\cos 6\theta \sin 2\theta$

C) $2\sin 6\theta \sin 2\theta$

D) $2\cos 6\theta \cos 2\theta$

11. **Express** $\cos 6\theta + \cos 3\theta$**.**

A) $2\cos\frac{9\theta}{2}\cos\frac{3\theta}{2}$

B) $2\sin\frac{9\theta}{2}\sin\frac{3\theta}{2}$

C) $2\cos\frac{9\theta}{2}\sin\frac{3\theta}{2}$

D) $2\sin\frac{9\theta}{2}\cos\frac{3\theta}{2}$

12. **What is** $\cos 7\theta - \cos\theta$**?**

A) $-2\sin 4\theta\sin 3\theta$

B) $-2\cos 4\theta\cos 3\theta$

C) $2\sin 4\theta\sin 3\theta$

D) $2\cos 4\theta\cos 3\theta$

13. **Express** $\cos 12^\circ + \cos 48^\circ$**.**

A) $2\cos 30^\circ\cos 18^\circ$

B) $2\sin 30^\circ\sin 18^\circ$

C) $2\cos 30^\circ\sin 18^\circ$

D) $2\sin 30^\circ\cos 18^\circ$

14. **What is** $\sin(x + 30^\circ) + \sin(x - 30^\circ)$**?**

A) $2\sin x\cos 30^\circ$

B) $2\cos x\sin 30^\circ$

C) $2\sin x\sin 30^\circ$

D) $2\cos x\cos 30^\circ$

15. **What is** $\frac{\sin 3x - \sin x}{\cos x - \cos 3x}$**?**

A) $\tan 2x$

B) $\cot 2x$

C) $\tan x$

D) $\cot x$

16. **What is** $\frac{\sin 8x + \sin 2x}{\cos 8x + \cos 2x}$**?**

A) $\tan 5x$

B) $\cot 5x$

C) $\tan 3x$

D) $\cot 3x$

17. **What is** $\frac{\sin\alpha - \sin\beta}{\sin\alpha + \sin\beta}$**?**

A) $\tan\left(\frac{\alpha-\beta}{2}\right)\cot\left(\frac{\alpha+\beta}{2}\right)$

B) $\tan\left(\frac{\alpha+\beta}{2}\right)\cot\left(\frac{\alpha-\beta}{2}\right)$

C) $\sin\left(\frac{\alpha-\beta}{2}\right)\cos\left(\frac{\alpha+\beta}{2}\right)$

D) $\cos\left(\frac{\alpha-\beta}{2}\right)\sin\left(\frac{\alpha+\beta}{2}\right)$

18. **What is** $\cos 20^\circ + \cos 100^\circ + \cos 140^\circ$**?**

A) 0

B) $\frac{1}{2}$

C) 1

D) -1

19. **What is** $\sin\left(\frac{\pi}{4}-\theta\right)\sin\left(\frac{\pi}{4}+\theta\right)$**?**

A) $\frac{1}{2}\cos 2\theta$

B) $\frac{1}{2}\sin 2\theta$

C) $\cos 2\theta$

D) $\sin 2\theta$

20. **What is** $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ$**?**

A) $\frac{1}{8}$

B) $\frac{1}{16}$

C) $\frac{1}{32}$

D) $\frac{1}{4}$

Solutions and Explanations

1. **Solution to Question 1:**

$$2\sin 3\theta\cos\theta = \sin(3\theta+\theta)+\sin(3\theta-\theta) = \sin 4\theta + \sin 2\theta$$

Answer: A) $\sin 4\theta + \sin 2\theta$

2. **Solution to Question 2:**

$$2\cos 5\theta\sin 3\theta = \sin(5\theta+3\theta)-\sin(5\theta-3\theta) = \sin 8\theta - \sin 2\theta$$

Answer: B) $\sin 8\theta - \sin 2\theta$

3. **Solution to Question 3:**

$$\sin 5\theta\cos 2\theta = \frac{1}{2}[2\sin 5\theta\cos 2\theta] = \frac{1}{2}[\sin(5\theta+2\theta)+\sin(5\theta-2\theta)] = \frac{1}{2}[\sin 7\theta+\sin 3\theta]$$

Answer: A) $\frac{1}{2}[\sin 7\theta + \sin 3\theta]$

4. **Solution to Question 4:**

$2\sin 7\theta\sin 2\theta = -[-2\sin 7\theta\sin 2\theta] = -[\cos(7\theta+2\theta)-\cos(7\theta-2\theta)] = -[\cos 9\theta-\cos 5\theta] = \cos 5\theta-\cos$

Answer: B) $\cos 5\theta - \cos 9\theta$

5. **Solution to Question 5:**

$$\cos(x+y)\sin(x-y) = \frac{1}{2}[2\cos(x+y)\sin(x-y)] = \frac{1}{2}[\sin(2x) - \sin(2y)]$$

Answer: B) $\frac{1}{2}[\sin 2x - \sin 2y]$

6. **Solution to Question 6:**

$$\cos(2x+30^\circ)\cos(2x-30^\circ) = \frac{1}{2}[2\cos(2x+30^\circ)\cos(2x-30^\circ)] = \frac{1}{2}[\cos 4x + \cos 60^\circ]$$

Answer: A) $\frac{1}{2}[\cos 4x + \cos 60^\circ]$

7. **Solution to Question 7:**

$$\sin 12^\circ \sin 46^\circ = \frac{-1}{2}[-2\sin 12^\circ \sin 46^\circ] = \frac{-1}{2}[\cos(12^\circ+46^\circ) - \cos(12^\circ-46^\circ)] = \frac{-1}{2}[\cos 58^\circ - \cos(-34$$

Answer: B) $\frac{-1}{2}[\cos 58^\circ - \cos 34^\circ]$

8. **Solution to Question 8:**

$$\sin(x+45^\circ)\sin(x-45^\circ) = \frac{-1}{2}[-2\sin(x+45^\circ)\sin(x-45^\circ)] = \frac{-1}{2}[\cos 2x - \cos 90^\circ]$$

Answer: B) $\frac{-1}{2}[\cos 2x - \cos 90^\circ]$

9. **Solution to Question 9:**

$$\sin 5\theta + \sin 3\theta = 2\sin\left(\frac{5\theta+3\theta}{2}\right)\cos\left(\frac{5\theta-3\theta}{2}\right) = 2\sin 4\theta\cos\theta$$

Answer: A) $2\sin 4\theta\cos\theta$

10. **Solution to Question 10:**

$$\sin 8\theta - \sin 4\theta = 2\cos\left(\frac{8\theta+4\theta}{2}\right)\sin\left(\frac{8\theta-4\theta}{2}\right) = 2\cos 6\theta\sin 2\theta$$

Answer: B) $2\cos 6\theta\sin 2\theta$

11. **Solution to Question 11:**

$$\cos 6\theta + \cos 3\theta = 2\cos\left(\frac{6\theta+3\theta}{2}\right)\cos\left(\frac{6\theta-3\theta}{2}\right) = 2\cos\frac{9\theta}{2}\cos\frac{3\theta}{2}$$

Answer: A) $2\cos\frac{9\theta}{2}\cos\frac{3\theta}{2}$

12. **Solution to Question 12:**

$$\cos 7\theta - \cos\theta = -2\sin\left(\frac{7\theta+\theta}{2}\right)\sin\left(\frac{7\theta-\theta}{2}\right) = -2\sin 4\theta\sin 3\theta$$

Answer: A) $-2\sin 4\theta\sin 3\theta$

13. **Solution to Question 13:**

$$\cos 12^\circ + \cos 48^\circ = 2\cos\left(\frac{12^\circ + 48^\circ}{2}\right)\cos\left(\frac{12^\circ - 48^\circ}{2}\right) = 2\cos 30^\circ \cos 18^\circ$$

Answer: A) $2\cos 30^\circ \cos 18^\circ$

14. **Solution to Question 14:**

$$\sin(x{+}30^\circ){+}\sin(x{-}30^\circ) = 2\sin\left(\frac{x + 30^\circ + x - 30^\circ}{2}\right)\cos\left(\frac{x + 30^\circ - x + 30^\circ}{2}\right) = 2\sin x \cos 30^\circ$$

Answer: A) $2\sin x \cos 30^\circ$

15. **Solution to Question 15:**

$$\frac{\sin 3x - \sin x}{\cos x - \cos 3x} = \frac{2\cos\left(\frac{3x+x}{2}\right)\sin\left(\frac{3x-x}{2}\right)}{-2\sin\left(\frac{3x+x}{2}\right)\sin\left(\frac{3x-x}{2}\right)} = \frac{\cos 2x}{\sin 2x} = \cot 2x$$

Answer: B) $\cot 2x$

16. **Solution to Question 16:**

$$\frac{\sin 8x + \sin 2x}{\cos 8x + \cos 2x} = \frac{2\sin\left(\frac{8x+2x}{2}\right)\cos\left(\frac{8x-2x}{2}\right)}{2\cos\left(\frac{8x+2x}{2}\right)\cos\left(\frac{8x-2x}{2}\right)} = \frac{\sin 5x}{\cos 5x} = \tan 5x$$

Answer: A) $\tan 5x$

17. **Solution to Question 17:**

$$\frac{\sin\alpha - \sin\beta}{\sin\alpha + \sin\beta} = \frac{2\cos\left(\frac{\alpha+\beta}{2}\right)\sin\left(\frac{\alpha-\beta}{2}\right)}{2\sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)} = \cot\left(\frac{\alpha+\beta}{2}\right)\tan\left(\frac{\alpha-\beta}{2}\right)$$

Answer: A) $\tan\left(\frac{\alpha-\beta}{2}\right)\cot\left(\frac{\alpha+\beta}{2}\right)$

18. **Solution to Question 18:**

$$\cos 20^\circ{+}\cos 100^\circ{+}\cos 140^\circ = 2\cos\left(\frac{140^\circ + 20^\circ}{2}\right)\cos\left(\frac{140^\circ - 20^\circ}{2}\right){+}\cos 100^\circ = 2\cos 80^\circ \cos 60^\circ{+}$$

Answer: A) 0

19. **Solution to Question 19:**

$$\sin\left(\frac{\pi}{4} - \theta\right)\sin\left(\frac{\pi}{4} + \theta\right) = \left(\frac{\sqrt{2}}{2}\cos\theta - \frac{\sqrt{2}}{2}\sin\theta\right)\left(\frac{\sqrt{2}}{2}\cos\theta + \frac{\sqrt{2}}{2}\sin\theta\right) = \frac{1}{2}(\cos^2\theta{-}\sin^2\theta) =$$

Answer: A) $\frac{1}{2}\cos 2\theta$

20. **Solution to Question 20:**

$$\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ = \frac{1}{4}[\cos 60^\circ{+}\cos 20^\circ]\cos 80^\circ = \frac{1}{4}\left[\frac{1}{2} + \cos 20^\circ\right]\cos 80^\circ = \frac{1}{8}[\cos 80^\circ{+}c$$

Answer: B) $\frac{1}{16}$