EXPRESSWALA ACADEMY

Maths 1A: Transformations

MCQ Test, Set 02

Time: 30 minutes | Maximum marks: 25

Name: _____ Class: _____ Date: _____

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

1. The value of $4\cos 105^\circ \sin 15^\circ$ is

A. $-2+\sqrt{3}$ **B.** $\sqrt{3}+2$ **C.** $-4+2\sqrt{3}$ **D.** -1

2. The value of $2\sin 105^\circ \sin 15^\circ$ is

A. 1 **B.** $1-\frac{\sqrt{3}}{2}$ **C.** $\frac{1}{2}$ **D.** $-\frac{1}{2}$

3. The value of $4\sin 105^\circ \sin 45^\circ$ is

A. $1-\sqrt{3}$ **B.** $1+\sqrt{3}$ **C.** $-1+\sqrt{3}$ **D.** $2+2\sqrt{3}$

4. $\sin 7\theta - \sin\theta =$

A. $2\cos 3\theta \sin 4\theta$ **B.** $2\sin 4\theta \cos 3\theta$

C. $2\cos 4\theta \sin 3\theta$ **D.** $-2\cos 4\theta \sin 3\theta$

5. $\cos 7\theta + \cos\theta =$

A. $2\cos 4\theta \cos 3\theta$ **B.** $-2\cos 4\theta \cos 3\theta$

C. $2\sin 4\theta \sin 3\theta$ **D.** $\cos 4\theta \cos 3\theta$

6. $\cos 9\theta - \cos 5\theta =$

A. $-\sin 7\theta \sin 2\theta$ **B.** $-2\cos 7\theta \cos 2\theta$

C. $2\sin 7\theta \sin 2\theta$ **D.** $-2\sin 7\theta \sin 2\theta$

7. The value of $\sin 165^\circ + \sin 75^\circ$ is

A. $-\frac{\sqrt{6}}{2}$ **B.** $1+\frac{\sqrt{6}}{2}$ **C.** $\frac{\sqrt{6}}{4}$ **D.** $\frac{\sqrt{6}}{2}$

8. $\cos 52^\circ + \cos 68^\circ + \cos 172^\circ =$

A. -1 **B.** 0 **C.** $\frac{1}{2}$ **D.** 1

9. $\sin 93^\circ - \sin 27^\circ =$

A. $\sin 33^\circ$ **B.** $\cos 33^\circ$

C. $2\sin 33^\circ$ **D.** $-\sin 33^\circ$

10. $\frac{\sin 7\theta - \sin 3\theta}{\cos 7\theta + \cos 3\theta} =$

A. $\tan 5\theta$ **B.** $\tan 2\theta$

C. $\cot 2\theta$ **D.** $-\tan 2\theta$

---

11. $\frac{\sin 8\theta - \sin 4\theta}{\cos 8\theta + \cos 4\theta} =$

A. $\tan 6\theta$ **B.** $-\tan 2\theta$

C. $\cot 2\theta$ **D.** $\tan 2\theta$

---

12. $\frac{\cos 5\theta - \cos 7\theta}{\sin 7\theta + \sin 5\theta} =$

A. $\tan\theta$ **B.** $\cot\theta$

C. $\tan 6\theta$ **D.** $-\tan\theta$

---

13. In a triangle ABC, $\cos 2A + \cos 2B + \cos 2C =$

A. $1 - 4\cos A\cos B\cos C$ **B.** $-1 - 4\sin A\sin B\sin C$

C. $-1 - 4\cos A\cos B\cos C$ **D.** $-1 - 2\cos A\cos B\cos C$

---

14. In a triangle ABC, $-\sin 2A + \sin 2B + \sin 2C =$

A. $4\sin A\cos B\cos C$ **B.** $-4\sin A\cos B\cos C$

C. $4\cos A\sin B\sin C$ **D.** $2\sin A\cos B\cos C$

---

15. If $A + B + C = \pi$, then $\cos 2A + \cos 2B + \cos 2C =$

A. $-1 - 4\cos A\cos B\cos C$ **B.** $1 - 4\cos A\cos B\cos C$

C. $-1 - 4\sin A\sin B\sin C$ **D.** $-1 - 2\cos A\cos B\cos C$

---

16. If $A + B + C = \pi$, then $\cos A + \cos B - \cos C =$

A. $-1 + 4\sin\frac{A}{2}\sin\frac{B}{2}\cos\frac{C}{2}$

B. $1 + 4\cos\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$

C. $-1 + 2\cos\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$

D. $-1 + 4\cos\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$

---

17. If $\cos x - \cos y = \frac{1}{3}$ and $\sin x - \sin y = \frac{3}{4}$, then $\tan\frac{x+y}{2} =$

A. $\frac{4}{9}$ **B.** $-\frac{9}{4}$ **C.** $-\frac{4}{9}$ **D.** $\frac{9}{4}$

---

18. If $\cos x - \cos y = \frac{3}{5}$ and $\sin x + \sin y = \frac{1}{6}$, then $\cos(x - y) =$

A. $-\frac{180}{349}$ **B.** $\frac{299}{349}$ **C.** $-\frac{299}{349}$ **D.** $\frac{180}{349}$

---

19. If $\cos x + \cos y = \frac{1}{4}$ and $\sin x + \sin y = \frac{3}{5}$, then $\tan\frac{x+y}{2} =$

A. $\frac{5}{12}$ **B.** $\frac{12}{5}$ **C.** $-\frac{12}{5}$ **D.** $-\frac{5}{12}$

---

20. If $\cos x - \cos y = \frac{3}{5}$ and $\sin x - \sin y = \frac{5}{6}$, then $\cos(x + y) =$

A. $-\frac{301}{949}$ **B.** $-\frac{900}{949}$ **C.** $\frac{301}{949}$ **D.** $\frac{900}{949}$

---

21. If $\cos x - \cos y = \frac{4}{5}$ and $\sin x + \sin y = \frac{2}{7}$, then $\cos(x + y) =$

A. $-\frac{783}{1225}$ **B.** $\frac{783}{1225}$ **C.** $-\frac{341}{2450}$ **D.** $\frac{442}{1225}$

---

22. If $\cos x + \cos y = \frac{4}{3}$ and $\sin x + \sin y = \frac{1}{3}$, then $\cos(x - y) =$

A. $\frac{4}{9}$ **B.** $-\frac{1}{18}$ **C.** $\frac{1}{18}$ **D.** $\frac{17}{18}$

23. If $\cos x + \cos y = \frac{2}{5}$ and $\sin x - \sin y = \frac{2}{3}$, then $\cos(x + y) =$

A. $\frac{157}{225}$ **B.** $-\frac{89}{450}$ **C.** $\frac{68}{225}$ **D.** $-\frac{157}{225}$

24. In an acute angled triangle ABC, the least value of $\sec A + \sec B + \sec C$ is

A. $\frac{3}{2}$ **B.** 3 **C.** $3\sqrt{3}$ **D.** 6

25. In a triangle ABC with $A = 15^\circ$ and $B = 150^\circ$, $\cos A + \cos B + \cos C =$

A. $\frac{-\sqrt{3}+\sqrt{2}+\sqrt{6}}{2}$ **B.** $\frac{3}{2}$

C. $\frac{-2\sqrt{3}+\sqrt{2}+\sqrt{6}}{4}$ **D.** $-\frac{\sqrt{3}}{2}$

Key sheet

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

Solutions

1. The value of $4\cos 105^\circ \sin 15^\circ$ is

$2\cos A \sin B = \sin(A+B) - \sin(A-B)$

$4\cos 105^\circ \sin 15^\circ = 2\left(\sin 120^\circ - \sin 90^\circ\right)$

$= 2\left(\frac{\sqrt{3}}{2} - 1\right) = -2 + \sqrt{3}$

Ans: (A) $-2+\sqrt{3}$

---

2. The value of $2\sin 105^\circ \sin 15^\circ$ is

$2\sin A \sin B = \cos(A-B) - \cos(A+B)$

$2\sin 105^\circ \sin 15^\circ = \cos 90^\circ - \cos 120^\circ$

$= 0 + \frac{1}{2} = \frac{1}{2}$

Ans: (C) $\frac{1}{2}$

---

3. The value of $4\sin 105^\circ \sin 45^\circ$ is

$2\sin A \sin B = \cos(A-B) - \cos(A+B)$

$4\sin 105^\circ \sin 45^\circ = 2\left(\cos 60^\circ - \cos 150^\circ\right)$

$= 2\left(\frac{1}{2} + \frac{\sqrt{3}}{2}\right) = 1 + \sqrt{3}$

Ans: (B) $1+\sqrt{3}$

---

4. $\sin 7\theta - \sin\theta =$

$\sin C - \sin D = 2\cos\frac{C+D}{2}\sin\frac{C-D}{2}$

$\sin 7\theta - \sin\theta = 2\cos 4\theta \sin 3\theta$

Ans: (C) $2\cos 4\theta \sin 3\theta$

---

5. $\cos 7\theta + \cos\theta =$

$\cos C + \cos D = 2\cos\frac{C+D}{2}\cos\frac{C-D}{2}$

$\cos 7\theta + \cos\theta = 2\cos 4\theta \cos 3\theta$

Ans: (A) $2\cos 4\theta \cos 3\theta$

---

6. $\cos 9\theta - \cos 5\theta =$

$\cos C - \cos D = -2\sin\frac{C+D}{2}\sin\frac{C-D}{2}$

$\cos 9\theta - \cos 5\theta = -2\sin 7\theta \sin 2\theta$

Ans: (D) $-2\sin 7\theta \sin 2\theta$

---

7. The value of $\sin 165^\circ + \sin 75^\circ$ is

$\sin C + \sin D = 2\sin\frac{C+D}{2}\cos\frac{C-D}{2}$

$\sin 165^\circ + \sin 75^\circ = 2\sin 120^\circ \cos 45^\circ$

$= \frac{\sqrt{6}}{2}$

Ans: (D) $\frac{\sqrt{6}}{2}$

---

8. $\cos 52^\circ + \cos 68^\circ + \cos 172^\circ =$

$\cos 172^\circ + \cos 68^\circ = 2\cos\frac{172^\circ+68^\circ}{2}\cos\frac{172^\circ-68^\circ}{2} = 2\cos 120^\circ \cos 52^\circ$

$= 2\left(-\frac{1}{2}\right)\cos 52^\circ = -\cos 52^\circ$

$\therefore \cos 52^\circ + \cos 68^\circ + \cos 172^\circ = \cos 52^\circ - \cos 52^\circ = 0$

Ans: (B) 0

---

9. $\sin 93^\circ - \sin 27^\circ =$

The half sum of the angles is 60°, a standard angle.

$\sin 93^\circ - \sin 27^\circ = 2\cos 60^\circ \sin 33^\circ = \sin 33^\circ$

Ans: (A) $\sin 33^\circ$

---

10. $\frac{\sin 7\theta - \sin 3\theta}{\cos 7\theta + \cos 3\theta} =$

$\frac{\sin 7\theta - \sin 3\theta}{\cos 7\theta + \cos 3\theta} = \frac{2\cos 5\theta \sin 2\theta}{2\cos 5\theta \cos 2\theta}$

$= \tan 2\theta$

Ans: (B) $\tan 2\theta$

---

11. $\frac{\sin 8\theta - \sin 4\theta}{\cos 8\theta + \cos 4\theta} =$

$\frac{\sin 8\theta - \sin 4\theta}{\cos 8\theta + \cos 4\theta} = \frac{2\cos 6\theta \sin 2\theta}{2\cos 6\theta \cos 2\theta}$

$= \tan 2\theta$

Ans: (D) $\tan 2\theta$

---

12. $\frac{\cos 5\theta - \cos 7\theta}{\sin 7\theta + \sin 5\theta} =$

$\frac{\cos 5\theta - \cos 7\theta}{\sin 7\theta + \sin 5\theta} = \frac{2\sin 6\theta \sin \theta}{2\sin 6\theta \cos \theta}$

$= \tan \theta$

Ans: (A) $\tan \theta$

---

13. In a triangle ABC, $\cos 2A + \cos 2B + \cos 2C =$

$\cos 2A + \cos 2B = 2\cos(A+B)\cos(A-B) = -2\cos C \cos(A-B)$

$\text{LHS} = -1 - 2\cos C[\cos(A-B) + \cos(A+B)] = -1 - 2\cos C \cdot 2\cos A \cos B$

$= -1 - 4\cos A \cos B \cos C = \text{RHS}$

Ans: (C) $-1 - 4\cos A \cos B \cos C$

---

14. In a triangle ABC, $-\sin 2A + \sin 2B + \sin 2C =$

$\sin 2B + \sin 2C = 2\sin(B+C)\cos(B-C) = 2\sin A \cos(B-C)$

$\text{LHS} = 2\sin A[\cos(B-C) + \cos(B+C)] = 2\sin A \cdot 2\cos B \cos C$

$= 4\sin A \cos B \cos C = \text{RHS}$

Ans: (A) $4\sin A \cos B \cos C$

---

15. If $A + B + C = \pi$, then $\cos 2A + \cos 2B + \cos 2C =$

$\cos 2A + \cos 2B = 2\cos(A+B)\cos(A-B) = -2\cos C \cos(A-B)$

$\text{LHS} = -1 - 2\cos C[\cos(A-B) + \cos(A+B)] = -1 - 2\cos C \cdot 2\cos A \cos B$

$= -1 - 4\cos A \cos B \cos C = \text{RHS}$

Ans: (A) $-1 - 4\cos A \cos B \cos C$

---

16. If $A+B+C=\pi$, then $\cos A+\cos B-\cos C=$

$\cos A+\cos B=2\cos\frac{A+B}{2}\cos\frac{A-B}{2}=2\sin\frac{C}{2}\cos\frac{A-B}{2}$

$\text{LHS}=-1+2\sin\frac{C}{2}\left[\cos\frac{A-B}{2}+\cos\frac{A+B}{2}\right]=-1+2\sin\frac{C}{2}\cdot 2\cos\frac{A}{2}\cos\frac{B}{2}$

$=-1+4\cos\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}=\text{RHS}$

Ans: (D) $-1+4\cos\frac{A}{2}\cos\frac{B}{2}\sin\frac{C}{2}$

---

17. If $\cos x-\cos y=\frac{1}{3}$ and $\sin x-\sin y=\frac{3}{4}$, then $\tan\frac{x+y}{2}=$

Transforming: $-2\sin\frac{x+y}{2}\sin\frac{x-y}{2}=\frac{1}{3}$ and $2\cos\frac{x+y}{2}\sin\frac{x-y}{2}=\frac{3}{4}$.

Dividing: $\tan\frac{x+y}{2}=-\frac{4}{9}$

Ans: (C) $-\frac{4}{9}$

---

18. If $\cos x-\cos y=\frac{3}{5}$ and $\sin x+\sin y=\frac{1}{6}$, then $\cos(x-y)=$

Transforming: $-2\sin\frac{x+y}{2}\sin\frac{x-y}{2}=\frac{3}{5}$ and $2\sin\frac{x+y}{2}\cos\frac{x-y}{2}=\frac{1}{6}$.

Dividing: $\tan\frac{x-y}{2}=-\frac{18}{5}$

With $t=-\frac{18}{5}$: $\sin(x-y)=\frac{2t}{1+t^2}=-\frac{180}{349}$, $\cos(x-y)=\frac{1-t^2}{1+t^2}=-\frac{299}{349}$

Ans: (C) $-\frac{299}{349}$

---

19. If $\cos x+\cos y=\frac{1}{4}$ and $\sin x+\sin y=\frac{3}{5}$, then $\tan\frac{x+y}{2}=$

Transforming: $2\cos\frac{x+y}{2}\cos\frac{x-y}{2}=\frac{1}{4}$ and $2\sin\frac{x+y}{2}\cos\frac{x-y}{2}=\frac{3}{5}$.

Dividing: $\tan\frac{x+y}{2}=\frac{12}{5}$

Ans: (B) $\frac{12}{5}$

---

20. If $\cos x-\cos y=\frac{3}{5}$ and $\sin x-\sin y=\frac{5}{6}$, then $\cos(x+y)=$

Transforming: $-2\sin\frac{x+y}{2}\sin\frac{x-y}{2}=\frac{3}{5}$ and $2\cos\frac{x+y}{2}\sin\frac{x-y}{2}=\frac{5}{6}$.

Dividing: $\tan\frac{x+y}{2}=-\frac{18}{25}$

With $t=-\frac{18}{25}$: $\sin(x+y)=\frac{2t}{1+t^2}=-\frac{900}{949}$, $\cos(x+y)=\frac{1-t^2}{1+t^2}=\frac{301}{949}$

Ans: (C) $\frac{301}{949}$

---

21. If $\cos x-\cos y=\frac{4}{5}$ and $\sin x+\sin y=\frac{2}{7}$, then $\cos(x+y)=$

Square both and add, using $\cos^2+\sin^2=1$:

$a^2+b^2=2-2(\cos x\cos y-\sin x\sin y)=2-2\cos(x+y)$

$\frac{16}{25}+\frac{4}{49}=2-2\cos(x+y)$

$\cos(x+y)=\frac{783}{1225}$

Ans: (B) $\frac{783}{1225}$

---

22. If $\cos x+\cos y=\frac{4}{3}$ and $\sin x+\sin y=\frac{1}{3}$, then $\cos(x-y)=$

Square both and add, using $\cos^2+\sin^2=1$:

$a^2+b^2=2+2(\cos x\cos y+\sin x\sin y)=2+2\cos(x-y)$

$\frac{16}{9}+\frac{1}{9}=2+2\cos(x-y)$

$\cos(x-y)=-\frac{1}{18}$

Ans: (B) $-\frac{1}{18}$

---

23. If $\cos x + \cos y = \frac{2}{5}$ and $\sin x - \sin y = \frac{2}{3}$, then $\cos(x+y) =$

Square both and add, using $\cos^2 + \sin^2 = 1$:

$a^2 + b^2 = 2 + 2(\cos x \cos y - \sin x \sin y) = 2 + 2\cos(x+y)$

$\frac{4}{25} + \frac{4}{9} = 2 + 2\cos(x+y)$

$\cos(x+y) = -\frac{157}{225}$

Ans: (D) $-\frac{157}{225}$

---

24. In an acute angled triangle ABC, the least value of $\sec A + \sec B + \sec C$ is

Equality holds for the equilateral triangle, where every angle is 60°.

The least value is 6.

Ans: (D) 6

---

25. In a triangle ABC with $A = 15^\circ$ and $B = 150^\circ$, $\cos A + \cos B + \cos C =$

$C = 180^\circ - 15^\circ - 150^\circ = 15^\circ$

$\cos 15^\circ + \cos 150^\circ + \cos 15^\circ = \frac{\sqrt{2}+\sqrt{6}}{4} - \frac{\sqrt{3}}{2} + \frac{\sqrt{2}+\sqrt{6}}{4} = \frac{-\sqrt{3}+\sqrt{2}+\sqrt{6}}{2}$

Ans: (A) $\frac{-\sqrt{3}+\sqrt{2}+\sqrt{6}}{2}$
