EXPRESSWALA ACADEMY

Maths 1A: Transformations

MCQ Test, Set 10

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 $\sin 45^\circ \cos 15^\circ$ is

A. $-\frac{1}{4}+\frac{\sqrt{3}}{4}$ **B.** $\frac{1}{4}+\frac{\sqrt{3}}{4}$

C. $\frac{\sqrt{3}}{4}+\frac{5}{4}$ **D.** $\frac{1}{2}+\frac{\sqrt{3}}{2}$

2. The value of $2\sin 45^\circ \sin 15^\circ$ is

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

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

3. The value of $4\cos 75^\circ \cos 15^\circ$ is

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

4. $\cos 6\theta - \cos 10\theta =$

A. $2\cos 8\theta \cos 2\theta$ **B.** $-2\sin 8\theta \sin 2\theta$

C. $2\sin 8\theta \sin 2\theta$ **D.** $\sin 8\theta \sin 2\theta$

5. $\cos 4\theta - \cos 2\theta =$

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

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

6. $\cos 7\theta - \cos 3\theta =$

A. $2\sin 5\theta \sin 2\theta$ **B.** $-\sin 5\theta \sin 2\theta$

C. $-2\cos 5\theta \cos 2\theta$ **D.** $-2\sin 5\theta \sin 2\theta$

7. $\cos 13^\circ + \cos 107^\circ =$

A. $-\cos 47^\circ$ **B.** $\sin 47^\circ$

C. $2\cos 47^\circ$ **D.** $\cos 47^\circ$

8. The value of $\cos 165^\circ + \cos 105^\circ$ is

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

9. $\sin 116^\circ - \sin 56^\circ + \cos 94^\circ =$

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

10. $\frac{\sin 9\theta - \sin 5\theta}{\cos 5\theta - \cos 9\theta} =$

A. $\cot 2\theta$ **B.** $\tan 7\theta$

C. $\cot 7\theta$ **D.** $-\cot 7\theta$

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11. $\frac{\sin 6\theta + \sin 2\theta}{\cos 6\theta + \cos 2\theta} =$

A. $\tan 2\theta$ **B.** $-\tan 4\theta$

C. $\cot 4\theta$ **D.** $\tan 4\theta$

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12. $\frac{\cos 8\theta - \cos 10\theta}{\sin 10\theta + \sin 8\theta} =$

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

C. $\tan 9\theta$ **D.** $\tan\theta$

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

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

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

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

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

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

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

D. $2\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$

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15. If $A + B + C = \pi$, then $\sin A + \sin B - \sin C =$

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

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

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

D. $2\sin\frac{A}{2}\sin\frac{B}{2}\cos\frac{C}{2}$

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16. If $A + B + C = \pi$, then $\sin 2A - \sin 2B + \sin 2C =$

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

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

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17. If $\cos x + \cos y = \frac{2}{3}$ and $\sin x + \sin y = \frac{3}{7}$, then $\sin(x+y) =$

A. $-\frac{115}{277}$ **B.** $\frac{115}{277}$ **C.** $-\frac{252}{277}$ **D.** $\frac{252}{277}$

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

A. $\frac{20}{101}$ **B.** $-\frac{20}{101}$ **C.** $\frac{99}{101}$ **D.** $-\frac{99}{101}$

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

A. $-\frac{6}{5}$ **B.** $\frac{6}{5}$ **C.** $\frac{5}{6}$ **D.** $-\frac{5}{6}$

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20. If $\cos x - \cos y = \frac{5}{4}$ and $\sin x - \sin y = \frac{5}{6}$, then $\tan\frac{x+y}{2} =$

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

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

A. $\frac{25}{288}$ **B.** $\frac{263}{288}$ **C.** $-\frac{263}{288}$ **D.** $-\frac{119}{288}$

22. If $\cos x - \cos y = \frac{4}{3}$ and $\sin x + \sin y = \frac{2}{3}$, then $\cos(x+y) =$

A. $-\frac{1}{9}$ **B.** $\frac{10}{9}$ **C.** $\frac{1}{9}$ **D.** $\frac{11}{18}$

23. If $\cos x - \cos y = \frac{3}{7}$ and $\sin x + \sin y = \frac{6}{5}$, then $\cos(x+y) =$

A. $\frac{461}{2450}$ **B.** $\frac{382}{1225}$ **C.** $\frac{1989}{2450}$ **D.** $-\frac{461}{2450}$

24. In a triangle ABC with $A = 45^\circ$ and $B = 60^\circ$, $\cos A + \cos B + \cos C =$

A. $\frac{-\sqrt{6}+3\sqrt{2}}{4} + \frac{1}{2}$ **B.** $\frac{3}{2}$

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

25. In a triangle ABC with $A = 120^\circ$ and $B = 30^\circ$, $\cos A + \cos B + \cos C =$

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

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

Key sheet

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

Solutions

1. The value of $\sin 45^\circ \cos 15^\circ$ is

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

$\sin 45^\circ \cos 15^\circ = \frac{1}{2}(\sin 60^\circ + \sin 30^\circ)$

$= \frac{1}{2}\left(\frac{\sqrt{3}}{2} + \frac{1}{2}\right) = \frac{1}{4} + \frac{\sqrt{3}}{4}$

Ans: (B) $\frac{1}{4} + \frac{\sqrt{3}}{4}$

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2. The value of $2\sin 45^\circ \sin 15^\circ$ is

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

$2\sin 45^\circ \sin 15^\circ = \cos 30^\circ - \cos 60^\circ$

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

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

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3. The value of $4\cos 75^\circ \cos 15^\circ$ is

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

$4\cos 75^\circ \cos 15^\circ = 2(\cos 90^\circ + \cos 60^\circ)$

$= 2\left(0 + \frac{1}{2}\right) = 1$

Ans: (A) 1

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4. $\cos 6\theta - \cos 10\theta =$

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

$\cos 6\theta - \cos 10\theta = 2\sin 8\theta \sin 2\theta$

Ans: (C) $2\sin 8\theta \sin 2\theta$

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5. $\cos 4\theta - \cos 2\theta =$

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

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

Ans: (B) $-2\sin 3\theta \sin\theta$

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6. $\cos 7\theta - \cos 3\theta =$

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

$\cos 7\theta - \cos 3\theta = -2\sin 5\theta \sin 2\theta$

Ans: (D) $-2\sin 5\theta \sin 2\theta$

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7. $\cos 13^\circ + \cos 107^\circ =$

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

$\cos 13^\circ + \cos 107^\circ = 2\cos 60^\circ \cos 47^\circ = \cos 47^\circ$

Ans: (D) $\cos 47^\circ$

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8. The value of $\cos 165^\circ + \cos 105^\circ$ is

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

$\cos 165^\circ + \cos 105^\circ = 2\cos 135^\circ \cos 30^\circ$

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

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

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9. $\sin 116^\circ - \sin 56^\circ + \cos 94^\circ =$

$\sin 116^\circ - \sin 56^\circ = 2\cos\frac{116^\circ+56^\circ}{2}\sin\frac{116^\circ-56^\circ}{2} = 2\cos 86^\circ \sin 30^\circ = \cos 86^\circ$

$\cos 94^\circ = \cos(180^\circ - 86^\circ) = -\cos 86^\circ$

$\therefore \sin 116^\circ - \sin 56^\circ + \cos 94^\circ = \cos 86^\circ - \cos 86^\circ = 0$

Ans: (B) 0

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10. $\frac{\sin 9\theta - \sin 5\theta}{\cos 5\theta - \cos 9\theta} =$

$\frac{\sin 9\theta - \sin 5\theta}{\cos 5\theta - \cos 9\theta} = \frac{2\cos 7\theta \sin 2\theta}{2\sin 7\theta \sin 2\theta}$

$= \cot 7\theta$

Ans: (C) $\cot 7\theta$

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11. $\frac{\sin 6\theta + \sin 2\theta}{\cos 6\theta + \cos 2\theta} =$

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

$= \tan 4\theta$

Ans: (D) $\tan 4\theta$

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12. $\frac{\cos 8\theta - \cos 10\theta}{\sin 10\theta + \sin 8\theta} =$

$\frac{\cos 8\theta - \cos 10\theta}{\sin 10\theta + \sin 8\theta} = \frac{2\sin 9\theta \sin\theta}{2\sin 9\theta \cos\theta}$

$= \tan\theta$

Ans: (D) $\tan\theta$

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

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

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

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

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

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

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

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

$= 4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2} = \text{RHS}$

Ans: (C) $4\cos\frac{A}{2}\cos\frac{B}{2}\cos\frac{C}{2}$

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15. If $A+B+C=\pi$, then $\sin A+\sin B-\sin C=$

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

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

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

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

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16. If $A+B+C=\pi$, then $\sin 2A-\sin 2B+\sin 2C=$

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

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

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

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

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17. If $\cos x+\cos y=\frac{2}{3}$ and $\sin x+\sin y=\frac{3}{7}$, then $\sin(x+y)=$

Transforming: $2\cos\frac{x+y}{2}\cos\frac{x-y}{2}=\frac{2}{3}$ and $2\sin\frac{x+y}{2}\cos\frac{x-y}{2}=\frac{3}{7}$.

Dividing: $\tan\frac{x+y}{2}=\frac{9}{14}$

With $t=\frac{9}{14}$: $\sin(x+y)=\frac{2t}{1+t^2}=\frac{252}{277}$, $\cos(x+y)=\frac{1-t^2}{1+t^2}=\frac{115}{277}$

Ans: (D) $\frac{252}{277}$

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

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

Dividing: $\tan\frac{x+y}{2}=-\frac{1}{10}$

With $t=-\frac{1}{10}$: $\sin(x+y)=\frac{2t}{1+t^2}=-\frac{20}{101}$, $\cos(x+y)=\frac{1-t^2}{1+t^2}=\frac{99}{101}$

Ans: (B) $-\frac{20}{101}$

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

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

Dividing: $\tan\frac{x-y}{2}=\frac{5}{6}$

Ans: (C) $\frac{5}{6}$

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20. If $\cos x-\cos y=\frac{5}{4}$ and $\sin x-\sin y=\frac{5}{6}$, then $\tan\frac{x+y}{2}=$

Transforming: $-2\sin\frac{x+y}{2}\sin\frac{x-y}{2}=\frac{5}{4}$ and $2\cos\frac{x+y}{2}\sin\frac{x-y}{2}=\frac{5}{6}$.

Dividing: $\tan\frac{x+y}{2}=-\frac{3}{2}$

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

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

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

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

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

$\cos(x+y)=\frac{263}{288}$

Ans: (B) $\frac{263}{288}$

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22. If $\cos x - \cos y = \frac{4}{3}$ and $\sin x + \sin y = \frac{2}{3}$, then $\cos(x+y) =$

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

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

$\frac{16}{9} + \frac{4}{9} = 2 - 2\cos(x+y)$

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

Ans: (A) $-\frac{1}{9}$

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23. If $\cos x - \cos y = \frac{3}{7}$ and $\sin x + \sin y = \frac{6}{5}$, then $\cos(x+y) =$

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

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

$\frac{9}{49} + \frac{36}{25} = 2 - 2\cos(x+y)$

$\cos(x+y) = \frac{461}{2450}$

Ans: (A) $\frac{461}{2450}$

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24. In a triangle ABC with $A = 45^\circ$ and $B = 60^\circ$, $\cos A + \cos B + \cos C =$

$C = 180^\circ - 45^\circ - 60^\circ = 75^\circ$

$\cos 45^\circ + \cos 60^\circ + \cos 75^\circ = \frac{\sqrt{2}}{2} + \frac{1}{2} + \frac{-\sqrt{2}+\sqrt{6}}{4} = \frac{1}{2} + \frac{\sqrt{2}+\sqrt{6}}{4}$

Ans: (C) $\frac{1}{2} + \frac{\sqrt{2}+\sqrt{6}}{4}$

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25. In a triangle ABC with $A = 120^\circ$ and $B = 30^\circ$, $\cos A + \cos B + \cos C =$

$C = 180^\circ - 120^\circ - 30^\circ = 30^\circ$

$\cos 120^\circ + \cos 30^\circ + \cos 30^\circ = -\frac{1}{2} + \frac{\sqrt{3}}{2} + \frac{\sqrt{3}}{2} = -\frac{1}{2} + \sqrt{3}$

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