EXPRESSWALA ACADEMY

Maths 1A: Transformations

MCQ Test, Set 04

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 $\cos 75^\circ \sin 15^\circ$ is

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

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

2. The value of $\sin 105^\circ \cos 75^\circ$ is

A. $-\frac{1}{4}$ **B.** $\frac{1}{2}$

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

3. The value of $\sin 75^\circ \sin 45^\circ$ is

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

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

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

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

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

5. $\sin 11\theta + \sin 9\theta =$

A. $2 \sin \theta \cos 10\theta$ **B.** $-2 \sin 10\theta \cos \theta$

C. $2 \sin 10\theta \cos \theta$ **D.** $2 \cos 10\theta \sin \theta$

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

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

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

7. $\cos 48^\circ + \cos 72^\circ =$

A. $\cos 12^\circ$ **B.** $\sin 12^\circ$

C. $2 \cos 12^\circ$ **D.** $-\cos 12^\circ$

8. The value of $\cos 75^\circ + \cos 15^\circ$ is

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

9. $\sin 18^\circ + \sin 42^\circ - \sin 78^\circ =$

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

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

A. $\tan 3\theta$ **B.** $\cot 3\theta$

C. $\tan 7\theta$ **D.** $-\tan 3\theta$

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11. $\frac{\sin 11\theta + \sin 5\theta}{\cos 11\theta + \cos 5\theta} =$

A. $-\tan 8\theta$ **B.** $\tan 8\theta$

C. $\tan 3\theta$ **D.** $\cot 8\theta$

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12. $\frac{\sin 9\theta - \sin 3\theta}{\cos 9\theta + \cos 3\theta} =$

A. $\cot 3\theta$ **B.** $\tan 6\theta$

C. $-\tan 3\theta$ **D.** $\tan 3\theta$

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

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

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

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

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

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

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

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

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15. In a triangle ABC, $\cos A - \cos B + \cos C =$

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

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

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

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

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

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

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

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17. If $\cos x + \cos y = \frac{3}{7}$ and $\sin x - \sin y = \frac{4}{3}$, then $\tan\frac{x-y}{2} =$

A. $-\frac{9}{28}$ **B.** $\frac{9}{28}$ **C.** $\frac{28}{9}$ **D.** $-\frac{28}{9}$

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

A. $\frac{12}{13}$ **B.** $-\frac{5}{13}$ **C.** $-\frac{12}{13}$ **D.** $\frac{5}{13}$

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

A. $\frac{2301}{2501}$ **B.** $-\frac{980}{2501}$ **C.** $\frac{980}{2501}$ **D.** $-\frac{2301}{2501}$

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20. If $\cos x + \cos y = \frac{4}{5}$ and $\sin x - \sin y = \frac{3}{7}$, then $\tan\frac{x-y}{2} =$

A. $-\frac{28}{15}$ **B.** $\frac{15}{28}$ **C.** $-\frac{15}{28}$ **D.** $\frac{28}{15}$

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21. If $\cos x - \cos y = \frac{3}{7}$ and $\sin x + \sin y = \frac{1}{6}$, then $\cos(x+y) =$

A. $\frac{373}{3528}$ **B.** $\frac{3155}{3528}$ **C.** $-\frac{1391}{3528}$ **D.** $-\frac{3155}{3528}$

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

A. $-\frac{211}{450}$ **B.** $\frac{211}{450}$ **C.** $\frac{661}{450}$ **D.** $\frac{218}{225}$

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

A. $\frac{25}{72}$ **B.** $-\frac{11}{72}$ **C.** $\frac{61}{72}$ **D.** $\frac{11}{72}$

24. In a triangle ABC with $A = 75^\circ$ and $B = 75^\circ$, $\cos A + \cos B + \cos C =$

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

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

25. In a triangle ABC with $A = 45^\circ$ and $B = 105^\circ$, $\cos A + \cos B + \cos C =$

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

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

Key sheet

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

Solutions

1. The value of $\cos 75^\circ \sin 15^\circ$ is

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

$\cos 75^\circ \sin 15^\circ = \frac{1}{2}(\sin 90^\circ - \sin 60^\circ)$

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

Ans: (B) $\frac{1}{2} - \frac{\sqrt{3}}{4}$

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2. The value of $\sin 105^\circ \cos 75^\circ$ is

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

$\sin 105^\circ \cos 75^\circ = \frac{1}{2}(\sin 180^\circ + \sin 30^\circ)$

$= \frac{1}{2}\left(0 + \frac{1}{2}\right) = \frac{1}{4}$

Ans: (C) $\frac{1}{4}$

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3. The value of $\sin 75^\circ \sin 45^\circ$ is

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

$\sin 75^\circ \sin 45^\circ = \frac{1}{2}(\cos 30^\circ - \cos 120^\circ)$

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

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

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

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

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

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

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5. $\sin 11\theta + \sin 9\theta =$

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

$\sin 11\theta + \sin 9\theta = 2\sin 10\theta \cos\theta$

Ans: (C) $2\sin 10\theta \cos\theta$

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

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

$\cos 5\theta + \cos\theta = 2\cos 3\theta \cos 2\theta$

Ans: (D) $2\cos 3\theta \cos 2\theta$

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7. $\cos 48^\circ + \cos 72^\circ =$

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

$\cos 48^\circ + \cos 72^\circ = 2\cos 60^\circ \cos 12^\circ = \cos 12^\circ$

Ans: (A) $\cos 12^\circ$

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8. The value of $\cos 75^\circ + \cos 15^\circ$ is

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

$\cos 75^\circ + \cos 15^\circ = 2\cos 45^\circ \cos 30^\circ$

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

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

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9. $\sin 18^\circ + \sin 42^\circ - \sin 78^\circ =$

$\sin 42^\circ + \sin 18^\circ = 2\sin\frac{42^\circ+18^\circ}{2}\cos\frac{42^\circ-18^\circ}{2} = 2\sin 30^\circ \cos 12^\circ = \cos 12^\circ$

$\sin 78^\circ = \sin(90^\circ - 12^\circ) = \cos 12^\circ$

$\therefore \sin 18^\circ + \sin 42^\circ - \sin 78^\circ = \cos 12^\circ - \cos 12^\circ = 0$

Ans: (B) 0

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

$\frac{\sin 10\theta - \sin 4\theta}{\cos 10\theta + \cos 4\theta} = \frac{2\cos 7\theta \sin 3\theta}{2\cos 7\theta \cos 3\theta}$

$= \tan 3\theta$

Ans: (A) $\tan 3\theta$

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11. $\frac{\sin 11\theta + \sin 5\theta}{\cos 11\theta + \cos 5\theta} =$

$\frac{\sin 11\theta + \sin 5\theta}{\cos 11\theta + \cos 5\theta} = \frac{2\sin 8\theta \cos 3\theta}{2\cos 8\theta \cos 3\theta}$

$= \tan 8\theta$

Ans: (B) $\tan 8\theta$

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12. $\frac{\sin 9\theta - \sin 3\theta}{\cos 9\theta + \cos 3\theta} =$

$\frac{\sin 9\theta - \sin 3\theta}{\cos 9\theta + \cos 3\theta} = \frac{2\cos 6\theta \sin 3\theta}{2\cos 6\theta \cos 3\theta}$

$= \tan 3\theta$

Ans: (D) $\tan 3\theta$

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

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

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

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

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

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

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

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

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

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

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15. In a triangle ABC, $\cos A - \cos B + \cos C =$

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

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

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

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

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

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

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

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

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

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17. If $\cos x + \cos y = \frac{3}{7}$ and $\sin x - \sin y = \frac{4}{3}$, then $\tan\frac{x-y}{2} =$

Transforming: $2\cos\frac{x+y}{2}\cos\frac{x-y}{2} = \frac{3}{7}$ and $2\cos\frac{x+y}{2}\sin\frac{x-y}{2} = \frac{4}{3}$.

Dividing: $\tan\frac{x-y}{2} = \frac{28}{9}$

Ans: (C) $\frac{28}{9}$

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

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

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

With $t = -5$: $\sin(x-y) = \frac{2t}{1+t^2} = -\frac{5}{13}$, $\cos(x-y) = \frac{1-t^2}{1+t^2} = -\frac{12}{13}$

Ans: (C) $-\frac{12}{13}$

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

Transforming: $2\cos\frac{x+y}{2}\cos\frac{x-y}{2} = \frac{2}{7}$ and $2\sin\frac{x+y}{2}\cos\frac{x-y}{2} = \frac{7}{5}$.

Dividing: $\tan\frac{x+y}{2} = \frac{49}{10}$

With $t = \frac{49}{10}$: $\sin(x+y) = \frac{2t}{1+t^2} = \frac{980}{2501}$, $\cos(x+y) = \frac{1-t^2}{1+t^2} = -\frac{2301}{2501}$

Ans: (D) $-\frac{2301}{2501}$

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20. If $\cos x + \cos y = \frac{4}{5}$ and $\sin x - \sin y = \frac{3}{7}$, then $\tan\frac{x-y}{2} =$

Transforming: $2\cos\frac{x+y}{2}\cos\frac{x-y}{2} = \frac{4}{5}$ and $2\cos\frac{x+y}{2}\sin\frac{x-y}{2} = \frac{3}{7}$.

Dividing: $\tan\frac{x-y}{2} = \frac{15}{28}$

Ans: (B) $\frac{15}{28}$

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21. If $\cos x - \cos y = \frac{3}{7}$ and $\sin x + \sin y = \frac{1}{6}$, then $\cos(x+y) =$

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

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

$\frac{9}{49} + \frac{1}{36} = 2 - 2\cos(x+y)$

$\cos(x+y) = \frac{3155}{3528}$

Ans: (B) $\frac{3155}{3528}$

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

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

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

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

$\cos(x-y) = -\frac{211}{450}$

Ans: (A) $-\frac{211}{450}$

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

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

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

$1 + \frac{25}{36} = 2 + 2\cos(x-y)$

$\cos(x-y) = -\frac{11}{72}$

Ans: (B) $-\frac{11}{72}$

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24. In a triangle ABC with $A = 75^\circ$ and $B = 75^\circ$, $\cos A + \cos B + \cos C =$

$C = 180^\circ - 75^\circ - 75^\circ = 30^\circ$

$\cos 75^\circ + \cos 75^\circ + \cos 30^\circ = \frac{-\sqrt{2}+\sqrt{6}}{4} + \frac{-\sqrt{2}+\sqrt{6}}{4} + \frac{\sqrt{3}}{2} = \frac{-\sqrt{2}+\sqrt{3}+\sqrt{6}}{2}$

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

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25. In a triangle ABC with $A = 45^\circ$ and $B = 105^\circ$, $\cos A + \cos B + \cos C =$

$C = 180^\circ - 45^\circ - 105^\circ = 30^\circ$

$\cos 45^\circ + \cos 105^\circ + \cos 30^\circ = \frac{\sqrt{2}}{2} + \frac{-\sqrt{6}+\sqrt{2}}{4} + \frac{\sqrt{3}}{2} = \frac{-\sqrt{6}+2\sqrt{3}+3\sqrt{2}}{4}$

Ans: (C) $\frac{-\sqrt{6}+2\sqrt{3}+3\sqrt{2}}{4}$
