EXPRESSWALA ACADEMY

Maths 1A: Transformations

MCQ Test, Set 08

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 $4\cos 75^\circ \cos 45^\circ$ is

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

2. The value of $2\cos 105^\circ \cos 45^\circ$ is

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

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

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

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

4. $\cos 10\theta + \cos 2\theta =$

A. $2\sin 6\theta \sin 4\theta$ **B.** $-2\cos 6\theta \cos 4\theta$

C. $2\cos 6\theta \cos 4\theta$ **D.** $\cos 6\theta \cos 4\theta$

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

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

C. $2\sin 6\theta \sin \theta$ **D.** $2\cos 6\theta \cos \theta$

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

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

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

7. The value of $\cos 45^\circ - \cos 75^\circ$ is

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

C. $\frac{\sqrt{6}+3\sqrt{2}}{4}$ **D.** $\frac{-\sqrt{6}+3\sqrt{2}}{8}$

8. $\sin 94^\circ - \sin 34^\circ + \cos 116^\circ =$

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

9. $\cos 108^\circ + \cos 132^\circ =$

A. $2\cos 12^\circ$ **B.** $-\sin 12^\circ$

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

10. $\frac{\sin 11\theta - \sin 3\theta}{\cos 3\theta - \cos 11\theta} =$

A. $-\cot 7\theta$ **B.** $\cot 7\theta$

C. $\tan 7\theta$ **D.** $\cot 4\theta$

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11. $\frac{\cos 2\theta - \cos 10\theta}{\sin 10\theta + \sin 2\theta} =$

A. $\tan 4\theta$ **B.** $\tan 6\theta$

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

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12. $\frac{\sin 11\theta + \sin 7\theta}{\cos 11\theta + \cos 7\theta} =$

A. $\cot 9\theta$ **B.** $\tan 2\theta$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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17. If $\cos x + \cos y = \frac{1}{3}$ and $\sin x + \sin y = \frac{2}{5}$, then $\sin(x+y) =$

A. $-\frac{11}{61}$ **B.** $\frac{11}{61}$ **C.** $-\frac{60}{61}$ **D.** $\frac{60}{61}$

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18. If $\cos x + \cos y = \frac{1}{4}$ and $\sin x + \sin y = \frac{5}{4}$, then $\sin(x+y) =$

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

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

A. $-\frac{8}{15}$ **B.** $\frac{15}{8}$ **C.** $-\frac{15}{8}$ **D.** $\frac{8}{15}$

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

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

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

A. $\frac{49}{1800}$ **B.** $-\frac{851}{1800}$ **C.** $\frac{851}{1800}$ **D.** $\frac{949}{1800}$

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

A. $\frac{23}{36}$ **B.** $\frac{13}{36}$ **C.** $-\frac{5}{36}$ **D.** $-\frac{23}{36}$

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

A. $\frac{65}{392}$ **B.** $-\frac{65}{392}$ **C.** $\frac{457}{392}$ **D.** $\frac{261}{392}$

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

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

25. In a triangle ABC with $A = 90^\circ$ and $B = 45^\circ$, $\cos A + \cos B + \cos C =$

A. $\frac{3}{2}$ **B.** $\frac{\sqrt{2}}{2}$ **C.** $\sqrt{2}$ **D.** 0

Key sheet

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

Solutions

1. The value of $4\cos 75^\circ \cos 45^\circ$ is

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

$4\cos 75^\circ \cos 45^\circ = 2\left(\cos 120^\circ + \cos 30^\circ\right)$

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

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

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2. The value of $2\cos 105^\circ \cos 45^\circ$ is

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

$2\cos 105^\circ \cos 45^\circ = \cos 150^\circ + \cos 60^\circ$

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

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

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

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

$4\sin 75^\circ \sin 15^\circ = 2\left(\cos 60^\circ - \cos 90^\circ\right)$

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

Ans: (A) 1

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4. $\cos 10\theta + \cos 2\theta =$

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

$\cos 10\theta+\cos 2\theta = 2\cos 6\theta\cos 4\theta$

Ans: (C) $2\cos 6\theta\cos 4\theta$

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

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

$\cos 7\theta+\cos 5\theta = 2\cos 6\theta\cos\theta$

Ans: (D) $2\cos 6\theta\cos\theta$

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

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

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

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

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7. The value of $\cos 45^\circ - \cos 75^\circ$ is

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

$\cos 45^\circ-\cos 75^\circ = 2\sin 60^\circ\sin 15^\circ$

$= \frac{-\sqrt{6}+3\sqrt{2}}{4}$

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

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8. $\sin 94^\circ - \sin 34^\circ + \cos 116^\circ =$

$\sin 94^\circ - \sin 34^\circ = 2\cos\frac{94^\circ+34^\circ}{2}\sin\frac{94^\circ-34^\circ}{2} = 2\cos 64^\circ \sin 30^\circ = \cos 64^\circ$

$\cos 116^\circ = \cos(180^\circ - 64^\circ) = -\cos 64^\circ$

$\therefore \sin 94^\circ - \sin 34^\circ + \cos 116^\circ = \cos 64^\circ - \cos 64^\circ = 0$

Ans: (C) 0

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9. $\cos 108^\circ + \cos 132^\circ =$

The half sum of the angles is 120°, a standard angle.

$\cos 108^\circ + \cos 132^\circ = 2\cos 120^\circ \cos 12^\circ = -\cos 12^\circ$

Ans: (D) $-\cos 12^\circ$

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10. $\frac{\sin 11\theta - \sin 3\theta}{\cos 3\theta - \cos 11\theta} =$

$\frac{\sin 11\theta - \sin 3\theta}{\cos 3\theta - \cos 11\theta} = \frac{2\cos 7\theta \sin 4\theta}{2\sin 7\theta \sin 4\theta}$

$= \cot 7\theta$

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

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11. $\frac{\cos 2\theta - \cos 10\theta}{\sin 10\theta + \sin 2\theta} =$

$\frac{\cos 2\theta - \cos 10\theta}{\sin 10\theta + \sin 2\theta} = \frac{2\sin 6\theta \sin 4\theta}{2\sin 6\theta \cos 4\theta}$

$= \tan 4\theta$

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

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12. $\frac{\sin 11\theta + \sin 7\theta}{\cos 11\theta + \cos 7\theta} =$

$\frac{\sin 11\theta + \sin 7\theta}{\cos 11\theta + \cos 7\theta} = \frac{2\sin 9\theta \cos 2\theta}{2\cos 9\theta \cos 2\theta}$

$= \tan 9\theta$

Ans: (D) $\tan 9\theta$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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17. If $\cos x + \cos y = \frac{1}{3}$ and $\sin x + \sin y = \frac{2}{5}$, then $\sin(x+y) =$

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

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

With $t = \frac{6}{5}$: $\sin(x+y) = \frac{2t}{1+t^2} = \frac{60}{61}$, $\cos(x+y) = \frac{1-t^2}{1+t^2} = -\frac{11}{61}$

Ans: (D) $\frac{60}{61}$

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18. If $\cos x + \cos y = \frac{1}{4}$ and $\sin x + \sin y = \frac{5}{4}$, then $\sin(x+y) =$

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

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: (B) $\frac{5}{13}$

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

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

Dividing: $\tan\frac{x-y}{2} = \frac{8}{15}$

Ans: (D) $\frac{8}{15}$

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

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

Dividing: $\tan\frac{x-y}{2} = \frac{1}{3}$

Ans: (A) $\frac{1}{3}$

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

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

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

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

$\cos(x+y) = -\frac{851}{1800}$

Ans: (B) $-\frac{851}{1800}$

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

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

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

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

$\cos(x-y) = \frac{23}{36}$

Ans: (A) $\frac{23}{36}$

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

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

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

$\frac{9}{4} + \frac{4}{49} = 2 - 2\cos(x+y)$

$\cos(x+y) = -\frac{65}{392}$

Ans: (B) $-\frac{65}{392}$

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

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

$\cos 60^\circ + \cos 60^\circ + \cos 60^\circ = \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{3}{2}$

Ans: (D) $\frac{3}{2}$

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25. In a triangle ABC with $A = 90^\circ$ and $B = 45^\circ$, $\cos A + \cos B + \cos C =$

$C = 180^\circ - 90^\circ - 45^\circ = 45^\circ$

$\cos 90^\circ + \cos 45^\circ + \cos 45^\circ = 0 + \frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2} = \sqrt{2}$

Ans: (C) $\sqrt{2}$
