EXPRESSWALA ACADEMY

Maths 1A: Transformations

MCQ Test, Set 05

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. $2\sin 9\theta \sin 3\theta =$

A. $\cos 9\theta - \cos 3\theta$ **B.** $\cos 6\theta + \cos 12\theta$

C. $\cos 6\theta - \cos 12\theta$ **D.** $\sin 6\theta - \sin 12\theta$

2. $2\sin 6\theta \sin \theta =$

A. $\cos 5\theta + \cos 7\theta$ **B.** $\sin 5\theta - \sin 7\theta$

C. $\cos 6\theta - \cos \theta$ **D.** $\cos 5\theta - \cos 7\theta$

3. $2\sin 8\theta \sin 3\theta =$

A. $\cos 5\theta - \cos 11\theta$ **B.** $\cos 8\theta - \cos 3\theta$

C. $\sin 5\theta - \sin 11\theta$ **D.** $\cos 5\theta + \cos 11\theta$

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

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

C. $2\sin 6\theta \sin 4\theta$ **D.** $-\sin 6\theta \sin 4\theta$

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

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

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

6. $\sin 10\theta + \sin 8\theta =$

A. $-2\sin 9\theta \cos \theta$ **B.** $2\sin 9\theta \cos \theta$

C. $2\sin \theta \cos 9\theta$ **D.** $2\cos 9\theta \sin \theta$

7. The value of $\cos 135^\circ + \cos 105^\circ$ is

A. $\frac{-\sqrt{6}-\sqrt{2}}{8}$ **B.** $\frac{-\sqrt{6}+\sqrt{2}}{4}$

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

8. $\sin 5^\circ + \sin 55^\circ - \sin 65^\circ =$

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

9. $\sin 53^\circ + \sin 7^\circ =$

A. $\sin 23^\circ$ **B.** $2\cos 23^\circ$

C. $\cos 23^\circ$ **D.** $-\cos 23^\circ$

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10. $\frac{\cos 36^\circ - \cos 84^\circ}{\sin 84^\circ - \sin 36^\circ} =$

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

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11. $\frac{\sin 48^\circ - \sin 42^\circ}{\cos 42^\circ - \cos 48^\circ} =$

A. 2 **B.** -1 **C.** 0 **D.** 1

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12. $\frac{\cos 47^\circ + \cos 13^\circ}{\sin 47^\circ + \sin 13^\circ} =$

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

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13. In a triangle ABC, $\tan\frac{B+A}{2} =$

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

C. $-\cot\frac{C}{2}$ **D.** $\cot\frac{C}{2}$

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14. In a triangle ABC, $\cos(B + A) =$

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

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15. In a triangle ABC, $\sin(2B + 2A) =$

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

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16. In a triangle ABC, $\tan(A + C) =$

A. $-\cot B$ **B.** $\tan B$ **C.** $-\tan B$ **D.** $\cot B$

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

A. $\frac{4}{5}$ **B.** $-\frac{4}{5}$ **C.** $-\frac{3}{5}$ **D.** $\frac{3}{5}$

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18. If $\cos x + \cos y = \frac{2}{7}$ and $\sin x - \sin y = \frac{1}{6}$, then $\tan\frac{x-y}{2} =$

A. $\frac{12}{7}$ **B.** $\frac{7}{12}$ **C.** $-\frac{7}{12}$ **D.** $-\frac{12}{7}$

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19. If $\cos x - \cos y = \frac{2}{7}$ and $\sin x + \sin y = \frac{6}{5}$, then $\tan\frac{x-y}{2} =$

A. $-\frac{21}{5}$ **B.** $\frac{5}{21}$ **C.** $-\frac{5}{21}$ **D.** $\frac{21}{5}$

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

A. $\frac{4}{5}$ **B.** $-\frac{3}{5}$ **C.** $\frac{3}{5}$ **D.** $-\frac{4}{5}$

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

A. $\frac{13}{98}$ **B.** $\frac{85}{98}$ **C.** $-\frac{85}{98}$ **D.** $-\frac{18}{49}$

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

A. $-\frac{1077}{1225}$ **B.** $\frac{1077}{1225}$ **C.** $-\frac{929}{2450}$ **D.** $\frac{148}{1225}$

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23. If $\cos x - \cos y = \frac{5}{4}$ and $\sin x - \sin y = \frac{1}{3}$, then $\cos(x - y) =$

A. $\frac{47}{288}$ **B.** $-\frac{47}{288}$ **C.** $\frac{241}{288}$ **D.** $\frac{97}{288}$

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24. In a triangle ABC with $A = 90^\circ$ and $B = 15^\circ$, $\cos A + \cos B + \cos C =$

A. $\frac{\sqrt{2}}{2}$

B. $\frac{\sqrt{6}}{2}$

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

D. $\frac{3}{2}$

25. In a triangle ABC with $A = 15^\circ$ and $B = 30^\circ$, $\cos A + \cos B + \cos C =$

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

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

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

D. $\frac{3}{2}$

Key sheet

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

Solutions

1. $2\sin 9\theta \sin 3\theta =$

$2\sin A\sin B = \cos(A-B) - \cos(A+B)$ with $A = 9\theta,\ B = 3\theta.$

$2\sin 9\theta \sin 3\theta = \cos 6\theta - \cos 12\theta$

Ans: (C) $\cos 6\theta - \cos 12\theta$

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2. $2\sin 6\theta \sin \theta =$

$2\sin A\sin B = \cos(A-B) - \cos(A+B)$ with $A = 6\theta,\ B = \theta.$

$2\sin 6\theta \sin \theta = \cos 5\theta - \cos 7\theta$

Ans: (D) $\cos 5\theta - \cos 7\theta$

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3. $2\sin 8\theta \sin 3\theta =$

$2\sin A\sin B = \cos(A-B) - \cos(A+B)$ with $A = 8\theta,\ B = 3\theta.$

$2\sin 8\theta \sin 3\theta = \cos 5\theta - \cos 11\theta$

Ans: (A) $\cos 5\theta - \cos 11\theta$

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

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

$\cos 10\theta - \cos 2\theta = -2\sin 6\theta \sin 4\theta$

Ans: (B) $-2\sin 6\theta \sin 4\theta$

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

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

$\cos 7\theta - \cos 5\theta = -2\sin 6\theta \sin \theta$

Ans: (D) $-2\sin 6\theta \sin \theta$

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6. $\sin 10\theta + \sin 8\theta =$

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

$\sin 10\theta + \sin 8\theta = 2\sin 9\theta \cos \theta$

Ans: (B) $2\sin 9\theta \cos \theta$

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7. The value of $\cos 135^\circ + \cos 105^\circ$ is

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

$\cos 135^\circ + \cos 105^\circ = 2\cos 120^\circ \cos 15^\circ$

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

Ans: (D) $\frac{-\sqrt{6}-\sqrt{2}}{4}$

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8. $\sin 5^\circ + \sin 55^\circ - \sin 65^\circ =$

$\sin 55^\circ + \sin 5^\circ = 2\sin\frac{55^\circ+5^\circ}{2}\cos\frac{55^\circ-5^\circ}{2} = 2\sin 30^\circ \cos 25^\circ = \cos 25^\circ$

$\sin 65^\circ = \sin(90^\circ - 25^\circ) = \cos 25^\circ$

$\therefore \sin 5^\circ + \sin 55^\circ - \sin 65^\circ = \cos 25^\circ - \cos 25^\circ = 0$

Ans: (A) 0

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9. $\sin 53^\circ + \sin 7^\circ =$

The half sum of the angles is 30°, a standard angle.

$\sin 53^\circ + \sin 7^\circ = 2\sin 30^\circ \cos 23^\circ = \cos 23^\circ$

Ans: (C) $\cos 23^\circ$

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10. $\frac{\cos 36^\circ - \cos 84^\circ}{\sin 84^\circ - \sin 36^\circ} =$

$\frac{\cos 36^\circ - \cos 84^\circ}{\sin 84^\circ - \sin 36^\circ} = \frac{2\sin 60^\circ \sin 24^\circ}{2\cos 60^\circ \sin 24^\circ}$

$= \tan 60^\circ = \sqrt{3}$

Ans: (C) $\sqrt{3}$

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11. $\frac{\sin 48^\circ - \sin 42^\circ}{\cos 42^\circ - \cos 48^\circ} =$

$\frac{\sin 48^\circ - \sin 42^\circ}{\cos 42^\circ - \cos 48^\circ} = \frac{2\cos 45^\circ \sin 3^\circ}{2\sin 45^\circ \sin 3^\circ}$

$= \cot 45^\circ = 1$

Ans: (D) 1

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12. $\frac{\cos 47^\circ + \cos 13^\circ}{\sin 47^\circ + \sin 13^\circ} =$

$\frac{\cos 47^\circ + \cos 13^\circ}{\sin 47^\circ + \sin 13^\circ} = \frac{2\cos 30^\circ \cos 17^\circ}{2\sin 30^\circ \cos 17^\circ}$

$= \cot 30^\circ = \sqrt{3}$

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

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13. In a triangle ABC, $\tan \frac{B+A}{2} =$

In a triangle, $B + A = 180^\circ - C$.

$\tan \frac{B+A}{2} = \cot \frac{C}{2}$

Ans: (D) $\cot \frac{C}{2}$

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14. In a triangle ABC, $\cos(B + A) =$

In a triangle, $B + A = 180^\circ - C$.

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

Ans: (D) $-\cos C$

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15. In a triangle ABC, $\sin(2B + 2A) =$

In a triangle, $B + A = 180^\circ - C$.

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

Ans: (B) $-\sin 2C$

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16. In a triangle ABC, $\tan(A + C) =$

In a triangle, $A + C = 180^\circ - B$.

$\tan(A + C) = -\tan B$

Ans: (C) $-\tan B$

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

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

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

With $t = 2$: $\sin(x+y) = \frac{2t}{1+t^2} = \frac{4}{5},\ \cos(x+y) = \frac{1-t^2}{1+t^2} = -\frac{3}{5}$

Ans: (A) $\frac{4}{5}$

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18. If $\cos x + \cos y = \frac{2}{7}$ and $\sin x - \sin y = \frac{1}{6}$, then $\tan\frac{x-y}{2} =$

Transforming: $2\cos\frac{x+y}{2}\cos\frac{x-y}{2} = \frac{2}{7}$ and $2\cos\frac{x+y}{2}\sin\frac{x-y}{2} = \frac{1}{6}$.

Dividing: $\tan\frac{x-y}{2} = \frac{7}{12}$

Ans: (B) $\frac{7}{12}$

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19. If $\cos x - \cos y = \frac{2}{7}$ and $\sin x + \sin y = \frac{6}{5}$, then $\tan\frac{x-y}{2} =$

Transforming: $-2\sin\frac{x+y}{2}\sin\frac{x-y}{2} = \frac{2}{7}$ and $2\sin\frac{x+y}{2}\cos\frac{x-y}{2} = \frac{6}{5}$.

Dividing: $\tan\frac{x-y}{2} = -\frac{5}{21}$

Ans: (C) $-\frac{5}{21}$

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

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

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

With $t = 2$: $\sin(x-y) = \frac{2t}{1+t^2} = \frac{4}{5},\ \cos(x-y) = \frac{1-t^2}{1+t^2} = -\frac{3}{5}$

Ans: (A) $\frac{4}{5}$

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

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

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

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

$\cos(x-y) = -\frac{85}{98}$

Ans: (C) $-\frac{85}{98}$

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

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

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

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

$\cos(x+y) = \frac{1077}{1225}$

Ans: (B) $\frac{1077}{1225}$

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23. If $\cos x - \cos y = \frac{5}{4}$ and $\sin x - \sin y = \frac{1}{3}$, then $\cos(x-y) =$

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

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

$\frac{25}{16} + \frac{1}{9} = 2 - 2\cos(x-y)$

$\cos(x-y) = \frac{47}{288}$

Ans: (A) $\frac{47}{288}$

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24. In a triangle ABC with $A = 90^\circ$ and $B = 15^\circ$, $\cos A + \cos B + \cos C =$

$C = 180^\circ - 90^\circ - 15^\circ = 75^\circ$

$\cos 90^\circ + \cos 15^\circ + \cos 75^\circ = 0 + \frac{\sqrt{2}+\sqrt{6}}{4} + \frac{-\sqrt{2}+\sqrt{6}}{4} = \frac{\sqrt{6}}{2}$

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

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25. In a triangle ABC with $A = 15^\circ$ and $B = 30^\circ$, $\cos A + \cos B + \cos C =$

$C = 180^\circ - 15^\circ - 30^\circ = 135^\circ$

$\cos 15^\circ + \cos 30^\circ + \cos 135^\circ = \frac{\sqrt{2}+\sqrt{6}}{4} + \frac{\sqrt{3}}{2} - \frac{\sqrt{2}}{2} = \frac{-\sqrt{2}+\sqrt{6}+2\sqrt{3}}{4}$

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