EXPRESSWALA ACADEMY

Maths 1A: Transformations

MCQ Test, Set 03

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. $2\cos 8\theta \cos 4\theta =$

A. $\cos 12\theta - \cos 4\theta$ **B.** $\sin 12\theta + \sin 4\theta$

C. $\cos 8\theta + \cos 4\theta$ **D.** $\cos 12\theta + \cos 4\theta$

2. $2\sin 9\theta \cos 7\theta =$

A. $\sin 16\theta - \sin 2\theta$ **B.** $\cos 16\theta + \cos 2\theta$

C. $\sin 9\theta + \sin 7\theta$ **D.** $\sin 16\theta + \sin 2\theta$

3. $2\cos 9\theta \sin 6\theta =$

A. $\sin 15\theta + \sin 3\theta$ **B.** $\cos 15\theta - \cos 3\theta$

C. $\sin 15\theta - \sin 3\theta$ **D.** $\sin 9\theta - \sin 6\theta$

4. $\sin 11\theta - \sin 3\theta =$

A. $2\cos 4\theta \sin 7\theta$ **B.** $-2\cos 7\theta \sin 4\theta$

C. $2\cos 7\theta \sin 4\theta$ **D.** $2\sin 7\theta \cos 4\theta$

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

A. $2\sin 5\theta \cos 4\theta$ **B.** $-2\sin 5\theta \cos 4\theta$

C. $2\sin 4\theta \cos 5\theta$ **D.** $2\cos 5\theta \sin 4\theta$

6. $\sin 10\theta - \sin 2\theta =$

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

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

7. $\sin 74^\circ - \sin 14^\circ + \cos 136^\circ =$

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

8. $\sin 14^\circ + \sin 46^\circ =$

A. $\sin 16^\circ$ **B.** $2\cos 16^\circ$

C. $\cos 16^\circ$ **D.** $-\cos 16^\circ$

9. The value of $\sin 75^\circ + \sin 15^\circ$ is

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

10. $\frac{\cos 25^\circ - \cos 35^\circ}{\sin 35^\circ - \sin 25^\circ} =$

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

11. $\frac{\sin 51^\circ - \sin 39^\circ}{\cos 39^\circ - \cos 51^\circ} =$

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

12. $\frac{\sin 50^\circ + \sin 40^\circ}{\cos 50^\circ + \cos 40^\circ} =$

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

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

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

14. In a triangle ABC, $\sin\frac{A+C}{2} =$

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

15. In a triangle ABC, $\tan(B+C) =$

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

16. In a triangle ABC, $\cos(2C+2B) =$

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

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

A. $-\frac{31}{481}$ **B.** $\frac{480}{481}$ **C.** $\frac{31}{481}$ **D.** $-\frac{480}{481}$

18. If $\cos x - \cos y = \frac{2}{7}$ and $\sin x - \sin y = \frac{1}{3}$, then $\sin(x+y) =$

A. $-\frac{13}{85}$ **B.** $-\frac{84}{85}$ **C.** $\frac{13}{85}$ **D.** $\frac{84}{85}$

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

A. $-\frac{240}{289}$ **B.** $-\frac{161}{289}$ **C.** $\frac{161}{289}$ **D.** $\frac{240}{289}$

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

A. $-\frac{8}{17}$ **B.** $\frac{8}{17}$ **C.** $\frac{15}{17}$ **D.** $-\frac{15}{17}$

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

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

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

A. $-\frac{5}{8}$ **B.** $\frac{5}{8}$ **C.** $\frac{13}{8}$ **D.** $\frac{9}{8}$

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

A. $-\frac{559}{800}$ **B.** $-\frac{159}{800}$ **C.** $\frac{559}{800}$ **D.** $\frac{241}{800}$

24. In a triangle ABC with $A = 75^\circ$ and $B = 45^\circ$, $\cos A + \cos B + \cos C =$

A. $\frac{1}{2} + \frac{\sqrt{2}+\sqrt{6}}{4}$

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

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

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

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25. In a triangle ABC with $A = 60^\circ$ and $B = 75^\circ$, $\cos A + \cos B + \cos C =$

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

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

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

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

Key sheet

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

Solutions

1. $2\cos 8\theta \cos 4\theta =$

$2\cos A\cos B = \cos(A+B)+\cos(A-B)$ with $A = 8\theta,\ B = 4\theta$.

$2\cos 8\theta \cos 4\theta = \cos 12\theta + \cos 4\theta$

Ans: (D) $\cos 12\theta + \cos 4\theta$

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2. $2\sin 9\theta \cos 7\theta =$

$2\sin A\cos B = \sin(A+B)+\sin(A-B)$ with $A = 9\theta,\ B = 7\theta$.

$2\sin 9\theta \cos 7\theta = \sin 16\theta + \sin 2\theta$

Ans: (D) $\sin 16\theta + \sin 2\theta$

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3. $2\cos 9\theta \sin 6\theta =$

$2\cos A\sin B = \sin(A+B)-\sin(A-B)$ with $A = 9\theta,\ B = 6\theta$.

$2\cos 9\theta \sin 6\theta = \sin 15\theta - \sin 3\theta$

Ans: (C) $\sin 15\theta - \sin 3\theta$

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4. $\sin 11\theta - \sin 3\theta =$

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

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

Ans: (C) $2\cos 7\theta \sin 4\theta$

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

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

$\sin 9\theta + \sin\theta = 2\sin 5\theta \cos 4\theta$

Ans: (A) $2\sin 5\theta \cos 4\theta$

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6. $\sin 10\theta - \sin 2\theta =$

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

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

Ans: (A) $2\cos 6\theta \sin 4\theta$

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7. $\sin 74^\circ - \sin 14^\circ + \cos 136^\circ =$

$\sin 74^\circ - \sin 14^\circ = 2\cos\frac{74^\circ+14^\circ}{2}\sin\frac{74^\circ-14^\circ}{2} = 2\cos 44^\circ \sin 30^\circ = \cos 44^\circ$

$\cos 136^\circ = \cos(180^\circ - 44^\circ) = -\cos 44^\circ$

$\therefore \sin 74^\circ - \sin 14^\circ + \cos 136^\circ = \cos 44^\circ - \cos 44^\circ = 0$

Ans: (D) 0

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8. $\sin 14^\circ + \sin 46^\circ =$

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

$\sin 14^\circ + \sin 46^\circ = 2\sin 30^\circ \cos 16^\circ = \cos 16^\circ$

Ans: (C) $\cos 16^\circ$

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9. The value of $\sin 75^\circ + \sin 15^\circ$ is

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

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

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

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

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10. $\frac{\cos 25^\circ - \cos 35^\circ}{\sin 35^\circ - \sin 25^\circ} =$

$\frac{\cos 25^\circ - \cos 35^\circ}{\sin 35^\circ - \sin 25^\circ} = \frac{2\sin 30^\circ \sin 5^\circ}{2\cos 30^\circ \sin 5^\circ}$

$= \tan 30^\circ = \frac{\sqrt{3}}{3}$

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

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11. $\frac{\sin 51^\circ - \sin 39^\circ}{\cos 39^\circ - \cos 51^\circ} =$

$\frac{\sin 51^\circ - \sin 39^\circ}{\cos 39^\circ - \cos 51^\circ} = \frac{2\cos 45^\circ \sin 6^\circ}{2\sin 45^\circ \sin 6^\circ}$

$= \cot 45^\circ = 1$

Ans: (B) 1

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12. $\frac{\sin 50^\circ + \sin 40^\circ}{\cos 50^\circ + \cos 40^\circ} =$

$\frac{\sin 50^\circ + \sin 40^\circ}{\cos 50^\circ + \cos 40^\circ} = \frac{2\sin 45^\circ \cos 5^\circ}{2\cos 45^\circ \cos 5^\circ}$

$= \tan 45^\circ = 1$

Ans: (B) 1

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

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

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

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

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14. In a triangle ABC, $\sin\frac{A+C}{2} =$

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

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

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

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15. In a triangle ABC, $\tan(B + C) =$

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

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

Ans: (D) $-\tan A$

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16. In a triangle ABC, $\cos(2C + 2B) =$

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

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

Ans: (B) $\cos 2A$

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

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

Dividing: $\tan\frac{x+y}{2} = -\frac{15}{16}$

With $t = -\frac{15}{16}$: $\sin(x+y) = \frac{2t}{1+t^2} = -\frac{480}{481}$, $\cos(x+y) = \frac{1-t^2}{1+t^2} = \frac{31}{481}$

Ans: (C) $\frac{31}{481}$

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18. If $\cos x - \cos y = \frac{2}{7}$ and $\sin x - \sin y = \frac{1}{3}$, then $\sin(x+y) =$

Transforming: $-2\sin\frac{x+y}{2}\sin\frac{x-y}{2} = \frac{2}{7}$ and $2\cos\frac{x+y}{2}\sin\frac{x-y}{2} = \frac{1}{3}$.

Dividing: $\tan\frac{x+y}{2} = -\frac{6}{7}$

With $t = -\frac{6}{7}$: $\sin(x+y) = \frac{2t}{1+t^2} = -\frac{84}{85}$, $\cos(x+y) = \frac{1-t^2}{1+t^2} = \frac{13}{85}$

Ans: (B) $-\frac{84}{85}$

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

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

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

With $t = -\frac{8}{15}$: $\sin(x-y) = \frac{2t}{1+t^2} = -\frac{240}{289}$, $\cos(x-y) = \frac{1-t^2}{1+t^2} = \frac{161}{289}$

Ans: (A) $-\frac{240}{289}$

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

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

Dividing: $\tan\frac{x+y}{2} = -\frac{3}{5}$

With $t = -\frac{3}{5}$: $\sin(x+y) = \frac{2t}{1+t^2} = -\frac{15}{17}$, $\cos(x+y) = \frac{1-t^2}{1+t^2} = \frac{8}{17}$

Ans: (B) $\frac{8}{17}$

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

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

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

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

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

Ans: (A) $-\frac{263}{288}$

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

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

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

$1 + \frac{9}{4} = 2 + 2\cos(x-y)$

$\cos(x-y) = \frac{5}{8}$

Ans: (B) $\frac{5}{8}$

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

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

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

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

$\cos(x - y) = -\frac{559}{800}$

Ans: (A) $-\frac{559}{800}$

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24. In a triangle ABC with $A = 75^\circ$ and $B = 45^\circ$, $\cos A + \cos B + \cos C =$

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

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

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

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25. In a triangle ABC with $A = 60^\circ$ and $B = 75^\circ$, $\cos A + \cos B + \cos C =$

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

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

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