EXPRESSWALA ACADEMY

Maths 1A: Transformations

MCQ Test, Set 01

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

A. $\sin 9\theta - \sin 7\theta$ **B.** $\cos 16\theta - \cos 2\theta$

C. $\sin 16\theta + \sin 2\theta$ **D.** $\sin 16\theta - \sin 2\theta$

2. $2\cos 9\theta \sin 4\theta =$

A. $\sin 13\theta - \sin 5\theta$ **B.** $\sin 9\theta - \sin 4\theta$

C. $\cos 13\theta - \cos 5\theta$ **D.** $\sin 13\theta + \sin 5\theta$

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

A. $\sin 9\theta - \sin 7\theta$ **B.** $\sin 9\theta + \sin 7\theta$

C. $\cos 9\theta + \cos 7\theta$ **D.** $\sin 8\theta + \sin \theta$

4. $\cos 7\theta - \cos 9\theta =$

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

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

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

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

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

6. $\cos 11\theta - \cos 5\theta =$

A. $-2\cos 8\theta \cos 3\theta$ **B.** $-\sin 8\theta \sin 3\theta$

C. $2\sin 8\theta \sin 3\theta$ **D.** $-2\sin 8\theta \sin 3\theta$

7. $\cos 2^\circ - \cos 58^\circ =$

A. $\cos 28^\circ$ **B.** $2\sin 28^\circ$

C. $-\sin 28^\circ$ **D.** $\sin 28^\circ$

8. The value of $\cos 105^\circ + \cos 15^\circ$ is

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

9. $\cos 43^\circ + \cos 77^\circ + \cos 163^\circ =$

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

10. $\frac{\cos 27^\circ - \cos 93^\circ}{\sin 93^\circ - \sin 27^\circ} =$

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

11. $\frac{\sin 116^\circ - \sin 4^\circ}{\cos 4^\circ - \cos 116^\circ} =$

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

12. $\frac{\cos 115^\circ + \cos 5^\circ}{\sin 115^\circ + \sin 5^\circ} =$

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

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

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

14. In a triangle ABC, $\cos(2C + 2A) =$

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

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

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

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

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

17. If $\cos x + \cos y = \frac{2}{7}$ and $\sin x + \sin y = \frac{1}{4}$, then $\sin(x + y) =$

A. $-\frac{112}{113}$ **B.** $-\frac{15}{113}$ **C.** $\frac{112}{113}$ **D.** $\frac{15}{113}$

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

A. $-\frac{360}{481}$ **B.** $\frac{319}{481}$ **C.** $\frac{360}{481}$ **D.** $-\frac{319}{481}$

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

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

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

A. $-\frac{7}{6}$ **B.** $\frac{7}{6}$ **C.** $\frac{6}{7}$ **D.** $-\frac{6}{7}$

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

A. $\frac{369}{800}$ **B.** $\frac{431}{800}$ **C.** $-\frac{31}{800}$ **D.** $-\frac{431}{800}$

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

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

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

A. $-\frac{159}{200}$ **B.** $-\frac{59}{200}$ **C.** $\frac{159}{200}$ **D.** $\frac{41}{200}$

24. In a triangle ABC with $A = 120^\circ$ and $B = 15^\circ$, $\cos A + \cos B + \cos C =$

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

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

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

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

25. In a triangle ABC, the greatest value of $\cos A + \cos B + \cos C$ is

A. 3

B. 6

C. $3\sqrt{3}$

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

Key sheet

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

Solutions

1. $2\cos 9\theta \sin 7\theta =$

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

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

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

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2. $2\cos 9\theta \sin 4\theta =$

$2\cos A\sin B = \sin(A+B) - \sin(A-B)$ with $A = 9\theta,\ B = 4\theta$.

$2\cos 9\theta \sin 4\theta = \sin 13\theta - \sin 5\theta$

Ans: (A) $\sin 13\theta - \sin 5\theta$

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

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

$2\sin 8\theta \cos \theta = \sin 9\theta + \sin 7\theta$

Ans: (B) $\sin 9\theta + \sin 7\theta$

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4. $\cos 7\theta - \cos 9\theta =$

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

$\cos 7\theta - \cos 9\theta = 2\sin 8\theta \sin \theta$

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

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

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

$\sin 6\theta - \sin 4\theta = 2\cos 5\theta \sin \theta$

Ans: (B) $2\cos 5\theta \sin \theta$

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6. $\cos 11\theta - \cos 5\theta =$

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

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

Ans: (D) $-2\sin 8\theta \sin 3\theta$

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7. $\cos 2^\circ - \cos 58^\circ =$

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

$\cos 2^\circ - \cos 58^\circ = 2\sin 30^\circ \sin 28^\circ = \sin 28^\circ$

Ans: (D) $\sin 28^\circ$

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8. The value of $\cos 105^\circ + \cos 15^\circ$ is

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

$\cos 105^\circ + \cos 15^\circ = 2\cos 60^\circ \cos 45^\circ$

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

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

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9. $\cos 43^\circ + \cos 77^\circ + \cos 163^\circ =$

$\cos 163^\circ + \cos 77^\circ = 2\cos\frac{163^\circ+77^\circ}{2}\cos\frac{163^\circ-77^\circ}{2} = 2\cos 120^\circ \cos 43^\circ$

$= 2\left(-\frac{1}{2}\right)\cos 43^\circ = -\cos 43^\circ$

$\therefore \cos 43^\circ + \cos 77^\circ + \cos 163^\circ = \cos 43^\circ - \cos 43^\circ = 0$

Ans: (A) 0

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10. $\frac{\cos 27^\circ - \cos 93^\circ}{\sin 93^\circ - \sin 27^\circ} =$

$\frac{\cos 27^\circ - \cos 93^\circ}{\sin 93^\circ - \sin 27^\circ} = \frac{2\sin 60^\circ \sin 33^\circ}{2\cos 60^\circ \sin 33^\circ}$

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

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

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11. $\frac{\sin 116^\circ - \sin 4^\circ}{\cos 4^\circ - \cos 116^\circ} =$

$\frac{\sin 116^\circ - \sin 4^\circ}{\cos 4^\circ - \cos 116^\circ} = \frac{2\cos 60^\circ \sin 56^\circ}{2\sin 60^\circ \sin 56^\circ}$

$= \cot 60^\circ = \frac{\sqrt{3}}{3}$

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

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12. $\frac{\cos 115^\circ + \cos 5^\circ}{\sin 115^\circ + \sin 5^\circ} =$

$\frac{\cos 115^\circ + \cos 5^\circ}{\sin 115^\circ + \sin 5^\circ} = \frac{2\cos 60^\circ \cos 55^\circ}{2\sin 60^\circ \cos 55^\circ}$

$= \cot 60^\circ = \frac{\sqrt{3}}{3}$

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

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

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

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

Ans: (A) $-\cos B$

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14. In a triangle ABC, $\cos(2C + 2A) =$

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

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

Ans: (C) $\cos 2B$

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

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

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

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

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

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

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

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

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17. If $\cos x + \cos y = \frac{2}{7}$ and $\sin x + \sin y = \frac{1}{4}$, then $\sin(x+y) =$

Transforming: $2\cos\frac{x+y}{2}\cos\frac{x-y}{2} = \frac{2}{7}$ and $2\sin\frac{x+y}{2}\cos\frac{x-y}{2} = \frac{1}{4}$.

Dividing: $\tan\frac{x+y}{2} = \frac{7}{8}$

With $t = \frac{7}{8}$: $\sin(x+y) = \frac{2t}{1+t^2} = \frac{112}{113},\ \cos(x+y) = \frac{1-t^2}{1+t^2} = \frac{15}{113}$

Ans: (C) $\frac{112}{113}$

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

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

Dividing: $\tan\frac{x+y}{2} = -\frac{9}{20}$

With $t = -\frac{9}{20}$: $\sin(x+y) = \frac{2t}{1+t^2} = -\frac{360}{481},\ \cos(x+y) = \frac{1-t^2}{1+t^2} = \frac{319}{481}$

Ans: (B) $\frac{319}{481}$

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

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

Dividing: $\tan\frac{x+y}{2} = \frac{1}{4}$

With $t = \frac{1}{4}$: $\sin(x+y) = \frac{2t}{1+t^2} = \frac{8}{17},\ \cos(x+y) = \frac{1-t^2}{1+t^2} = \frac{15}{17}$

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

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

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

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

Ans: (B) $\frac{7}{6}$

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

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

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

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

$\cos(x-y) = -\frac{431}{800}$

Ans: (D) $-\frac{431}{800}$

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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: (C) $\frac{211}{450}$

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

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

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

$\frac{1}{4} + \frac{4}{25} = 2 + 2\cos(x+y)$

$\cos(x+y) = -\frac{159}{200}$

Ans: (A) $-\frac{159}{200}$

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24. In a triangle ABC with $A = 120^\circ$ and $B = 15^\circ$, $\cos A + \cos B + \cos C =$

$C = 180^\circ - 120^\circ - 15^\circ = 45^\circ$

$\cos 120^\circ + \cos 15^\circ + \cos 45^\circ = -\frac{1}{2} + \frac{\sqrt{2}+\sqrt{6}}{4} + \frac{\sqrt{2}}{2} = -\frac{1}{2} + \frac{\sqrt{6}+3\sqrt{2}}{4}$

Ans: (B) $-\frac{1}{2} + \frac{\sqrt{6}+3\sqrt{2}}{4}$

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25. In a triangle ABC, the greatest value of $\cos A + \cos B + \cos C$ is

Equality holds for the equilateral triangle, where every angle is 60°.

The greatest value is $\frac{3}{2}$.

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