EXPRESSWALA ACADEMY

Maths 1A: Transformations

MCQ Test, Set 06

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 $2\sin 105^\circ \cos 15^\circ$ is

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

2. The value of $2\cos 135^\circ \sin 15^\circ$ is

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

3. The value of $4\sin 45^\circ \sin 15^\circ$ is

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

4. $\sin 10\theta - \sin 8\theta =$

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

5. $\sin 9\theta - \sin 7\theta =$

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

6. $\sin 9\theta + \sin 7\theta =$

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

7. $\sin 41^\circ + \sin 19^\circ - \sin 101^\circ =$

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

8. $\sin 32^\circ + \sin 28^\circ =$

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

9. The value of $\sin 135^\circ + \sin 105^\circ$ is

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

10. $\frac{\sin 7\theta - \sin\theta}{\cos 7\theta + \cos\theta} =$

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

C. $\tan 4\theta$ **D.** $\tan 3\theta$

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11. $\frac{\sin 11\theta + \sin 9\theta}{\cos 9\theta - \cos 11\theta} =$

A. $\cot\theta$ **B.** $\cot 10\theta$

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

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12. $\frac{\sin 5\theta - \sin 3\theta}{\cos 3\theta - \cos 5\theta} =$

A. $\cot 4\theta$ **B.** $-\cot 4\theta$

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

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13. If $A + B + C = \pi$, then $\sin 2A + \sin 2B - \sin 2C =$

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

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

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14. In a triangle ABC, $\sin 2A + \sin 2B - \sin 2C =$

A. $4\sin A\sin B\cos C$ **B.** $4\cos A\cos B\sin C$

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

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

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

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

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

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

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16. If $A + B + C = \pi$, then $\cos 2A - \cos 2B + \cos 2C =$

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

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

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17. If $\cos x - \cos y = \frac{1}{6}$ and $\sin x + \sin y = \frac{5}{4}$, then $\sin(x - y) =$

A. $\frac{60}{229}$ **B.** $\frac{221}{229}$ **C.** $-\frac{60}{229}$ **D.** $-\frac{221}{229}$

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18. If $\cos x + \cos y = \frac{5}{6}$ and $\sin x + \sin y = \frac{2}{5}$, then $\cos(x + y) =$

A. $\frac{481}{769}$ **B.** $-\frac{481}{769}$ **C.** $-\frac{600}{769}$ **D.** $\frac{600}{769}$

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19. If $\cos x + \cos y = \frac{2}{7}$ and $\sin x + \sin y = \frac{3}{4}$, then $\cos(x + y) =$

A. $-\frac{336}{505}$ **B.** $\frac{336}{505}$ **C.** $-\frac{377}{505}$ **D.** $\frac{377}{505}$

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20. If $\cos x - \cos y = \frac{3}{2}$ and $\sin x - \sin y = \frac{1}{4}$, then $\cos(x + y) =$

A. $-\frac{35}{37}$ **B.** $\frac{35}{37}$ **C.** $\frac{12}{37}$ **D.** $-\frac{12}{37}$

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21. If $\cos x - \cos y = \frac{7}{5}$ and $\sin x + \sin y = \frac{1}{2}$, then $\cos(x + y) =$

A. $\frac{221}{200}$ **B.** $-\frac{21}{200}$ **C.** $\frac{21}{200}$ **D.** $\frac{121}{200}$

22. If $\cos x - \cos y = \frac{6}{5}$ and $\sin x + \sin y = \frac{2}{3}$, then $\cos(x+y) =$

A. $\frac{13}{225}$ **B.** $\frac{212}{225}$ **C.** $\frac{199}{450}$ **D.** $-\frac{13}{225}$

23. If $\cos x - \cos y = \frac{6}{5}$ and $\sin x - \sin y = \frac{1}{3}$, then $\cos(x-y) =$

A. $\frac{349}{450}$ **B.** $\frac{62}{225}$ **C.** $\frac{101}{450}$ **D.** $-\frac{101}{450}$

24. In a triangle ABC with $A = 30^\circ$ and $B = 135^\circ$, $\cos A + \cos B + \cos C =$

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

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

25. In an acute angled triangle ABC, the least value of $\tan A + \tan B + \tan C$ is

A. $\frac{3}{2}$ **B.** $3\sqrt{3}$ **C.** 3 **D.** 6

Key sheet

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

Solutions

1. The value of $2\sin 105^\circ \cos 15^\circ$ is

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

$2\sin 105^\circ \cos 15^\circ = \sin 120^\circ + \sin 90^\circ$

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

Ans: (D) $\frac{\sqrt{3}}{2} + 1$

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2. The value of $2\cos 135^\circ \sin 15^\circ$ is

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

$2\cos 135^\circ \sin 15^\circ = \sin 150^\circ - \sin 120^\circ$

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

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

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3. The value of $4\sin 45^\circ \sin 15^\circ$ is

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

$4\sin 45^\circ \sin 15^\circ = 2\left(\cos 30^\circ - \cos 60^\circ\right)$

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

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

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4. $\sin 10\theta - \sin 8\theta =$

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

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

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

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5. $\sin 9\theta - \sin 7\theta =$

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

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

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

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6. $\sin 9\theta + \sin 7\theta =$

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

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

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

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7. $\sin 41^\circ + \sin 19^\circ - \sin 101^\circ =$

$\sin 19^\circ + \sin 41^\circ = 2\sin\frac{19^\circ+41^\circ}{2}\cos\frac{19^\circ-41^\circ}{2} = 2\sin 30^\circ \cos -11^\circ = \cos -11^\circ$

$\sin 101^\circ = \sin(90^\circ - -11^\circ) = \cos -11^\circ$

$\therefore \sin 41^\circ + \sin 19^\circ - \sin 101^\circ = \cos -11^\circ - \cos -11^\circ = 0$

Ans: (B) 0

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8. $\sin 32^\circ + \sin 28^\circ =$

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

$\sin 32^\circ + \sin 28^\circ = 2\sin 30^\circ \cos 2^\circ = \cos 2^\circ$

Ans: (B) $\cos 2^\circ$

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9. The value of $\sin 135^\circ + \sin 105^\circ$ is

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

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

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

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

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10. $\frac{\sin 7\theta - \sin\theta}{\cos 7\theta + \cos\theta} =$

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

$= \tan 3\theta$

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

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11. $\frac{\sin 11\theta + \sin 9\theta}{\cos 9\theta - \cos 11\theta} =$

$\frac{\sin 11\theta + \sin 9\theta}{\cos 9\theta - \cos 11\theta} = \frac{2\sin 10\theta \cos\theta}{2\sin 10\theta \sin\theta}$

$= \cot\theta$

Ans: (A) $\cot\theta$

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12. $\frac{\sin 5\theta - \sin 3\theta}{\cos 3\theta - \cos 5\theta} =$

$\frac{\sin 5\theta - \sin 3\theta}{\cos 3\theta - \cos 5\theta} = \frac{2\cos 4\theta \sin\theta}{2\sin 4\theta \sin\theta}$

$= \cot 4\theta$

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

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13. If $A + B + C = \pi$, then $\sin 2A + \sin 2B - \sin 2C =$

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

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

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

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

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14. In a triangle ABC, $\sin 2A + \sin 2B - \sin 2C =$

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

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

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

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

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

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

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

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

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

16. If $A+B+C=\pi$, then $\cos 2A-\cos 2B+\cos 2C=$

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

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

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

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

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17. If $\cos x-\cos y=\frac{1}{6}$ and $\sin x+\sin y=\frac{5}{4}$, then $\sin(x-y)=$

Transforming: $-2\sin\frac{x+y}{2}\sin\frac{x-y}{2}=\frac{1}{6}$ and $2\sin\frac{x+y}{2}\cos\frac{x-y}{2}=\frac{5}{4}$.

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

With $t=-\frac{2}{15}$: $\sin(x-y)=\frac{2t}{1+t^2}=-\frac{60}{229},\ \cos(x-y)=\frac{1-t^2}{1+t^2}=\frac{221}{229}$

Ans: (C) $-\frac{60}{229}$

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18. If $\cos x+\cos y=\frac{5}{6}$ and $\sin x+\sin y=\frac{2}{5}$, then $\cos(x+y)=$

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

Dividing: $\tan\frac{x+y}{2}=\frac{12}{25}$

With $t=\frac{12}{25}$: $\sin(x+y)=\frac{2t}{1+t^2}=\frac{600}{769},\ \cos(x+y)=\frac{1-t^2}{1+t^2}=\frac{481}{769}$

Ans: (A) $\frac{481}{769}$

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19. If $\cos x+\cos y=\frac{2}{7}$ and $\sin x+\sin y=\frac{3}{4}$, then $\cos(x+y)=$

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

Dividing: $\tan\frac{x+y}{2}=\frac{21}{8}$

With $t=\frac{21}{8}$: $\sin(x+y)=\frac{2t}{1+t^2}=\frac{336}{505},\ \cos(x+y)=\frac{1-t^2}{1+t^2}=-\frac{377}{505}$

Ans: (C) $-\frac{377}{505}$

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20. If $\cos x-\cos y=\frac{3}{2}$ and $\sin x-\sin y=\frac{1}{4}$, then $\cos(x+y)=$

Transforming: $-2\sin\frac{x+y}{2}\sin\frac{x-y}{2}=\frac{3}{2}$ and $2\cos\frac{x+y}{2}\sin\frac{x-y}{2}=\frac{1}{4}$.

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

With $t=-6$: $\sin(x+y)=\frac{2t}{1+t^2}=-\frac{12}{37},\ \cos(x+y)=\frac{1-t^2}{1+t^2}=-\frac{35}{37}$

Ans: (A) $-\frac{35}{37}$

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21. If $\cos x-\cos y=\frac{7}{5}$ and $\sin x+\sin y=\frac{1}{2}$, then $\cos(x+y)=$

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

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

$\frac{49}{25}+\frac{1}{4}=2-2\cos(x+y)$

$\cos(x+y)=-\frac{21}{200}$

Ans: (B) $-\frac{21}{200}$

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22. If $\cos x-\cos y=\frac{6}{5}$ and $\sin x+\sin y=\frac{2}{3}$, then $\cos(x+y)=$

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

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

$\frac{36}{25}+\frac{4}{9}=2-2\cos(x+y)$

$\cos(x+y)=\frac{13}{225}$

Ans: (A) $\frac{13}{225}$

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23. If $\cos x - \cos y = \frac{6}{5}$ and $\sin x - \sin y = \frac{1}{3}$, then $\cos(x-y) =$

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

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

$\frac{36}{25} + \frac{1}{9} = 2 - 2\cos(x-y)$

$\cos(x-y) = \frac{101}{450}$

Ans: (C) $\frac{101}{450}$

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24. In a triangle ABC with $A = 30^\circ$ and $B = 135^\circ$, $\cos A + \cos B + \cos C =$

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

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

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

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25. In an acute angled triangle ABC, the least value of $\tan A + \tan B + \tan C$ is

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

The least value is $3\sqrt{3}$.

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