EXPRESSWALA ACADEMY

# Maths 1A: Transformations

## MCQ Test, Set 09

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.** $2\cos 7\theta \cos 2\theta =$

**A.** $\cos 9\theta + \cos 5\theta$ **B.** $\cos 9\theta - \cos 5\theta$

**C.** $\sin 9\theta + \sin 5\theta$ **D.** $\cos 7\theta + \cos 2\theta$

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

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

**C.** $\cos 5\theta + \cos \theta$ **D.** $\sin 3\theta + \sin 2\theta$

**3.** $2\cos 4\theta \sin 2\theta =$

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

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

**4.** $\sin 7\theta + \sin \theta =$

**A.** $2\cos 4\theta \sin 3\theta$ **B.** $2\sin 3\theta \cos 4\theta$

**C.** $-2\sin 4\theta \cos 3\theta$ **D.** $2\sin 4\theta \cos 3\theta$

**5.** $\cos 11\theta + \cos 9\theta =$

**A.** $2\cos 10\theta \cos \theta$ **B.** $-2\cos 10\theta \cos \theta$

**C.** $2\sin 10\theta \sin \theta$ **D.** $\cos 10\theta \cos \theta$

**6.** $\cos 4\theta - \cos 6\theta =$

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

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

**7.** $\sin 65^\circ - \sin 5^\circ + \cos 145^\circ =$

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

**8.** $\cos 5^\circ - \cos 55^\circ =$

**A.** $\cos 25^\circ$ **B.** $-\sin 25^\circ$

**C.** $\sin 25^\circ$ **D.** $2\sin 25^\circ$

**9.** The value of $\cos 105^\circ - \cos 135^\circ$ is

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

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

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**10.** $\frac{\sin 52^\circ+\sin 38^\circ}{\cos 52^\circ+\cos 38^\circ} =$

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

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**11.** $\frac{\cos 104^\circ+\cos 16^\circ}{\sin 104^\circ+\sin 16^\circ} =$

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

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**12.** $\frac{\sin 53^\circ+\sin 7^\circ}{\cos 53^\circ+\cos 7^\circ} =$

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

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**13.** In a triangle $ABC$, $\sin(A+B) =$

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

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

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

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

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

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

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

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

**A.** $-\frac{40}{41}$ **B.** $\frac{9}{41}$ **C.** $\frac{40}{41}$ **D.** $-\frac{9}{41}$

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

**A.** $-\frac{119}{169}$ **B.** $\frac{120}{169}$ **C.** $-\frac{120}{169}$ **D.** $\frac{119}{169}$

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

**A.** $\frac{1200}{1201}$ **B.** $\frac{49}{1201}$ **C.** $-\frac{1200}{1201}$ **D.** $-\frac{49}{1201}$

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

**A.** $-\frac{9}{20}$ **B.** $\frac{9}{20}$ **C.** $\frac{20}{9}$ **D.** $-\frac{20}{9}$

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

**A.** $\frac{10}{9}$ **B.** $\frac{11}{18}$ **C.** $-\frac{11}{18}$ **D.** $\frac{29}{18}$

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

**A.** $\frac{881}{800}$ **B.** $\frac{481}{800}$ **C.** $\frac{81}{800}$ **D.** $-\frac{81}{800}$

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**23.** If $\cos x + \cos y = \frac{4}{5}$ and $\sin x - \sin y = \frac{7}{5}$, then $\cos(x+y) =$

**A.** $-\frac{3}{10}$ **B.** $\frac{3}{10}$ **C.** $\frac{4}{5}$ **D.** $\frac{13}{10}$

**24.** In a triangle $ABC$ with $A = 75^\circ$ and $B = 90^\circ$, $\cos A + \cos B + \cos C =$

**A.** $\frac{\sqrt{6}}{2}$

**B.** $\frac{3}{2}$

**C.** $-\frac{\sqrt{2}}{2}$

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

**25.** In a triangle $ABC$ with $A = 135^\circ$ and $B = 15^\circ$, $\cos A + \cos B + \cos C =$

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

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

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

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

## Key sheet

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

## Solutions

**1.** $2\cos 7\theta \cos 2\theta =$

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

$2\cos 7\theta \cos 2\theta = \cos 9\theta + \cos 5\theta$

**Ans: (A)** $\cos 9\theta + \cos 5\theta$

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

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

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

**Ans: (B)** $\sin 5\theta + \sin\theta$

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**3.** $2\cos 4\theta \sin 2\theta =$

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

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

**Ans: (A)** $\sin 6\theta - \sin 2\theta$

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**4.** $\sin 7\theta + \sin\theta =$

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

$\sin 7\theta + \sin\theta = 2\sin 4\theta\cos 3\theta$

**Ans: (D)** $2\sin 4\theta\cos 3\theta$

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**5.** $\cos 11\theta + \cos 9\theta =$

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

$\cos 11\theta + \cos 9\theta = 2\cos 10\theta\cos\theta$

**Ans: (A)** $2\cos 10\theta\cos\theta$

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**6.** $\cos 4\theta - \cos 6\theta =$

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

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

**Ans: (C)** $2\sin 5\theta\sin\theta$

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**7.** $\sin 65^\circ - \sin 5^\circ + \cos 145^\circ =$

$\sin 65^\circ - \sin 5^\circ = 2\cos\frac{65^\circ+5^\circ}{2}\sin\frac{65^\circ-5^\circ}{2} = 2\cos 35^\circ\sin 30^\circ = \cos 35^\circ$

$\cos 145^\circ = \cos(180^\circ - 35^\circ) = -\cos 35^\circ$

$\therefore \sin 65^\circ - \sin 5^\circ + \cos 145^\circ = \cos 35^\circ - \cos 35^\circ = 0$

**Ans: (B)** $0$

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**8.** $\cos 5^\circ - \cos 55^\circ =$

The half sum of the angles is $30^\circ$, a standard angle.

$\cos 5^\circ - \cos 55^\circ = 2\sin 30^\circ\sin 25^\circ = \sin 25^\circ$

**Ans: (C)** $\sin 25^\circ$

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**9.** The value of $\cos 105^\circ - \cos 135^\circ$ is

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

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

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

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

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**10.** $\frac{\sin 52^\circ+\sin 38^\circ}{\cos 52^\circ+\cos 38^\circ} =$

$\frac{\sin 52^\circ+\sin 38^\circ}{\cos 52^\circ+\cos 38^\circ} = \frac{2\sin 45^\circ \cos 7^\circ}{2\cos 45^\circ \cos 7^\circ}$

$= \tan 45^\circ = 1$

**Ans: (C)** $1$

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**11.** $\frac{\cos 104^\circ+\cos 16^\circ}{\sin 104^\circ+\sin 16^\circ} =$

$\frac{\cos 104^\circ+\cos 16^\circ}{\sin 104^\circ+\sin 16^\circ} = \frac{2\cos 60^\circ \cos 44^\circ}{2\sin 60^\circ \cos 44^\circ}$

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

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

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**12.** $\frac{\sin 53^\circ+\sin 7^\circ}{\cos 53^\circ+\cos 7^\circ} =$

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

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

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

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**13.** In a triangle $ABC$, $\sin(A+B) =$

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

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

**Ans: (B)** $\sin C$

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

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

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

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

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

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

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

**Ans: (D)** $-\sin 2B$

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

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

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

**Ans: (D)** $-\cos B$

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

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

Dividing: $\tan\frac{x+y}{2} = -\frac{4}{5}$

With $t = -\frac{4}{5}$: $\sin(x+y) = \frac{2t}{1+t^2} = -\frac{40}{41},\ \cos(x+y) = \frac{1-t^2}{1+t^2} = \frac{9}{41}$

**Ans: (A)** $-\frac{40}{41}$

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

Transforming: $-2\sin\frac{x+y}{2}\sin\frac{x-y}{2} = \frac{3}{5}$ and $2\sin\frac{x+y}{2}\cos\frac{x-y}{2} = \frac{1}{4}$.

Dividing: $\tan\frac{x-y}{2} = -\frac{12}{5}$

With $t = -\frac{12}{5}$: $\sin(x-y) = \frac{2t}{1+t^2} = -\frac{120}{169},\ \cos(x-y) = \frac{1-t^2}{1+t^2} = -\frac{119}{169}$

**Ans: (C)** $-\frac{120}{169}$

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

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

Dividing: $\tan\frac{x+y}{2} = \frac{24}{25}$

With $t = \frac{24}{25}$: $\sin(x+y) = \frac{2t}{1+t^2} = \frac{1200}{1201},\ \cos(x+y) = \frac{1-t^2}{1+t^2} = \frac{49}{1201}$

**Ans: (A)** $\frac{1200}{1201}$

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

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

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

**Ans: (B)** $\frac{9}{20}$

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

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

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

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

$\cos(x-y) = -\frac{11}{18}$

**Ans: (C)** $-\frac{11}{18}$

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

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

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

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

$\cos(x-y) = \frac{81}{800}$

**Ans: (C)** $\frac{81}{800}$

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**23.** If $\cos x + \cos y = \frac{4}{5}$ and $\sin x - \sin y = \frac{7}{5}$, then $\cos(x+y) =$

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

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

$\frac{16}{25} + \frac{49}{25} = 2 + 2\cos(x+y)$

$\cos(x+y) = \frac{3}{10}$

**Ans: (B)** $\frac{3}{10}$

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**24.** In a triangle $ABC$ with $A = 75^\circ$ and $B = 90^\circ$, $\cos A + \cos B + \cos C =$

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

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

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

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**25.** In a triangle $ABC$ with $A = 135^\circ$ and $B = 15^\circ$, $\cos A + \cos B + \cos C =$

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

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

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

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