EXPRESSWALA ACADEMY

# Maths 1A: Multiple and Submultiple Angles

## MCQ Test, Set 07

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.** If $\tan A = -\frac{5}{2}$, then $\cos 2A =$

**A.** $-\frac{21}{29}$ **B.** $-\frac{29}{21}$ **C.** $\frac{21}{29}$ **D.** $-\frac{20}{29}$

**2.** If $\cos A = \frac{35}{37}$ and $A$ is acute, then $\sin 2A =$

**A.** $\frac{1081}{1369}$ **B.** $-\frac{840}{1369}$ **C.** $\frac{70}{37}$ **D.** $\frac{840}{1369}$

**3.** $\tan^2 195^\circ =$

**A.** $\frac{\sqrt{3}}{4}$ **B.** $\frac{2-\sqrt{3}}{2}$ **C.** $7 - 4\sqrt{3}$ **D.** $\frac{2-\sqrt{3}}{4}$

**4.** If $\cos A = \frac{3}{5}$, then $\cos 3A =$

**A.** $\frac{33}{125}$ **B.** $\frac{333}{125}$ **C.** $\frac{117}{125}$ **D.** $-\frac{117}{125}$

**5.** If $\tan A = -\frac{7}{4}$, then $\tan 3A =$

**A.** $\frac{679}{524}$ **B.** $\frac{84}{131}$ **C.** $-\frac{7}{524}$ **D.** $\frac{7}{652}$

**6.** If $\cos A = -\frac{1}{5}$ and $-\pi < A < 0$, then $\sin \frac{A}{2} =$

**A.** $-\frac{\sqrt{15}}{5}$ **B.** $-\frac{\sqrt{10}}{5}$ **C.** $\frac{3}{5}$ **D.** $\frac{\sqrt{15}}{5}$

**7.** If $\tan \frac{A}{2} = -\frac{3}{2}$, then $\tan A =$

**A.** $\frac{6}{5}$ **B.** $-\frac{12}{5}$ **C.** $\frac{12}{5}$ **D.** $-\frac{12}{13}$

**8.** $2 \sin A \cos^3 A - 2 \sin^3 A \cos A =$

**A.** $2 \sin 4A$ **B.** $\frac{1}{2} \sin 4A$

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

**9.** $\sin 72^\circ =$

**A.** $\frac{\sqrt{10+2\sqrt{5}}}{4}$ **B.** $-\frac{\sqrt{10+2\sqrt{5}}}{4}$

**C.** $-\frac{\sqrt{10-2\sqrt{5}}}{4}$ **D.** $\frac{\sqrt{10-2\sqrt{5}}}{4}$

**10.** $\cos^2 72^\circ + \sin^2 54^\circ =$

**A.** $\frac{5}{4}$ **B.** $\frac{3}{2}$ **C.** $-\frac{3}{4}$ **D.** $\frac{3}{4}$

**11.** $\cot 7\frac{1}{2}^\circ =$

**A.** $(\sqrt{3}-\sqrt{2})(\sqrt{2}+1)$ **B.** $\sqrt{2}-1$

**C.** $(\sqrt{3}+\sqrt{2})(\sqrt{2}+1)$ **D.** $\sqrt{2}+1$

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**12.** $\tan 7\frac{1}{2}^\circ \tan 52\frac{1}{2}^\circ =$

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

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**13.** $\sin^2 75^\circ + \cos^4 75^\circ =$

**A.** $\frac{1}{16}$ **B.** $\frac{15}{16}$ **C.** $\frac{7}{8}$ **D.** $\frac{17}{16}$

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**14.** If $\sin 2\theta = \frac{2}{3}$, then $\sin^6\theta + \cos^6\theta =$

**A.** $\frac{2}{3}$ **B.** $\frac{1}{2}$ **C.** $\frac{1}{3}$ **D.** $\frac{4}{3}$

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**15.** $\tan 67\frac{1}{2}^\circ - \tan 22\frac{1}{2}^\circ =$

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

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**16.** $\cos\frac{2\pi}{15}\cos\frac{4\pi}{15}\cos\frac{8\pi}{15}\cos\frac{16\pi}{15} =$

**A.** $\frac{1}{32}$ **B.** $\frac{1}{16}$ **C.** $-\frac{1}{16}$ **D.** $\frac{1}{8}$

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**17.** $\tan\frac{5\pi}{24}\left(1+\sec\frac{5\pi}{12}\right)\left(1+\sec\frac{5\pi}{6}\right) =$

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

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**18.** $\sin 40^\circ + \sin 100^\circ + \sin 160^\circ + \cdots + \sin 340^\circ =$

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

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**19.** $\sin 20^\circ + \sin 92^\circ + \sin 164^\circ + \sin 236^\circ + \sin 308^\circ =$

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

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**20.** $\frac{\cos\frac{\pi}{7}+\cos\frac{3\pi}{7}+\cos\frac{5\pi}{7}}{\sin\frac{\pi}{7}\sin\frac{2\pi}{7}\sin\frac{3\pi}{7}} =$

**A.** $\frac{8\sqrt{7}}{7}$ **B.** $-\frac{4\sqrt{7}}{7}$ **C.** $\frac{4\sqrt{7}}{7}$ **D.** $\frac{7+4\sqrt{7}}{7}$

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**21.** $\sin^2 75^\circ + \sin^2 15^\circ - \sin 75^\circ \sin 15^\circ =$

**A.** $1$ **B.** $\frac{3}{2}$ **C.** $\frac{1}{4}$ **D.** $\frac{3}{4}$

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**22.** $\sin^2 10^\circ + \sin^2 50^\circ + \sin 10^\circ \sin 50^\circ =$

**A.** $\frac{3}{2}$ **B.** $\frac{1}{4}$ **C.** $1$ **D.** $\frac{3}{4}$

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**23.** If $\frac{x}{y} = \frac{\sin 90^\circ}{\sin 60^\circ}$, then $\frac{x+y}{x-y} =$

**A.** $14+8\sqrt{3}$ **B.** $7-4\sqrt{3}$ **C.** $7+4\sqrt{3}$ **D.** $2+\sqrt{3}$

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**24.** $\sqrt{1+\sin 640^\circ} =$

**A.** $-(\cos 320^\circ + \sin 320^\circ)$ **B.** $\cos 320^\circ + \sin 320^\circ$

**C.** $\cos 320^\circ - \sin 320^\circ$ **D.** $-(\cos 320^\circ - \sin 320^\circ)$

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**25.** $\sqrt{1-\sin 640^\circ} =$

**A.** $\cos 320^\circ - \sin 320^\circ$

**B.** $-(\cos 320^\circ - \sin 320^\circ)$

**C.** $\cos 320^\circ + \sin 320^\circ$

**D.** $-(\cos 320^\circ + \sin 320^\circ)$

## Key sheet

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

## Solutions

**1.** If $\tan A = -\frac{5}{2}$, then $\cos 2A =$

$\cos 2A = \frac{1-\tan^2 A}{1+\tan^2 A}$

$= -\frac{21}{29}$

**Ans: (A)** $-\frac{21}{29}$

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**2.** If $\cos A = \frac{35}{37}$ and $A$ is acute, then $\sin 2A =$

$\sin A = \sqrt{1-\cos^2 A} = \frac{12}{37}$ ($\sin A$ is positive in this quadrant)

$\sin 2A = 2\sin A \cos A = \frac{840}{1369}$

**Ans: (D)** $\frac{840}{1369}$

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**3.** $\tan^2 195^\circ =$

$\tan^2 A = \frac{1-\cos 2A}{1+\cos 2A}$

$\tan^2 195^\circ = \frac{1-\cos 390^\circ}{1+\cos 390^\circ}$

$\cos 390^\circ = \frac{\sqrt{3}}{2}$

$= 7 - 4\sqrt{3}$

**Ans: (C)** $7 - 4\sqrt{3}$

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**4.** If $\cos A = \frac{3}{5}$, then $\cos 3A =$

$\cos 3A = 4\cos^3 A - 3\cos A$

$= 4(\frac{3}{5})^3 - 3(\frac{3}{5})$

$= -\frac{117}{125}$

**Ans: (D)** $-\frac{117}{125}$

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**5.** If $\tan A = -\frac{7}{4}$, then $\tan 3A =$

$\tan 3A = \frac{3\tan A - \tan^3 A}{1-3\tan^2 A}$

$= \frac{3(-\frac{7}{4}) - (-\frac{7}{4})^3}{1-3(-\frac{7}{4})^2}$

$= -\frac{7}{524}$

**Ans: (C)** $-\frac{7}{524}$

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**6.** If $\cos A = -\frac{1}{5}$ and $-\pi < A < 0$, then $\sin \frac{A}{2} =$

Here $-\frac{\pi}{2} < \frac{A}{2} < 0$.

$\sin \frac{A}{2} = -\frac{\sqrt{15}}{5}$

**Ans: (A)** $-\frac{\sqrt{15}}{5}$

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**7.** If $\tan \frac{A}{2} = -\frac{3}{2}$, then $\tan A =$

$\tan A = \frac{2\tan \frac{A}{2}}{1-\tan^2 \frac{A}{2}}$

$= \frac{12}{5}$

**Ans: (C)** $\frac{12}{5}$

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**8.** $2\sin A\cos^3 A - 2\sin^3 A\cos A =$

$= 2\sin A\cos A(\cos^2 A - \sin^2 A) = \sin 2A\cos 2A = \frac{1}{2}\sin 4A$

**Ans: (B)** $\frac{1}{2}\sin 4A$

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**9.** $\sin 72^\circ =$

$\sin 72^\circ = \frac{\sqrt{10+2\sqrt{5}}}{4}$

**Ans: (A)** $\frac{\sqrt{10+2\sqrt{5}}}{4}$

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**10.** $\cos^2 72^\circ + \sin^2 54^\circ =$

$\cos 72^\circ = \frac{\sqrt{5}-1}{4},\ \sin 54^\circ = \frac{\sqrt{5}+1}{4}$

$\cos^2 72^\circ + \sin^2 54^\circ = \frac{3}{4}$

**Ans: (D)** $\frac{3}{4}$

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**11.** $\cot 7\frac{1}{2}^\circ =$

$\tan\frac{A}{2} = \frac{1-\cos A}{\sin A}$ with the half of a known angle, simplified.

$\cot 7\frac{1}{2}^\circ = (\sqrt{3}+\sqrt{2})(\sqrt{2}+1)$

**Ans: (C)** $(\sqrt{3}+\sqrt{2})(\sqrt{2}+1)$

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**12.** $\tan 7\frac{1}{2}^\circ\ \tan 52\frac{1}{2}^\circ =$

$\tan 7\frac{1}{2}^\circ = (\sqrt{3}-\sqrt{2})(\sqrt{2}-1),\ \tan 52\frac{1}{2}^\circ = (\sqrt{3}+\sqrt{2})(\sqrt{2}-1)$

$\tan 7\frac{1}{2}^\circ\ \tan 52\frac{1}{2}^\circ = 3-2\sqrt{2}$

**Ans: (C)** $3-2\sqrt{2}$

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**13.** $\sin^2 75^\circ + \cos^4 75^\circ =$

$\sin^2\theta + \cos^4\theta = 1 - \frac{1}{4}\sin^2 2\theta$

$\sin 150^\circ = \frac{1}{2}$

$\sin^2 75^\circ + \cos^4 75^\circ = 1 - \frac{1}{4}\cdot\frac{1}{4} = \frac{15}{16}$

**Ans: (B)** $\frac{15}{16}$

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**14.** If $\sin 2\theta = \frac{2}{3}$, then $\sin^6\theta + \cos^6\theta =$

$\sin^6\theta + \cos^6\theta = 1 - \frac{3}{4}\sin^2 2\theta$

$= 1 - \frac{3}{4}\cdot\frac{4}{9} = \frac{2}{3}$

**Ans: (A)** $\frac{2}{3}$

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**15.** $\tan 67\frac{1}{2}^\circ - \tan 22\frac{1}{2}^\circ =$

$\tan(45^\circ + A) - \tan(45^\circ - A) = 2\tan 2A$

With $A = 22\frac{1}{2}^\circ$: $\tan 67\frac{1}{2}^\circ - \tan 22\frac{1}{2}^\circ = 2$

**Ans: (A)** $2$

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**16.** $\cos\frac{2\pi}{15}\cos\frac{4\pi}{15}\cos\frac{8\pi}{15}\cos\frac{16\pi}{15} =$

This is $\cos\theta\cos 2\theta\cdots\cos 2^3\theta = \frac{\sin 2^4\theta}{2^4\sin\theta}$ with $\theta = \frac{2\pi}{15}$.

$\sin 2^4\theta = \sin\theta$

$\text{Value} = \frac{1}{16}$

**Ans: (B)** $\frac{1}{16}$

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**17.** $\tan\frac{5\pi}{24}\left(1+\sec\frac{5\pi}{12}\right)\left(1+\sec\frac{5\pi}{6}\right) =$

$\tan\frac{\theta}{2}(1+\sec\theta) = \tan\theta$, and repeating, the product is $\tan 2\theta$ with $\theta = \frac{5\pi}{12}$.

$\tan\frac{5\pi}{6} = -\frac{\sqrt{3}}{3}$

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

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**18.** $\sin 40^\circ + \sin 100^\circ + \sin 160^\circ + \cdots + \sin 340^\circ =$

$a_1 = 40^\circ$, $d = 60^\circ$, $n = 6$, $a_n = 340^\circ$

$\text{Sum} = \frac{\sin\left(\frac{a_1+a_n}{2}\right)\sin\frac{nd}{2}}{\sin\frac{d}{2}} = \frac{\sin 190^\circ\ \sin 180^\circ}{\sin 30^\circ}$

$\frac{nd}{2} = 180^\circ$ and $\sin 180^\circ = 0$.

$= 0$

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

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**19.** $\sin 20^\circ + \sin 92^\circ + \sin 164^\circ + \sin 236^\circ + \sin 308^\circ =$

$a_1 = 20^\circ$, $d = 72^\circ$, $n = 5$, $a_n = 308^\circ$

$\text{Sum} = \frac{\sin\left(\frac{a_1+a_n}{2}\right)\sin\frac{nd}{2}}{\sin\frac{d}{2}} = \frac{\sin 164^\circ\ \sin 180^\circ}{\sin 36^\circ}$

$\frac{nd}{2} = 180^\circ$ and $\sin 180^\circ = 0$.

$= 0$

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

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**20.** $\frac{\cos\frac{\pi}{7}+\cos\frac{3\pi}{7}+\cos\frac{5\pi}{7}}{\sin\frac{\pi}{7}\sin\frac{2\pi}{7}\sin\frac{3\pi}{7}} =$

Known results: $\cos\frac{\pi}{7}+\cos\frac{3\pi}{7}+\cos\frac{5\pi}{7} = \frac{1}{2}$ and $\sin\frac{\pi}{7}\sin\frac{2\pi}{7}\sin\frac{3\pi}{7} = \frac{\sqrt{7}}{8}$

$\text{Value} = \frac{4\sqrt{7}}{7}$

**Ans: (C)** $\frac{4\sqrt{7}}{7}$

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**21.** $\sin^2 75^\circ + \sin^2 15^\circ - \sin 75^\circ\ \sin 15^\circ =$

$A - B = 60^\circ \Rightarrow \sin^2 A + \sin^2 B - \sin A\sin B = \frac{3}{4}$

Here the two angles differ by $60^\circ$, so the value is $\frac{3}{4}$.

**Ans: (D)** $\frac{3}{4}$

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**22.** $\sin^2 10^\circ + \sin^2 50^\circ + \sin 10^\circ\ \sin 50^\circ =$

$A + B = 60^\circ \Rightarrow \sin^2 A + \sin^2 B + \sin A\sin B = \frac{3}{4}$

Here the two angles add to $60^\circ$, so the value is $\frac{3}{4}$.

**Ans: (D)** $\frac{3}{4}$

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**23.** If $\frac{x}{y} = \frac{\sin 90^\circ}{\sin 60^\circ}$, then $\frac{x+y}{x-y} =$

$\frac{x+y}{x-y} = \frac{\sin A+\sin B}{\sin A-\sin B} = \frac{\tan \frac{A+B}{2}}{\tan \frac{A-B}{2}}$

$= \frac{\tan 75^\circ}{\tan 15^\circ} = 7 + 4\sqrt{3}$

**Ans: (C)** $7 + 4\sqrt{3}$

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**24.** $\sqrt{1 + \sin 640^\circ} =$

$\sqrt{1 + \sin A} = \left|\cos \frac{A}{2} + \sin \frac{A}{2}\right|$

$\frac{A}{2} = 320^\circ$, where $\cos \frac{A}{2} + \sin \frac{A}{2}$ is positive.

**Ans: (B)** $\cos 320^\circ + \sin 320^\circ$

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**25.** $\sqrt{1 - \sin 640^\circ} =$

$\sqrt{1 - \sin A} = \left|\cos \frac{A}{2} - \sin \frac{A}{2}\right|$

$\frac{A}{2} = 320^\circ$, where $\cos \frac{A}{2} - \sin \frac{A}{2}$ is positive.

**Ans: (A)** $\cos 320^\circ - \sin 320^\circ$

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