EXPRESSWALA ACADEMY

Maths 1A: Multiple and Submultiple Angles

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. If $\tan A = \frac{5}{4}$, then $\sin 2A =$

A. $-\frac{9}{41}$ **B.** $\frac{40}{41}$ **C.** $-\frac{40}{9}$ **D.** $\frac{20}{41}$

2. If $\cos A = -\frac{7}{25}$ and $\frac{\pi}{2} < A < \pi$, then $\cos 2A =$

A. $-\frac{527}{625}$ **B.** $-\frac{14}{25}$ **C.** $\frac{527}{625}$ **D.** $-\frac{336}{625}$

3. If $\cos 2A = \frac{1}{2}$, then $\sin^2 A =$

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

4. If $\cos A = \frac{1}{6}$, then $\cos 3A =$

A. $\frac{14}{27}$ **B.** $-\frac{4}{27}$ **C.** $\frac{13}{27}$ **D.** $-\frac{13}{27}$

5. If $\sin A = -\frac{3}{4}$, then $\sin 3A =$

A. $-\frac{117}{64}$ **B.** $-\frac{63}{16}$ **C.** $-\frac{9}{16}$ **D.** $\frac{9}{16}$

6. If $\cos A = -\frac{6}{7}$ and $\pi < A < 2\pi$, then $\sin \frac{A}{2} =$

A. $\frac{\sqrt{14}}{14}$ **B.** $-\frac{\sqrt{182}}{14}$ **C.** $\frac{13}{14}$ **D.** $\frac{\sqrt{182}}{14}$

7. If $\tan \frac{A}{2} = -\frac{1}{4}$, then $\cos A =$

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

8. $\frac{1+\cos 2A}{1-\cos 2A} =$

A. $\cot 2A$ **B.** $\cot^2 A$ **C.** $\tan^2 A$ **D.** $\cos^2 A$

9. $\sin 162^\circ =$

A. $\frac{\sqrt{5}+1}{4}$ **B.** $\frac{\sqrt{5}-1}{4}$ **C.** $-\frac{\sqrt{5}-1}{4}$ **D.** $-\frac{\sqrt{5}+1}{4}$

10. $\sin 18^\circ \cos 72^\circ =$

A. $\frac{3-\sqrt{5}}{4}$ **B.** $\frac{\sqrt{5}-3}{8}$ **C.** $\frac{3-\sqrt{5}}{8}$ **D.** $\frac{3+\sqrt{5}}{8}$

11. $\cot 67\frac{1}{2}^\circ =$

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

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

12. $\cot^2 22\frac{1}{2}^\circ - \tan^2 22\frac{1}{2}^\circ =$

A. $8\sqrt{2}$ **B.** $-4\sqrt{2}$ **C.** $2\sqrt{2}$ **D.** $4\sqrt{2}$

13. $\sin^4 15^\circ + \cos^4 15^\circ =$

A. $\frac{9}{8}$ **B.** $\frac{3}{4}$ **C.** $\frac{7}{8}$ **D.** $\frac{1}{8}$

14. If $\sin 2\theta = -\frac{3}{7}$, then $\sin^6\theta + \cos^6\theta =$

A. $\frac{71}{98}$ **B.** $\frac{37}{28}$ **C.** $\frac{27}{196}$ **D.** $\frac{169}{196}$

15. $\operatorname{cosec} 15^\circ - \cot 15^\circ =$

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

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

16. $\cos\frac{5\pi}{31}\cos\frac{10\pi}{31}\cos\frac{20\pi}{31}\cos\frac{40\pi}{31}\cos\frac{80\pi}{31} =$

A. $-\frac{1}{32}$ **B.** $-\frac{1}{16}$ **C.** $-\frac{1}{64}$ **D.** $\frac{1}{32}$

17. $(2\cos 52\frac{1}{2}^\circ - 1)(2\cos 52\frac{1}{2}^\circ + 1)(2\cos 105^\circ - 1) =$

A. $-1-\sqrt{3}$ **B.** $\sqrt{3}-1$

C. $1-\sqrt{3}$ **D.** $\frac{2+\sqrt{2}-\sqrt{6}}{2}$

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

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

19. $\sin 60^\circ + \sin 120^\circ + \sin 180^\circ =$

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

20. $4\tan\frac{\pi}{7}\tan\frac{2\pi}{7}\tan\frac{4\pi}{7} - 1 =$

A. $-1-4\sqrt{7}$ **B.** $-2-8\sqrt{7}$ **C.** $-4\sqrt{7}$ **D.** $1+4\sqrt{7}$

21. $\tan 20^\circ \tan 40^\circ \tan 100^\circ =$

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

22. $\sin^2 65^\circ + \sin^2 5^\circ - \sin 65^\circ \sin 5^\circ =$

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

23. If $\frac{x}{y} = \frac{\tan 97\frac{1}{2}^\circ}{\tan 37\frac{1}{2}^\circ}$, then $\frac{x+y}{x-y} =$

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

24. $\sqrt{1-\sin 40^\circ} =$

A. $-(\cos 20^\circ - \sin 20^\circ)$ **B.** $\cos 20^\circ - \sin 20^\circ$

C. $-(\cos 20^\circ + \sin 20^\circ)$ **D.** $\cos 20^\circ + \sin 20^\circ$

25. $\sqrt{1+\sin 260^\circ} =$

A. $\cos 130^\circ + \sin 130^\circ$ **B.** $-(\cos 130^\circ + \sin 130^\circ)$

C. $-(\cos 130^\circ - \sin 130^\circ)$ **D.** $\cos 130^\circ - \sin 130^\circ$

Key sheet

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

Solutions

1. If $\tan A = \frac{5}{4}$, then $\sin 2A =$

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

$= \frac{40}{41}$

Ans: (B) $\frac{40}{41}$

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2. If $\cos A = -\frac{7}{25}$ and $\frac{\pi}{2} < A < \pi$, then $\cos 2A =$

$\sin A = \sqrt{1-\cos^2 A} = \frac{24}{25}$ ($\sin A$ is positive in this quadrant)

$\cos 2A = \cos^2 A - \sin^2 A = -\frac{527}{625}$

Ans: (A) $-\frac{527}{625}$

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3. If $\cos 2A = \frac{1}{2}$, then $\sin^2 A =$

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

$= \frac{1}{4}$

Ans: (B) $\frac{1}{4}$

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4. If $\cos A = \frac{1}{6}$, then $\cos 3A =$

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

$= 4(\frac{1}{6})^3 - 3(\frac{1}{6})$

$= -\frac{13}{27}$

Ans: (D) $-\frac{13}{27}$

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5. If $\sin A = -\frac{3}{4}$, then $\sin 3A =$

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

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

$= -\frac{9}{16}$

Ans: (C) $-\frac{9}{16}$

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6. If $\cos A = -\frac{6}{7}$ and $\pi < A < 2\pi$, then $\sin \frac{A}{2} =$

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

$\sin \frac{A}{2} = \frac{\sqrt{182}}{14}$

Ans: (D) $\frac{\sqrt{182}}{14}$

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7. If $\tan \frac{A}{2} = -\frac{1}{4}$, then $\cos A =$

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

$= \frac{15}{17}$

Ans: (D) $\frac{15}{17}$

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8. $\frac{1+\cos 2A}{1-\cos 2A} =$

$= \frac{2\cos^2 A}{2\sin^2 A} = \cot^2 A$

Ans: (B) $\cot^2 A$

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9. $\sin 162^\circ =$

$\sin 162^\circ = \sin 18^\circ$

$\sin 18^\circ = \frac{\sqrt{5}-1}{4}$

Ans: (B) $\frac{\sqrt{5}-1}{4}$

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10. $\sin 18^\circ \cos 72^\circ =$

$\sin 18^\circ = \frac{\sqrt{5}-1}{4},\ \cos 72^\circ = \frac{\sqrt{5}-1}{4}$

$\sin 18^\circ \cos 72^\circ = \frac{3-\sqrt{5}}{8}$

Ans: (C) $\frac{3-\sqrt{5}}{8}$

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11. $\cot 67\frac{1}{2}^\circ =$

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

$\cot 67\frac{1}{2}^\circ = \sqrt{2}-1$

Ans: (C) $\sqrt{2}-1$

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12. $\cot^2 22\frac{1}{2}^\circ - \tan^2 22\frac{1}{2}^\circ =$

$\cot 22\frac{1}{2}^\circ = \sqrt{2}+1,\ \tan 22\frac{1}{2}^\circ = \sqrt{2}-1$

$\cot^2 22\frac{1}{2}^\circ - \tan^2 22\frac{1}{2}^\circ = 4\sqrt{2}$

Ans: (D) $4\sqrt{2}$

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13. $\sin^4 15^\circ + \cos^4 15^\circ =$

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

$\sin 30^\circ = \frac{1}{2}$

$\sin^4 15^\circ + \cos^4 15^\circ = 1 - \frac{1}{2}\cdot\frac{1}{4} = \frac{7}{8}$

Ans: (C) $\frac{7}{8}$

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14. If $\sin 2\theta = -\frac{3}{7}$, then $\sin^6\theta + \cos^6\theta =$

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

$= 1 - \frac{3}{4}\cdot\frac{9}{49} = \frac{169}{196}$

Ans: (D) $\frac{169}{196}$

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15. $\operatorname{cosec} 15^\circ - \cot 15^\circ =$

$\operatorname{cosec} 2A - \cot 2A = \tan A$

With $A = 7\frac{1}{2}^\circ$: $\operatorname{cosec} 15^\circ - \cot 15^\circ = \sqrt{2}+\sqrt{6}-2-\sqrt{3}$

Ans: (A) $\sqrt{2}+\sqrt{6}-2-\sqrt{3}$

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16. $\cos\frac{5\pi}{31}\cos\frac{10\pi}{31}\cos\frac{20\pi}{31}\cos\frac{40\pi}{31}\cos\frac{80\pi}{31} =$

This is $\cos\theta\cos 2\theta\cdots\cos 2^4\theta = \frac{\sin 2^5\theta}{2^5\sin\theta}$ with $\theta = \frac{5\pi}{31}$.

$\sin 2^5\theta = -\sin\theta$

$\text{Value} = -\frac{1}{32}$

Ans: (A) $-\frac{1}{32}$

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17. $(2\cos 52\frac{1}{2}^\circ - 1)(2\cos 52\frac{1}{2}^\circ + 1)(2\cos 105^\circ - 1) =$

$(2\cos\theta - 1)(2\cos\theta + 1) = 2\cos 2\theta + 1$, then $(2\cos 2\theta + 1)(2\cos 2\theta - 1) = 2\cos 4\theta + 1$

$= 2\cos 210^\circ + 1 = 1 - \sqrt{3}$

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

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

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

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

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

$= 0$

Ans: (C) 0

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19. $\sin 60^\circ + \sin 120^\circ + \sin 180^\circ =$

$a_1 = 60^\circ$, $d = 60^\circ$, $n = 3$, $a_n = 180^\circ$

$\text{Sum} = \frac{\sin\left(\frac{a_1 + a_n}{2}\right)\sin\frac{nd}{2}}{\sin\frac{d}{2}} = \frac{\sin 120^\circ \sin 90^\circ}{\sin 30^\circ}$

$= \sqrt{3}$

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

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20. $4\tan\frac{\pi}{7}\tan\frac{2\pi}{7}\tan\frac{4\pi}{7} - 1 =$

Known result: $\tan\frac{\pi}{7}\tan\frac{2\pi}{7}\tan\frac{4\pi}{7} = -\sqrt{7}$

$\text{Value} = -1 - 4\sqrt{7}$

Ans: (A) $-1 - 4\sqrt{7}$

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21. $\tan 20^\circ \tan 40^\circ \tan 100^\circ =$

$\tan\theta\tan(60^\circ - \theta)\tan(60^\circ + \theta) = \tan 3\theta$

With $\theta = 40^\circ$: value $= -\sqrt{3}$

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

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22. $\sin^2 65^\circ + \sin^2 5^\circ - \sin 65^\circ \sin 5^\circ =$

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

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

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

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23. If $\frac{x}{y} = \frac{\tan 97\frac{1}{2}^\circ}{\tan 37\frac{1}{2}^\circ}$, then $\frac{x+y}{x-y} =$

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

$= \frac{\sin 135^\circ}{\sin 60^\circ} = \frac{\sqrt{6}}{3}$

Ans: (B) $\frac{\sqrt{6}}{3}$

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24. $\sqrt{1 - \sin 40^\circ} =$

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

$\frac{A}{2} = 20^\circ$, where $\cos\frac{A}{2} - \sin\frac{A}{2}$ is positive.

Ans: (B) $\cos 20^\circ - \sin 20^\circ$

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25. $\sqrt{1+\sin 260^\circ} =$

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

$\frac{A}{2} = 130^\circ$, where $\cos\frac{A}{2} + \sin\frac{A}{2}$ is positive.

Ans: (A) $\cos 130^\circ + \sin 130^\circ$
