EXPRESSWALA ACADEMY

Maths 1A: Multiple and Submultiple Angles

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. If $\tan A = \frac{5}{3}$, then $\cos 2A =$

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

2. If $\cos A = -\frac{9}{41}$ and $\pi < A < \frac{3\pi}{2}$, then $\cos 2A =$

A. $\frac{1519}{1681}$ **B.** $\frac{720}{1681}$ **C.** $-\frac{18}{41}$ **D.** $-\frac{1519}{1681}$

3. If $\cos 2A = \frac{5}{6}$, then $\cos^2 A =$

A. $\frac{1}{6}$ **B.** 11 **C.** $\frac{1}{12}$ **D.** $\frac{11}{12}$

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

A. $\frac{11}{8}$ **B.** 2 **C.** 1 **D.** -1

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

A. $-\frac{556}{125}$ **B.** $-\frac{44}{125}$ **C.** $-\frac{156}{125}$ **D.** $\frac{44}{125}$

6. If $\cos A = -\frac{5}{7}$ and $0 < A < \pi$, then $\sin \frac{A}{2} =$

A. $\frac{\sqrt{42}}{7}$ **B.** $\frac{6}{7}$ **C.** $\frac{\sqrt{7}}{7}$ **D.** $-\frac{\sqrt{42}}{7}$

7. If $\tan \frac{A}{2} = \frac{3}{5}$, then $\sin A =$

A. $\frac{8}{17}$ **B.** $\frac{15}{17}$ **C.** $\frac{15}{8}$ **D.** $\frac{15}{34}$

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

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

9. $\cos 126^\circ =$

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. $\cos^2 36^\circ + \sin^2 54^\circ =$

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

11. $\tan 22\frac{1}{2}^\circ =$

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. $\tan 82\frac{1}{2}^\circ + \tan 67\frac{1}{2}^\circ =$

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

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

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13. $\sin^2 37\frac{1}{2}^\circ + \cos^4 37\frac{1}{2}^\circ =$

A. $\frac{16-\sqrt{2}-\sqrt{6}}{16}$ **B.** $\frac{2+\sqrt{3}}{16}$

C. $\frac{6-\sqrt{3}}{8}$ **D.** $\frac{14-\sqrt{3}}{16}$

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14. If $\sin 2\theta = \frac{1}{5}$, then $\sin^4\theta + \cos^4\theta =$

A. $\frac{49}{50}$ **B.** $\frac{1}{50}$ **C.** $\frac{24}{25}$ **D.** $\frac{9}{10}$

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15. $\cot 67\frac{1}{2}^\circ + \tan 67\frac{1}{2}^\circ =$

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

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16. $\cos\frac{2\pi}{17}\cos\frac{4\pi}{17}\cos\frac{8\pi}{17}\cos\frac{16\pi}{17} =$

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

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17. $\left(2\cos\frac{4\pi}{9}-1\right)\left(2\cos\frac{8\pi}{9}-1\right)\left(2\cos\frac{16\pi}{9}-1\right) =$

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

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18. $\sin 30^\circ + \sin 90^\circ + \sin 150^\circ + \sin 210^\circ =$

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

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19. $\sin 15^\circ + \sin 75^\circ + \sin 135^\circ + \cdots + \sin 315^\circ =$

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

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20. $\tan\frac{\pi}{7}\tan\frac{2\pi}{7}\tan\frac{4\pi}{7} + \left(\operatorname{cosec}^2\frac{\pi}{7} + \operatorname{cosec}^2\frac{2\pi}{7} + \operatorname{cosec}^2\frac{3\pi}{7}\right) =$

A. $16-2\sqrt{7}$ **B.** $\sqrt{7}-8$ **C.** $8-\sqrt{7}$ **D.** $9-\sqrt{7}$

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21. $\cos^2 25^\circ + \cos^2 35^\circ + \cos^2 85^\circ =$

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

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22. $\cos^2 85^\circ + \cos^2 25^\circ - \cos 85^\circ\ \cos 25^\circ =$

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

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23. If $\frac{x}{y} = \frac{\sin 105^\circ}{\sin 15^\circ}$, then $\frac{x+y}{x-y} =$

A. $\frac{\sqrt{6}}{2}$ **B.** $-7-4\sqrt{3}$ **C.** $\frac{\sqrt{3}}{3}$ **D.** $\sqrt{3}$

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

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25. $\sqrt{1+\sin 480^\circ} =$

A. $\cos 240^\circ - \sin 240^\circ$

B. $-(\cos 240^\circ - \sin 240^\circ)$

C. $-(\cos 240^\circ + \sin 240^\circ)$

D. $\cos 240^\circ + \sin 240^\circ$

Key sheet

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

Solutions

1. If $\tan A = \frac{5}{3}$, then $\cos 2A =$

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

$= -\frac{8}{17}$

Ans: (A) $-\frac{8}{17}$

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2. If $\cos A = -\frac{9}{41}$ and $\pi < A < \frac{3\pi}{2}$, then $\cos 2A =$

$\sin A = -\sqrt{1-\cos^2 A} = -\frac{40}{41}$ ($\sin A$ is negative in this quadrant)

$\cos 2A = \cos^2 A - \sin^2 A = -\frac{1519}{1681}$

Ans: (D) $-\frac{1519}{1681}$

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3. If $\cos 2A = \frac{5}{6}$, then $\cos^2 A =$

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

$= \frac{11}{12}$

Ans: (D) $\frac{11}{12}$

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

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

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

$= 1$

Ans: (C) 1

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

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

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

$= \frac{44}{125}$

Ans: (D) $\frac{44}{125}$

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6. If $\cos A = -\frac{5}{7}$ and $0 < A < \pi$, then $\sin \frac{A}{2} =$

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

$\sin \frac{A}{2} = \frac{\sqrt{42}}{7}$

Ans: (A) $\frac{\sqrt{42}}{7}$

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7. If $\tan \frac{A}{2} = \frac{3}{5}$, then $\sin A =$

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

$= \frac{15}{17}$

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

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

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

Ans: (A) $\tan A$

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9. $\cos 126^\circ =$

$\cos 126^\circ = -\cos 54^\circ$

$\cos 54^\circ = \frac{\sqrt{10-2\sqrt{5}}}{4}$

Ans: (B) $-\frac{\sqrt{10-2\sqrt{5}}}{4}$

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10. $\cos^2 36^\circ + \sin^2 54^\circ =$

$\cos 36^\circ = \frac{\sqrt{5}+1}{4},\ \sin 54^\circ = \frac{\sqrt{5}+1}{4}$

$\cos^2 36^\circ + \sin^2 54^\circ = \frac{3+\sqrt{5}}{4}$

Ans: (D) $\frac{3+\sqrt{5}}{4}$

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11. $\tan 22\frac{1}{2}^\circ =$

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

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

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

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12. $\tan 82\frac{1}{2}^\circ + \tan 67\frac{1}{2}^\circ =$

$\tan 82\frac{1}{2}^\circ = (\sqrt{3}+\sqrt{2})(\sqrt{2}+1),\ \tan 67\frac{1}{2}^\circ = \sqrt{2}+1$

$\tan 82\frac{1}{2}^\circ + \tan 67\frac{1}{2}^\circ = 3 + \sqrt{3} + \sqrt{6} + 2\sqrt{2}$

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

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13. $\sin^2 37\frac{1}{2}^\circ + \cos^4 37\frac{1}{2}^\circ =$

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

$\sin 75^\circ = \frac{\sqrt{2}}{4} + \frac{\sqrt{6}}{4}$

$\sin^2 37\frac{1}{2}^\circ + \cos^4 37\frac{1}{2}^\circ = 1 - \frac{1}{4}\cdot\frac{2+\sqrt{3}}{4} = \frac{14-\sqrt{3}}{16}$

Ans: (D) $\frac{14-\sqrt{3}}{16}$

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14. If $\sin 2\theta = \frac{1}{5}$, then $\sin^4\theta + \cos^4\theta =$

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

$= 1 - \frac{1}{2}\cdot\frac{1}{25} = \frac{49}{50}$

Ans: (A) $\frac{49}{50}$

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15. $\cot 67\frac{1}{2}^\circ + \tan 67\frac{1}{2}^\circ =$

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

With $A = 67\frac{1}{2}^\circ$: $\cot 67\frac{1}{2}^\circ + \tan 67\frac{1}{2}^\circ = 2\sqrt{2}$

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

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16. $\cos\frac{2\pi}{17}\cos\frac{4\pi}{17}\cos\frac{8\pi}{17}\cos\frac{16\pi}{17} =$

This is $\cos\theta\cos 2\theta\cdots\cos 2^3\theta = \frac{\sin 2^4\theta}{2^4\sin\theta}$ with $\theta = \frac{2\pi}{17}$.

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

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

Ans: (A) $-\frac{1}{16}$

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17. $\left(2\cos\frac{4\pi}{9}-1\right)\left(2\cos\frac{8\pi}{9}-1\right)\left(2\cos\frac{16\pi}{9}-1\right)=$

$(2\cos\theta-1)(2\cos 2\theta-1)\cdots(2\cos 2^2\theta-1)=\frac{2\cos 2^3\theta+1}{2\cos\theta+1}$ with $\theta=\frac{4\pi}{9}$

$2^3\theta$ differs from $\pm\theta$ by a multiple of 2π, so $\cos 2^3\theta=\cos\theta$ and the value is 1.

Ans: (B) 1

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18. $\sin 30^\circ+\sin 90^\circ+\sin 150^\circ+\sin 210^\circ=$

$a_1=30^\circ$, $d=60^\circ$, $n=4$, $a_n=210^\circ$

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

$=\frac{3}{2}$

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

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19. $\sin 15^\circ+\sin 75^\circ+\sin 135^\circ+\cdots+\sin 315^\circ=$

$a_1=15^\circ$, $d=60^\circ$, $n=6$, $a_n=315^\circ$

$\text{Sum}=\frac{\sin\left(\frac{a_1+a_n}{2}\right)\sin\frac{nd}{2}}{\sin\frac{d}{2}}=\frac{\sin 165^\circ\ \sin 180^\circ}{\sin 30^\circ}$

$=0$

Ans: (D) 0

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20. $\tan\frac{\pi}{7}\tan\frac{2\pi}{7}\tan\frac{4\pi}{7}+\left(\text{cosec}^2\frac{\pi}{7}+\text{cosec}^2\frac{2\pi}{7}+\text{cosec}^2\frac{3\pi}{7}\right)=$

Known results: $\tan\frac{\pi}{7}\tan\frac{2\pi}{7}\tan\frac{4\pi}{7}=-\sqrt{7}$ and $\text{cosec}^2\frac{\pi}{7}+\text{cosec}^2\frac{2\pi}{7}+\text{cosec}^2\frac{3\pi}{7}=8$

$\text{Value}=8-\sqrt{7}$

Ans: (C) $8-\sqrt{7}$

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21. $\cos^2 25^\circ+\cos^2 35^\circ+\cos^2 85^\circ=$

$\cos^2\theta+\cos^2(60^\circ+\theta)+\cos^2(60^\circ-\theta)=\frac{3}{2}$

Here $\theta=25^\circ$, so the sum is $\frac{3}{2}$.

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

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22. $\cos^2 85^\circ+\cos^2 25^\circ-\cos 85^\circ\ \cos 25^\circ=$

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

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

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

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23. If $\frac{x}{y}=\frac{\sin 105^\circ}{\sin 15^\circ}$, then $\frac{x+y}{x-y}=$

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

$=\frac{\tan 60^\circ}{\tan 45^\circ}=\sqrt{3}$

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

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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. $\sqrt{1+\sin 480^\circ} =$

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

$\frac{A}{2} = 240^\circ$, where $\cos\frac{A}{2} + \sin\frac{A}{2}$ is negative.

Ans: (C) $-(\cos 240^\circ + \sin 240^\circ)$
