EXPRESSWALA ACADEMY

Maths 1A: Multiple and Submultiple Angles

MCQ Test, Set 08

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 $\tan A = -\frac{2}{7}$, then $\sin 2A =$

A. $-\frac{28}{45}$ **B.** $-\frac{28}{53}$ **C.** $\frac{45}{53}$ **D.** $-\frac{14}{53}$

2. If $\sin A = -\frac{12}{13}$ and $\pi < A < \frac{3\pi}{2}$, then $\sin 2A =$

A. $\frac{120}{169}$ **B.** $-\frac{24}{13}$ **C.** $-\frac{119}{169}$ **D.** $-\frac{120}{169}$

3. If $\cos 2A = \frac{5}{9}$, then $\tan^2 A =$

A. $\frac{7}{9}$ **B.** $\frac{4}{9}$ **C.** $\frac{7}{2}$ **D.** $\frac{2}{7}$

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

A. $-\frac{44}{171}$ **B.** $\frac{44}{117}$ **C.** $\frac{12}{13}$ **D.** $\frac{172}{117}$

5. If $\sin A = \frac{1}{7}$, then $\sin 3A =$

A. $\frac{143}{343}$ **B.** $\frac{146}{343}$ **C.** $-\frac{143}{343}$ **D.** $\frac{151}{343}$

6. If $\cos A = -\frac{7}{9}$ and $\pi < A < 2\pi$, then $\cos \frac{A}{2} =$

A. $-\frac{1}{3}$ **B.** $\frac{1}{3}$ **C.** $\frac{1}{9}$ **D.** $-\frac{2\sqrt{2}}{3}$

7. If $\tan \frac{A}{2} = -\frac{6}{7}$, then $\sin A =$

A. $-\frac{84}{13}$ **B.** $-\frac{42}{85}$ **C.** $\frac{13}{85}$ **D.** $-\frac{84}{85}$

8. $(\cos A - \sin A)^2 =$

A. $1 + \sin 2A$ **B.** $1 - \sin 2A$

C. $1 - \cos 2A$ **D.** $\cos 2A$

9. $\cos 252^\circ =$

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. $4 \sin 18^\circ \cos 36^\circ =$

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

11. $\cot 37\frac{1}{2}^\circ =$

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

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

12. $\cot^2 52\frac{1}{2}^\circ - \tan^2 52\frac{1}{2}^\circ =$

A. $10\sqrt{2} - 6\sqrt{6}$ **B.** $12\sqrt{6} - 20\sqrt{2}$

C. $20\sqrt{2} - 12\sqrt{6}$ **D.** $40\sqrt{2} - 24\sqrt{6}$

---

13. $\sin^2 165^\circ + \cos^4 165^\circ =$

A. $\frac{7}{8}$ **B.** $\frac{9}{8}$ **C.** $\frac{15}{16}$ **D.** $\frac{1}{16}$

---

14. The greatest value of $\sin^6\theta + \cos^6\theta$ is

A. $\frac{1}{4}$ **B.** 1 **C.** $\frac{3}{4}$ **D.** $\frac{5}{8}$

---

15. $\operatorname{cosec} 45^\circ + \cot 45^\circ =$

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

---

16. $\cos 96^\circ \cos 192^\circ \cos 384^\circ \cos 768^\circ =$

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

---

17. $(2\cos 37\frac{1}{2}^\circ - 1)(2\cos 37\frac{1}{2}^\circ + 1)(2\cos 75^\circ - 1) =$

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

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

---

18. $\sin 15^\circ + \sin 45^\circ + \sin 75^\circ + \sin 105^\circ + \sin 135^\circ =$

A. $\frac{4+3\sqrt{6}+5\sqrt{2}}{4}$ **B.** $\frac{3\sqrt{6}+5\sqrt{2}}{2}$

C. $-\frac{5\sqrt{2}+3\sqrt{6}}{4}$ **D.** $\frac{3\sqrt{6}+5\sqrt{2}}{4}$

---

19. $\cos 30^\circ + \cos 90^\circ + \cos 150^\circ + \cos 210^\circ =$

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

---

20. $\frac{\tan\frac{\pi}{7}\tan\frac{2\pi}{7} + \tan\frac{2\pi}{7}\tan\frac{4\pi}{7} + \tan\frac{4\pi}{7}\tan\frac{\pi}{7}}{\cos\frac{\pi}{7} + \cos\frac{3\pi}{7} + \cos\frac{5\pi}{7}} =$

A. 14 **B.** -14 **C.** -13 **D.** -28

---

21. $\cos^2 15^\circ + \cos^2 45^\circ + \cos^2 105^\circ =$

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

---

22. $\cos 10^\circ \cos 50^\circ \cos 110^\circ =$

A. $-\frac{\sqrt{3}}{8}$ **B.** $\frac{1}{8}$ **C.** $-\frac{\sqrt{3}}{16}$ **D.** $-\frac{\sqrt{3}}{2}$

---

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

A. $\frac{\sqrt{3}}{2}$ **B.** $\frac{2\sqrt{3}}{3}$ **C.** 0 **D.** $-\frac{\sqrt{3}}{2}$

---

24. $\sqrt{1 + \sin 280^\circ} =$

A. $\cos 140^\circ + \sin 140^\circ$ **B.** $\cos 140^\circ - \sin 140^\circ$

C. $-(\cos 140^\circ - \sin 140^\circ)$ **D.** $-(\cos 140^\circ + \sin 140^\circ)$

---

25. $\sqrt{1-\sin 240^\circ} =$

A. $-(\cos 120^\circ - \sin 120^\circ)$

B. $\cos 120^\circ + \sin 120^\circ$

C. $-(\cos 120^\circ + \sin 120^\circ)$

D. $\cos 120^\circ - \sin 120^\circ$

Key sheet

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

Solutions

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

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

$= -\frac{28}{53}$

Ans: (B) $-\frac{28}{53}$

---

2. If $\sin A = -\frac{12}{13}$ and $\pi < A < \frac{3\pi}{2}$, then $\sin 2A =$

$\cos A = -\sqrt{1-\sin^2 A} = -\frac{5}{13}$ ($\cos A$ is negative in this quadrant)

$\sin 2A = 2\sin A \cos A = \frac{120}{169}$

Ans: (A) $\frac{120}{169}$

---

3. If $\cos 2A = \frac{5}{9}$, then $\tan^2 A =$

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

$= \frac{2}{7}$

Ans: (D) $\frac{2}{7}$

---

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

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

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

$= \frac{44}{117}$

Ans: (B) $\frac{44}{117}$

---

5. If $\sin A = \frac{1}{7}$, then $\sin 3A =$

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

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

$= \frac{143}{343}$

Ans: (A) $\frac{143}{343}$

---

6. If $\cos A = -\frac{7}{9}$ and $\pi < A < 2\pi$, then $\cos \frac{A}{2} =$

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

$\cos \frac{A}{2} = -\frac{1}{3}$

Ans: (A) $-\frac{1}{3}$

---

7. If $\tan \frac{A}{2} = -\frac{6}{7}$, then $\sin A =$

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

$= -\frac{84}{85}$

Ans: (D) $-\frac{84}{85}$

---

8. $(\cos A - \sin A)^2 =$

$= \cos^2 A + \sin^2 A - 2\sin A \cos A = 1 - \sin 2A$

Ans: (B) $1 - \sin 2A$

---

9. $\cos 252^\circ =$

$\cos 252^\circ = -\cos 72^\circ$

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

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

---

10. $4\sin 18^\circ \cos 36^\circ =$

$\sin 18^\circ = \frac{\sqrt{5}-1}{4},\ \cos 36^\circ = \frac{\sqrt{5}+1}{4}$

$4\sin 18^\circ \cos 36^\circ = 1$

Ans: (D) 1

---

11. $\cot 37\frac{1}{2}^\circ =$

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

$\cot 37\frac{1}{2}^\circ = (\sqrt{3}+\sqrt{2})(\sqrt{2}-1)$

Ans: (A) $(\sqrt{3}+\sqrt{2})(\sqrt{2}-1)$

---

12. $\cot^2 52\frac{1}{2}^\circ - \tan^2 52\frac{1}{2}^\circ =$

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

$\cot^2 52\frac{1}{2}^\circ - \tan^2 52\frac{1}{2}^\circ = 20\sqrt{2} - 12\sqrt{6}$

Ans: (C) $20\sqrt{2} - 12\sqrt{6}$

---

13. $\sin^2 165^\circ + \cos^4 165^\circ =$

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

$\sin 330^\circ = -\frac{1}{2}$

$\sin^2 165^\circ + \cos^4 165^\circ = 1 - \frac{1}{4}\cdot\frac{1}{4} = \frac{15}{16}$

Ans: (C) $\frac{15}{16}$

---

14. The greatest value of $\sin^6\theta + \cos^6\theta$ is

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

$0 \le \sin^2 2\theta \le 1$, so the greatest value is 1.

Ans: (B) 1

---

15. $\operatorname{cosec} 45^\circ + \cot 45^\circ =$

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

With $A = 22\frac{1}{2}^\circ$: $\operatorname{cosec} 45^\circ + \cot 45^\circ = 1 + \sqrt{2}$

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

---

16. $\cos 96^\circ \cos 192^\circ \cos 384^\circ \cos 768^\circ =$

This is $\cos\theta\cos 2\theta\cdots\cos 2^3\theta = \frac{\sin 2^4\theta}{2^4\sin\theta}$ with $\theta = 96^\circ$.

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

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

Ans: (C) $\frac{1}{16}$

---

17. $(2\cos 37\frac{1}{2}^\circ - 1)(2\cos 37\frac{1}{2}^\circ + 1)(2\cos 75^\circ - 1) =$

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

$= 2\cos 150^\circ + 1 = 1 - \sqrt{3}$

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

---

18. $\sin 15^\circ + \sin 45^\circ + \sin 75^\circ + \sin 105^\circ + \sin 135^\circ =$

$a_1 = 15^\circ$, $d = 30^\circ$, $n = 5$, $a_n = 135^\circ$

$\text{Sum} = \frac{\sin\left(\frac{a_1+a_n}{2}\right)\sin\frac{nd}{2}}{\sin\frac{d}{2}} = \frac{\sin 75^\circ \sin 75^\circ}{\sin 15^\circ}$

$= \frac{3\sqrt{6}+5\sqrt{2}}{4}$

Ans: (D) $\frac{3\sqrt{6}+5\sqrt{2}}{4}$

---

19. $\cos 30^\circ + \cos 90^\circ + \cos 150^\circ + \cos 210^\circ =$

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

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

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

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

---

20. $\frac{\tan\frac{\pi}{7}\tan\frac{2\pi}{7}+\tan\frac{2\pi}{7}\tan\frac{4\pi}{7}+\tan\frac{4\pi}{7}\tan\frac{\pi}{7}}{\cos\frac{\pi}{7}+\cos\frac{3\pi}{7}+\cos\frac{5\pi}{7}} =$

Known results: $\tan\frac{\pi}{7}\tan\frac{2\pi}{7} + \tan\frac{2\pi}{7}\tan\frac{4\pi}{7} + \tan\frac{4\pi}{7}\tan\frac{\pi}{7} = -7$ and $\cos\frac{\pi}{7} + \cos\frac{3\pi}{7} + \cos\frac{5\pi}{7} = \frac{1}{2}$

$\text{Value} = -14$

Ans: (B) -14

---

21. $\cos^2 15^\circ + \cos^2 45^\circ + \cos^2 105^\circ =$

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

Here $\theta = 45^\circ$, so the sum is $\frac{3}{2}$.

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

---

22. $\cos 10^\circ \cos 50^\circ \cos 110^\circ =$

$\cos\theta\cos(60^\circ - \theta)\cos(60^\circ + \theta) = \frac{1}{4}\cos 3\theta$

With $\theta = 50^\circ$: value $= -\frac{\sqrt{3}}{8}$

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

---

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

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

$= \frac{\sin 120^\circ}{\sin 90^\circ} = \frac{\sqrt{3}}{2}$

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

---

24. $\sqrt{1 + \sin 280^\circ} =$

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

$\frac{A}{2} = 140^\circ$, where $\cos\frac{A}{2} + \sin\frac{A}{2}$ is negative.

Ans: (D) $-(\cos 140^\circ + \sin 140^\circ)$

---

25. $\sqrt{1-\sin 240^\circ} =$

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

$\frac{A}{2} = 120^\circ$, where $\cos\frac{A}{2} - \sin\frac{A}{2}$ is negative.

Ans: (A) $-(\cos 120^\circ - \sin 120^\circ)$