EXPRESSWALA ACADEMY

Maths 1A: Multiple and Submultiple Angles

MCQ Test, Set 10

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

A. $\frac{8}{15}$ **B.** $\frac{8}{17}$ **C.** $\frac{4}{17}$ **D.** $\frac{15}{17}$

2. If $\cos A = -\frac{5}{13}$ and $\frac{\pi}{2} < A < \pi$, then $\cos 2A =$

A. $-\frac{119}{169}$ **B.** $-\frac{120}{169}$ **C.** $-\frac{10}{13}$ **D.** $\frac{119}{169}$

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

A. $\frac{1}{13}$ **B.** $\frac{13}{7}$ **C.** $\frac{13}{14}$ **D.** $\frac{1}{14}$

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

A. $\frac{49}{52}$ **B.** $\frac{12}{13}$ **C.** $\frac{47}{76}$ **D.** $\frac{47}{52}$

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

A. $-\frac{13}{16}$ **B.** $-\frac{11}{16}$ **C.** $\frac{11}{16}$ **D.** $-\frac{47}{64}$

6. If $\cos A = \frac{7}{8}$ and $-\pi < A < 0$, then $\sin \frac{A}{2} =$

A. $-\frac{\sqrt{15}}{4}$ **B.** $\frac{1}{4}$ **C.** $-\frac{1}{4}$ **D.** $\frac{1}{16}$

7. If $\tan \frac{A}{2} = -\frac{4}{5}$, then $\cos A =$

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

8. $\frac{\sin 3A}{\sin A} + \frac{\cos 3A}{\cos A} =$

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

9. $\cos 324^\circ =$

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. $\cos 72^\circ - \cos 36^\circ =$

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

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

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

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

12. $\tan^2 7\frac{1}{2}^\circ + \cot^2 7\frac{1}{2}^\circ =$

A. $-30 - 16\sqrt{3}$ **B.** $15 + 8\sqrt{3}$ **C.** $60 + 32\sqrt{3}$ **D.** $30 + 16\sqrt{3}$

13. $\sin^4 67\frac{1}{2}^\circ + \cos^4 67\frac{1}{2}^\circ =$

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

14. The greatest value of $4\left(\sin^6\theta + \cos^6\theta\right)$ is

A. 3 **B.** $\frac{5}{2}$ **C.** 4 **D.** 1

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

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

16. $\cos\frac{7\pi}{17}\cos\frac{14\pi}{17}\cos\frac{28\pi}{17}\cos\frac{56\pi}{17} =$

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

17. $\left(2\cos\frac{10\pi}{17}-1\right)\left(2\cos\frac{20\pi}{17}-1\right)\left(2\cos\frac{40\pi}{17}-1\right)\left(2\cos\frac{80\pi}{17}-1\right) =$

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

18. $\sin 45^\circ + \sin 105^\circ + \sin 165^\circ + \sin 225^\circ =$

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

19. $\sin 15^\circ + \sin 75^\circ + \sin 135^\circ + \sin 195^\circ =$

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

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

20. $\left(\cos\frac{2\pi}{7} + \cos\frac{4\pi}{7} + \cos\frac{6\pi}{7}\right) - \left(\operatorname{cosec}^2\frac{\pi}{7} + \operatorname{cosec}^2\frac{2\pi}{7} + \operatorname{cosec}^2\frac{3\pi}{7}\right) =$

A. $-\frac{17}{2}$ **B.** $-\frac{15}{2}$ **C.** $\frac{17}{2}$ **D.** -17

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

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

22. $\sin 5^\circ \sin 55^\circ \sin 115^\circ =$

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

C. $\frac{\sqrt{6}}{32} - \frac{\sqrt{2}}{32}$ **D.** $\frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{4}$

23. If $\frac{x}{y} = \frac{\tan 37\frac{1}{2}^\circ}{\tan 7\frac{1}{2}^\circ}$, then $\frac{x+y}{x-y} =$

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

24. $\sqrt{1-\sin 220^\circ} =$

A. $\cos 110^\circ + \sin 110^\circ$ **B.** $\cos 110^\circ - \sin 110^\circ$

C. $-(\cos 110^\circ + \sin 110^\circ)$ **D.** $-(\cos 110^\circ - \sin 110^\circ)$

25. $\sqrt{1-\sin 580^\circ} =$

A. $\cos 290^\circ - \sin 290^\circ$ **B.** $-(\cos 290^\circ + \sin 290^\circ)$

C. $-(\cos 290^\circ - \sin 290^\circ)$ **D.** $\cos 290^\circ + \sin 290^\circ$

Key sheet

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

Solutions

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

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

$= \frac{8}{17}$

Ans: (B) $\frac{8}{17}$

---

2. If $\cos A = -\frac{5}{13}$ and $\frac{\pi}{2} < A < \pi$, then $\cos 2A =$

$\sin A = \sqrt{1-\cos^2 A} = \frac{12}{13}$ ($\sin A$ is positive in this quadrant)

$\cos 2A = \cos^2 A - \sin^2 A = -\frac{119}{169}$

Ans: (A) $-\frac{119}{169}$

---

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

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

$= \frac{13}{14}$

Ans: (C) $\frac{13}{14}$

---

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

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

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

$= \frac{47}{52}$

Ans: (D) $\frac{47}{52}$

---

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

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

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

$= -\frac{11}{16}$

Ans: (B) $-\frac{11}{16}$

---

6. If $\cos A = \frac{7}{8}$ and $-\pi < A < 0$, then $\sin \frac{A}{2} =$

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

$\sin \frac{A}{2} = -\frac{1}{4}$

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

---

7. If $\tan \frac{A}{2} = -\frac{4}{5}$, then $\cos A =$

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

$= \frac{9}{41}$

Ans: (D) $\frac{9}{41}$

---

8. $\frac{\sin 3A}{\sin A} + \frac{\cos 3A}{\cos A} =$

$= (3 - 4\sin^2 A) + (4\cos^2 A - 3) = 4\cos 2A$

Ans: (B) $4\cos 2A$

---

9. $\cos 324^\circ =$

$\cos 324^\circ = \cos 36^\circ$

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

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

---

10. $\cos 72^\circ - \cos 36^\circ =$

$\cos 72^\circ = \frac{\sqrt{5}-1}{4},\ \cos 36^\circ = \frac{\sqrt{5}+1}{4}$

$\cos 72^\circ - \cos 36^\circ = -\frac{1}{2}$

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

---

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

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

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

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

---

12. $\tan^2 7\frac{1}{2}^\circ + \cot^2 7\frac{1}{2}^\circ =$

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

$\tan^2 7\frac{1}{2}^\circ + \cot^2 7\frac{1}{2}^\circ = 30 + 16\sqrt{3}$

Ans: (D) $30 + 16\sqrt{3}$

---

13. $\sin^4 67\frac{1}{2}^\circ + \cos^4 67\frac{1}{2}^\circ =$

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

$\sin 135^\circ = \frac{\sqrt{2}}{2}$

$\sin^4 67\frac{1}{2}^\circ + \cos^4 67\frac{1}{2}^\circ = 1 - \frac{1}{2}\cdot\frac{1}{2} = \frac{3}{4}$

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

---

14. The greatest value of $4\left(\sin^6\theta + \cos^6\theta\right)$ 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 4.

Ans: (C) 4

---

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

$\cot A - \tan A = 2\cot 2A$

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

Ans: (D) 2

---

16. $\cos\frac{7\pi}{17}\cos\frac{14\pi}{17}\cos\frac{28\pi}{17}\cos\frac{56\pi}{17} =$

This is $\cos\theta\cos 2\theta\cdots\cos 2^3\theta = \frac{\sin 2^4\theta}{2^4\sin\theta}$ with $\theta = \frac{7\pi}{17}$.

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

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

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

---

17. $\left(2\cos\frac{10\pi}{17}-1\right)\left(2\cos\frac{20\pi}{17}-1\right)\left(2\cos\frac{40\pi}{17}-1\right)\left(2\cos\frac{80\pi}{17}-1\right)=$

$(2\cos\theta-1)(2\cos 2\theta-1)\cdots(2\cos 2^3\theta-1)=\frac{2\cos 2^4\theta+1}{2\cos\theta+1}$ with $\theta=\frac{10\pi}{17}$

$2^4\theta$ differs from $\pm\theta$ by a multiple of 2π, so $\cos 2^4\theta=\cos\theta$ and the value is 1.

Ans: (D) 1

---

18. $\sin 45^\circ+\sin 105^\circ+\sin 165^\circ+\sin 225^\circ=$

$a_1=45^\circ$, $d=60^\circ$, $n=4$, $a_n=225^\circ$

$\text{Sum}=\frac{\sin\left(\frac{a_1+a_n}{2}\right)\sin\frac{nd}{2}}{\sin\frac{d}{2}}=\frac{\sin 135^\circ\ \sin 120^\circ}{\sin 30^\circ}$

$=\frac{\sqrt{6}}{2}$

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

---

19. $\sin 15^\circ+\sin 75^\circ+\sin 135^\circ+\sin 195^\circ=$

$a_1=15^\circ$, $d=60^\circ$, $n=4$, $a_n=195^\circ$

$\text{Sum}=\frac{\sin\left(\frac{a_1+a_n}{2}\right)\sin\frac{nd}{2}}{\sin\frac{d}{2}}=\frac{\sin 105^\circ\ \sin 120^\circ}{\sin 30^\circ}$

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

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

---

20. $\left(\cos\frac{2\pi}{7}+\cos\frac{4\pi}{7}+\cos\frac{6\pi}{7}\right)-\left(\text{cosec}^2\frac{\pi}{7}+\text{cosec}^2\frac{2\pi}{7}+\text{cosec}^2\frac{3\pi}{7}\right)=$

Known results: $\cos\frac{2\pi}{7}+\cos\frac{4\pi}{7}+\cos\frac{6\pi}{7}=-\frac{1}{2}$ and $\text{cosec}^2\frac{\pi}{7}+\text{cosec}^2\frac{2\pi}{7}+\text{cosec}^2\frac{3\pi}{7}=8$

$\text{Value}=-\frac{17}{2}$

Ans: (A) $-\frac{17}{2}$

---

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

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

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

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

---

22. $\sin 5^\circ\sin 55^\circ\sin 115^\circ=$

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

With $\theta=55^\circ$: value $=\frac{\sqrt{6}}{16}-\frac{\sqrt{2}}{16}$

Ans: (B) $\frac{\sqrt{6}}{16}-\frac{\sqrt{2}}{16}$

---

23. If $\frac{x}{y}=\frac{\tan 37\frac{1}{2}^\circ}{\tan 7\frac{1}{2}^\circ}$, then $\frac{x+y}{x-y}=$

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

$=\frac{\sin 45^\circ}{\sin 30^\circ}=\sqrt{2}$

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

---

24. $\sqrt{1-\sin 220^\circ}=$

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

$\frac{A}{2}=110^\circ$, where $\cos\frac{A}{2}-\sin\frac{A}{2}$ is negative.

Ans: (D) $-(\cos 110^\circ-\sin 110^\circ)$

---

25. $\sqrt{1-\sin 580^\circ} =$

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

$\frac{A}{2} = 290^\circ$, where $\cos\frac{A}{2} - \sin\frac{A}{2}$ is positive.

Ans: (A) $\cos 290^\circ - \sin 290^\circ$
