EXPRESSWALA ACADEMY

Maths 1A: Inverse Trigonometric Functions

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. The domain of $\cos^{-1}(5x-4)$ is

A. $[3,5]$ **B.** $[\frac{3}{5},1]$

C. $[-\frac{1}{5},\frac{1}{5}]$ **D.** $[-1,-\frac{3}{5}]$

2. The principal value of $\operatorname{cosec}^{-1}\sqrt{2}$ is

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

3. The principal value of $\tan^{-1}1$ is

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

4. $\sin^{-1}\left(\sin-\frac{3\pi}{10}\right)=$

A. $\frac{3\pi}{10}$ **B.** $-\frac{3\pi}{10}$ **C.** $\frac{4\pi}{5}$ **D.** $\frac{13\pi}{10}$

5. $\sec\left(\sec^{-1}\left(-\frac{7}{4}\right)\right)=$

A. $-\frac{7}{4}$ **B.** $\frac{7}{4}$ **C.** $-\frac{4}{7}$ **D.** $\frac{11}{4}$

6. If $\sin^{-1}\frac{5}{11}=\alpha$, then $\sin^{-1}\left(-\frac{5}{11}\right)=$

A. α **B.** $\pi+\alpha$ **C.** $-\alpha$ **D.** $\frac{\pi}{2}-\alpha$

7. If $\operatorname{cosec}^{-1}9=\alpha$, then $\operatorname{cosec}^{-1}(-9)=$

A. $\pi+\alpha$ **B.** $-\alpha$ **C.** $\frac{\pi}{2}-\alpha$ **D.** α

8. $\tan^{-1}\left(-\frac{7}{2}\right)$ in terms of an inverse cotangent is

A. $\frac{\pi}{2}-\sin^{-1}\frac{7}{2}$ **B.** $\pi+\cot^{-1}\left(-\frac{2}{7}\right)$

C. $\cot^{-1}\left(-\frac{2}{7}\right)$ **D.** $-\pi+\cot^{-1}\left(-\frac{2}{7}\right)$

9. If $\cot^{-1}x=\frac{5\pi}{12}$, then $\tan^{-1}x=$

A. $\frac{5\pi}{12}$ **B.** $-\frac{5\pi}{12}$ **C.** $\frac{7\pi}{12}$ **D.** $\frac{\pi}{12}$

10. $\sin^{-1}\left(-\frac{5}{8}\right)+\cos^{-1}\left(-\frac{5}{8}\right)=$

A. $\frac{\pi}{2}$ **B.** 0 **C.** π **D.** $\frac{\pi}{4}$

11. $\cos^{-1}\frac{7}{25} - \cos^{-1}\frac{4}{5} =$

A. $\cos^{-1}\frac{4}{5}$ **B.** $\sin^{-1}\frac{4}{5}$

C. $\cos^{-1}\left(-\frac{44}{125}\right)$ **D.** $-\cos^{-1}\frac{4}{5}$

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12. $\tan^{-1}\frac{1}{4} + \tan^{-1}\frac{3}{11} =$

A. $\tan^{-1}\frac{23}{44}$ **B.** $\pi + \tan^{-1}\frac{23}{41}$

C. $-\pi + \tan^{-1}\frac{23}{41}$ **D.** $\tan^{-1}\frac{23}{41}$

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13. $\tan^{-1}\frac{7}{2} - \tan^{-1}\frac{1}{3} =$

A. $\pi + \tan^{-1}\frac{19}{13}$ **B.** $-\pi + \tan^{-1}\frac{19}{13}$

C. $\tan^{-1}\frac{23}{6}$ **D.** $\tan^{-1}\frac{19}{13}$

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14. $\tan^{-1}\frac{2}{7} + \tan^{-1}\frac{1}{4} + \tan^{-1}\frac{1}{5} =$

A. $\tan^{-1}\frac{103}{140}$ **B.** $\tan^{-1}\frac{101}{115}$

C. $\tan^{-1}\frac{103}{115}$ **D.** $\tan^{-1}\frac{101}{165}$

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15. $\sin^{-1}\left(-\frac{20}{29}\right)$ written as an inverse cosine is

A. $\cos^{-1}\left(-\frac{21}{29}\right)$ **B.** $-\cos^{-1}\frac{20}{29}$

C. $-\cos^{-1}\frac{21}{29}$ **D.** $\cos^{-1}\frac{21}{29}$

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16. $\cos^{-1}\frac{4}{5}$ written as an inverse tangent is

A. $\tan^{-1}\frac{3}{4}$ **B.** $\tan^{-1}\frac{3}{5}$

C. $\tan^{-1}\frac{4}{3}$ **D.** $\pi - \tan^{-1}\frac{3}{4}$

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17. $2\tan^{-1}\frac{3}{8}$ written as a single inverse cosine is

A. $-\cos^{-1}\frac{55}{73}$ **B.** $\cos^{-1}\left(-\frac{55}{73}\right)$

C. $\cos^{-1}\frac{55}{73}$ **D.** $\cos^{-1}\frac{48}{73}$

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18. $2\tan^{-1}8$ written as a single inverse tangent is

A. $\pi + \tan^{-1}\frac{16}{63}$ **B.** $\tan^{-1}16$

C. $\tan^{-1}\frac{16}{63}$ **D.** $\pi - \tan^{-1}\frac{16}{63}$

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19. The graph of $y = \sin^{-1}x$ is steepest

A. near the end points $x = \pm 1$ **B.** nowhere: it is a straight line

C. at the origin **D.** at $x = \frac{1}{2}$ only

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20. $\tan^{-1}(\tan 3) =$

A. $-3 + \pi$ **B.** 3 **C.** $-3 + 2\pi$ **D.** $3 - \pi$

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21. $\cot^{-1}(\cot 4) =$

A. $4 - \pi$ **B.** $-4 + 2\pi$ **C.** $-4 + \pi$ **D.** 4

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22. For $-1 \le x \le -\frac{1}{2}$, $\cos^{-1}(4x^3 - 3x) =$

A. $3\cos^{-1} x$ **B.** $-(3\cos^{-1} x - 2\pi)$

C. $3\cos^{-1} x - 2\pi$ **D.** $2\pi - 3\cos^{-1} x$

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23. If $\tan^{-1}\frac{6}{x} + \tan^{-1}\frac{24}{x} = \frac{\pi}{2}$, $x > 0$, then $x =$

A. $6\sqrt{17}$ **B.** 12 **C.** 30 **D.** 144

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24. If $\sin^{-1}\frac{11}{x} + \sin^{-1}\frac{60}{x} = \frac{\pi}{2}$, $x > 0$, then $x =$

A. $2\sqrt{165}$ **B.** 71 **C.** $7\sqrt{71}$ **D.** 61

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25. To remove the root in $\sqrt{x^2 - 4}$, use

A. the sine substitution $x = 2\sin\theta$ **B.** the tangent substitution $x = 2\tan\theta$

C. the cosine substitution $x = 2\cos\theta$ **D.** the secant substitution $x = 2\sec\theta$

Key sheet

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

Solutions

1. The domain of $\cos^{-1}(5x-4)$ is

$-1 \le 5x-4 \le 1 \Rightarrow \frac{3}{5} \le x \le 1$

Ans: (B) $\left[\frac{3}{5}, 1\right]$

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2. The principal value of $\operatorname{cosec}^{-1}\sqrt{2}$ is

The angle in $\left[-\frac{\pi}{2}, 0\right) \cup \left(0, \frac{\pi}{2}\right]$ with $\operatorname{cosec}\theta = \sqrt{2}$ is $\frac{\pi}{4}$.

Ans: (C) $\frac{\pi}{4}$

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3. The principal value of $\tan^{-1} 1$ is

The angle in $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ with $\tan\theta = 1$ is $\frac{\pi}{4}$.

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

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4. $\sin^{-1}\left(\sin -\frac{3\pi}{10}\right) =$

$-\frac{3\pi}{10}$ is in $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$, so the value is $-\frac{3\pi}{10}$ itself.

Ans: (B) $-\frac{3\pi}{10}$

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5. $\sec\left(\sec^{-1}\left(-\frac{7}{4}\right)\right) =$

$\sec(\sec^{-1} x) = x$ on the domain of $\sec^{-1}$.

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

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6. If $\sin^{-1}\frac{5}{11} = \alpha$, then $\sin^{-1}\left(-\frac{5}{11}\right) =$

$\sin^{-1}(-x) = -\sin^{-1} x$

$\sin^{-1}\left(-\frac{5}{11}\right) = -\alpha$

Ans: (C) $-\alpha$

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7. If $\operatorname{cosec}^{-1} 9 = \alpha$, then $\operatorname{cosec}^{-1}(-9) =$

$\operatorname{cosec}^{-1}(-x) = -\operatorname{cosec}^{-1} x$

$\operatorname{cosec}^{-1}(-9) = -\alpha$

Ans: (B) $-\alpha$

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8. $\tan^{-1}\left(-\frac{7}{2}\right)$ in terms of an inverse cotangent is

$\tan^{-1} x = -\pi + \cot^{-1}\frac{1}{x},\ x < 0$

$\tan^{-1}\left(-\frac{7}{2}\right) = -\pi + \cot^{-1}\left(-\frac{2}{7}\right)$

Ans: (D) $-\pi + \cot^{-1}\left(-\frac{2}{7}\right)$

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9. If $\cot^{-1} x = \frac{5\pi}{12}$, then $\tan^{-1} x =$

$\tan^{-1} x = \frac{\pi}{2} - \frac{5\pi}{12} = \frac{\pi}{12}$

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

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10. $\sin^{-1}\left(-\frac{5}{8}\right) + \cos^{-1}\left(-\frac{5}{8}\right) =$

$\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}$ for every x in the common domain.

Ans: (A) $\frac{\pi}{2}$

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11. $\cos^{-1}\frac{7}{25} - \cos^{-1}\frac{4}{5} =$

$\sqrt{1-x^2} = \frac{24}{25},\ \sqrt{1-y^2} = \frac{3}{5}$

Here $x \le y$.

$xy + \sqrt{1-x^2}\sqrt{1-y^2} = \frac{7}{25}\cdot\frac{4}{5} + \frac{24}{25}\cdot\frac{3}{5} = \frac{4}{5}$

So the formula gives $\cos^{-1}\frac{4}{5}$.

Ans: (A) $\cos^{-1}\frac{4}{5}$

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12. $\tan^{-1}\frac{1}{4} + \tan^{-1}\frac{3}{11} =$

Here $xy = \frac{3}{44} < 1$.

$\frac{x+y}{1-xy} = \frac{\frac{23}{44}}{\frac{41}{44}} = \frac{23}{41}$

$= \tan^{-1}\frac{23}{41}$

Ans: (D) $\tan^{-1}\frac{23}{41}$

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13. $\tan^{-1}\frac{7}{2} - \tan^{-1}\frac{1}{3} =$

Here $xy = \frac{7}{6} > -1$.

$\frac{x-y}{1+xy} = \frac{\frac{19}{6}}{\frac{13}{6}} = \frac{19}{13}$

$= \tan^{-1}\frac{19}{13}$

Ans: (D) $\tan^{-1}\frac{19}{13}$

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14. $\tan^{-1}\frac{2}{7} + \tan^{-1}\frac{1}{4} + \tan^{-1}\frac{1}{5} =$

$S_1 = \frac{103}{140},\ S_2 = \frac{5}{28},\ S_3 = \frac{1}{70}$

$\tan^{-1}\frac{S_1 - S_3}{1-S_2} = \tan^{-1}\frac{101}{115}$

Ans: (B) $\tan^{-1}\frac{101}{115}$

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15. $\sin^{-1}\left(-\frac{20}{29}\right)$ written as an inverse cosine is

$x < 0$, so $\sin^{-1}x = -\cos^{-1}\sqrt{1-x^2} = -\cos^{-1}\frac{21}{29}$.

Ans: (C) $-\cos^{-1}\frac{21}{29}$

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16. $\cos^{-1}\frac{4}{5}$ written as an inverse tangent is

$\cos\theta = \frac{4}{5}$, $\sin\theta = \frac{3}{5}$, so $\tan\theta = \frac{3}{4}$.

Ans: (A) $\tan^{-1}\frac{3}{4}$

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17. $2\tan^{-1}\frac{3}{8}$ written as a single inverse cosine is

$\frac{1-x^2}{1+x^2} = \frac{55}{73}$

For $x \ge 0$, $2\tan^{-1}x = \cos^{-1}\frac{1-x^2}{1+x^2}$.

Ans: (C) $\cos^{-1}\frac{55}{73}$

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18. $2\tan^{-1}8$ written as a single inverse tangent is

Use $2\tan^{-1}x = \pi + \tan^{-1}\frac{2x}{1-x^2}$ for $x > 1$.

$\frac{2x}{1-x^2} = -\frac{16}{63}$

Ans: (D) $\pi - \tan^{-1}\frac{16}{63}$

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19. The graph of $y = \sin^{-1} x$ is steepest

This follows from the shape of the graph described in the lesson on graphs.

Ans: (A) near the end points $x = \pm 1$

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20. $\tan^{-1}(\tan 3) =$

3 lies outside $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$; bring it into the range using the periodic graph.
The value is $3 - \pi$.

Ans: (D) $3 - \pi$

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21. $\cot^{-1}(\cot 4) =$

4 lies outside $(0, \pi)$; bring it into the range using the periodic graph.
The value is $4 - \pi$.

Ans: (A) $4 - \pi$

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22. For $-1 \le x \le -\frac{1}{2}$, $\cos^{-1}(4x^3 - 3x) =$

Put $x = \cos\theta$, so that the expression inside is a ratio of 3θ.
For $-1 \le x \le -\frac{1}{2}$ the angle has to be brought back into the principal range.
$\cos^{-1}(4x^3 - 3x) = 3\cos^{-1} x - 2\pi$

Ans: (C) $3\cos^{-1} x - 2\pi$

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23. If $\tan^{-1}\frac{6}{x} + \tan^{-1}\frac{24}{x} = \frac{\pi}{2}$, $x > 0$, then $x =$

The product of the two values must be 1: $x^2 = 144$.

Ans: (B) 12

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24. If $\sin^{-1}\frac{11}{x} + \sin^{-1}\frac{60}{x} = \frac{\pi}{2}$, $x > 0$, then $x =$

$x = \sqrt{11^2 + 60^2} = 61$.

Ans: (D) 61

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25. To remove the root in $\sqrt{x^2 - 4}$, use

$4\sec^2\theta - 4 = 4\tan^2\theta$.

Ans: (D) the secant substitution $x = 2\sec\theta$
