

1. Find the value of $\sin \left(2\sin^{-1} \left(\frac{1}{4} \right) \right)$
2. Find the value of $\cos \left(2\cos^{-1} \left(\frac{1}{3} \right) \right)$
3. Find the value of $\cos \left(2\tan^{-1} \left(\frac{1}{3} \right) \right)$
4. Find the value of $\sin \left(\frac{1}{2} \cot^{-2} \left(\frac{3}{4} \right) \right)$
5. Find the value of $\tan^{-1} \left(\frac{3\pi}{4} - 2\tan^{-1} \left(\frac{3}{4} \right) \right)$
6. Prove that $\sin \left(2\sin^{-1} \left(\frac{1}{2} \right) \right) = \frac{\sqrt{3}}{2}$
7. Prove the $\sin \left(3\sin^{-1} \left(\frac{1}{3} \right) \right) = \frac{23}{27}$
8. Prove that $\cos \left(\frac{1}{2} \cos^{-1} \left(\frac{1}{8} \right) \right) = \frac{3}{4}$
9. Prove that $\cos \left(\frac{1}{2} \cos^{-1} \left(-\frac{1}{10} \right) \right) = \frac{3\sqrt{5}}{10}$
10. Prove that $\sin \left(\frac{1}{2} \cos^{-1} \left(\frac{1}{9} \right) \right) = \frac{2}{3}$
11. Prove that $\sin \left(\frac{1}{4} \tan^{-1} \sqrt{63} \right) = \frac{1}{2\sqrt{2}}$
12. Prove that $\cos \left(\frac{1}{4} \left(\tan^{-1} \left(\frac{24}{7} \right) \right) \right) = \frac{3}{\sqrt{10}}$
13. Prove that $\tan \left(\frac{1}{2} \cos^{-1} \left(\frac{2}{3} \right) \right) = \frac{1}{\sqrt{5}}$
14. Prove that $\tan \left(2\tan^{-1} \left(\frac{1}{5} \right) - \frac{\pi}{4} \right) = -\frac{7}{17}$
15. Prove that $\tan \left(\frac{3\pi}{4} - \frac{1}{4} \sin^{-1} \left(-\frac{4}{5} \right) \right) = \frac{1-\sqrt{5}}{2}$

(MATHEMATICS)

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16. The domain of the function $f(x) = \sin^{-1} \left(\frac{x^2 - 3x + 2}{x^2 + 2x + 7} \right)$ is. [Main, 2022]
 (A) $[1, \infty)$ (B) $(-1, 2]$ (C) $[-1, \infty)$ (D) $(-\infty, 2]$
17. The domain of the function $\cos^{-1} \left(\frac{2\sin^{-1} \left(\frac{1}{4x^2 - 1} \right)}{\pi} \right)$ is: [Main, 2022]
 (A) $\mathbb{R} - \left\{ -\frac{1}{2}, \frac{1}{2} \right\}$ (B) $(-\infty, -1] \cup [1, \infty) \cup \{0\}$
 (C) $(-\infty, \frac{-1}{2}) \cup (\frac{1}{2}, \infty) \cup \{0\}$ (D) $(-\infty, \frac{-1}{\sqrt{2}}] \cup [\frac{1}{\sqrt{2}}, \infty) \cup \{0\}$
18. Considering only the principal values of the inverse trigonometric functions, the domain of the function $f(x) = \cos^{-1} \left(\frac{x^2 - 4x + 2}{x^2 + 3} \right)$ is: [Main, 2022]
 (A) $(-\infty, \frac{1}{4}]$ (B) $[-\frac{1}{4}, \infty)$ (C) $(-\frac{1}{3}, \infty)$ (D) $(-\infty, \frac{1}{3}]$
19. Considering the principal values of the inverse trigonometric functions, the sum of all the solutions of the equation $\cos^{-1}(x) - 2\sin^{-1}(x) = \cos^{-1}(2x)$ is equal to:
 (A) 0 (B) 1 (C) $\frac{1}{2}$ (D) $-\frac{1}{2}$ [Main, 2022]
20. The domain of the function $f(x) = \sin^{-1} [2x^2 - 3] + \log_2 \left(\log_{\frac{1}{2}} (x^2 - 5x + 5) \right)$ where $[t]$ is the greatest integer function, is: [Main, 2022]
 (A) $\left(-\sqrt{\frac{5}{2}}, \frac{5-\sqrt{5}}{2} \right)$ (B) $\left(\frac{5-\sqrt{5}}{2}, \frac{5+\sqrt{5}}{2} \right)$
 (C) $\left(1, \frac{5-\sqrt{5}}{2} \right)$ (D) $\left[1, \frac{5+\sqrt{5}}{2} \right)$
21. If the inverse trigonometric functions take principal values, then $\cos^{-1} \left(\frac{3}{10} \cos \left(\tan^{-1} \left(\frac{4}{3} \right) \right) \right) + \frac{2}{5} \sin \left(\tan^{-1} \left(\frac{4}{3} \right) \right)$ is equal to: [Main, 2022]
 (A) 0 (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{6}$
22. The domain of the function $f(x) = \frac{\cos^{-1} \left(\frac{x^2 - 5x + 6}{x^2 - 9} \right)}{\log_e (x^2 - 3x + 2)}$ is [Main, 2022]
 (A) $(-\infty, 1) \cup (2, \infty)$ (B) $(2, \infty)$
 (C) $\left[-\frac{1}{2}, 1 \right) \cup (2, \infty)$ (D) $\left[-\frac{1}{2}, 1 \right) \cup (2, \infty) - \left\{ \frac{3+\sqrt{5}}{2}, \frac{3-\sqrt{5}}{2} \right\}$

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23. Let $x * y = x^2 + y^3$ and $(x * 1) * 1 = x * (1 * 1)$.

Then a value of $2\sin^{-1} \left(\frac{x^4 + x^2 - 2}{x^4 + x^2 + 2} \right)$ is

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

(B) $\frac{\pi}{3}$

(C) $\frac{\pi}{2}$

(D) $\frac{\pi}{6}$

[Main, 2022]

24. The domain of the function $f(x) = \sin^{-1} \left(\frac{3x^2 + x - 1}{(x-1)^2} \right) + \cos^{-1} \left(\frac{x-1}{x+1} \right)$ is [Main, 2021]

(A) $\left[0, \frac{1}{4}\right]$

(B) $[-2, 0] \cup \left[\frac{1}{4}, \frac{1}{2}\right]$

(C) $\left[\frac{1}{4}, \frac{1}{2}\right] \cup \{0\}$

(D) $\left[0, \frac{1}{2}\right]$



(MATHEMATICS)

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ANSWER KEY

1. $\frac{\sqrt{15}}{8}$ 2. $-\frac{7}{9}$ 3. $\frac{4}{5}$ 4. $\frac{2}{\sqrt{5}}$ 5. $\frac{41}{17}$ 16. (C) 17. (D)
18. (B) 19. (A) 20. (C) 21. (C) 22. (D) 23. (B) 24. (C)

