CLASS 12 MATHEMATICS EXTRA QUESTIONS

Class 12 Mathematics Chapter 2 Inverse Trigonometric Functions – Extra Questions with Answers

Extra practice questions for Class 12 Maths Chapter 2 (Inverse Trigonometric Functions), beyond the textbook. These Class 12 Mathematics Chapter 2 important questions are handy for last-minute exam practice.

Contents

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Very Short Answer Questions (1 mark)

Q1. What is the range of $\cos^{-1}x$?
Ans: $[0, \pi]$.

Q2. Find the principal value of $\sin^{-1}(1/2)$.
Ans: $\pi/6$.

Q3. Find the principal value of $\tan^{-1}(1)$.
Ans: $\pi/4$.

Q4. Is $\sin^{-1}x$ an odd or even function?
Ans: Odd function ($\sin^{-1}(-x)=-\sin^{-1}x$).

Q5. What is the domain of $\sec^{-1}x$?
Ans: $R-(-1,1)$, i.e. $|x|\geq 1$.

Short Answer Questions (2–3 marks)

Q6. Find the value of $\cos^{-1}(-1/2)$.
Ans: $\cos^{-1}(-1/2)=\pi-\cos^{-1}(1/2)=\pi-\pi/3=2\pi/3$.

Q7. Prove that $\tan^{-1}(1)+\tan^{-1}(2)+\tan^{-1}(3)=\pi$.
Ans: Using $\tan^{-1}x+\tan^{-1}y=\pi+\tan^{-1}((x+y)/(1-xy))$ when $xy>1$:
$\tan^{-1}(2)+\tan^{-1}(3)=\pi+\tan^{-1}((2+3)/(1-6))=\pi+\tan^{-1}(-1)=\pi-\pi/4=3\pi/4$. Adding $\tan^{-1}(1)=\pi/4$: total$=3\pi/4+\pi/4=\pi$.

Q8. Simplify $\sin(\cos^{-1}x)$ in terms of x.
Ans: If $\cos^{-1}x=\theta$, then $\cos\theta=x$, so $\sin\theta=\sqrt{1-x^2}$ (since $\theta\in[0,\pi]$, $\sin\theta\geq 0$). So $\sin(\cos^{-1}x)=\sqrt{1-x^2}$.

Higher-Order Thinking / Application Questions

Q9. Prove that $2\tan^{-1}(1/2)+\tan^{-1}(1/7)=\tan^{-1}(31/17)$, showing all steps, and explain why care must be taken with the sum formula's domain restriction throughout.
Ans: First, find $2\tan^{-1}(1/2)$ using the double angle-like formula $\tan^{-1}x+\tan^{-1}x=\tan^{-1}(2x/(1-x^2))$ valid since $x^2=1/4<1$: $2\tan^{-1}(1/2)=\tan^{-1}((2\times 1/2)/(1-1/4))=\tan^{-1}(1/(3/4))=\tan^{-1}(4/3)$. Now add $\tan^{-1}(4/3)+\tan^{-1}(1/7)$: since $xy=(4/3)(1/7)=4/21<1$, we use the direct sum formula: $\tan^{-1}((4/3+1/7)/(1-4/21))=\tan^{-1}((28/21+3/21)/(17/21))=\tan^{-1}((31/21)/(17/21))=\tan^{-1}(31/17)$. This confirms the identity. Throughout, care must be taken because the addition formula $\tan^{-1}x+\tan^{-1}y=\tan^{-1}((x+y)/(1-xy))$ is only valid (giving a result directly, without needing to add or subtract π) when $xy<1$; if $xy>1$ an extra $\pm\pi$ term must be added depending on the signs of x and y, since without this adjustment the formula could give a value outside the correct principal value range of $\tan^{-1}$.

Q10. Explain, using the concept of function invertibility, why we cannot simply say $\sin^{-1}(\sin x)=x$ for all real x, and specify the exact condition under which this identity does hold.
Ans: The function sin(x) is periodic (period 2π) and is not one-to-one over its entire domain (all real numbers) — multiple different x values (e.g. $x=0$, $x=\pi$, $x=2\pi$, etc.) can produce the same sin(x) output, meaning sin(x) has no true inverse function over all of R. To define an inverse, mathematicians restrict

sin(x) to a specific interval where it IS one-to-one (strictly increasing/decreasing and covers the full range $[-1,1]$ exactly once), which is chosen to be $[-\pi/2, \pi/2]$ — this restricted version is what $\sin^{-1}x$ is actually the inverse of. Consequently, the identity $\sin^{-1}(\sin x)=x$ only holds true when x itself already lies within this specific principal value domain, i.e. when $x\in[-\pi/2, \pi/2]$. If x lies outside this interval (e.g. $x=3\pi/4$), then $\sin^{-1}(\sin x)$ will NOT simply return x, but instead will return some other value within $[-\pi/2, \pi/2]$ that has the same sine value as x (for $x=3\pi/4$, $\sin(3\pi/4)=\sqrt{2}/2$, and $\sin^{-1}(\sqrt{2}/2)=\pi/4$, not $3\pi/4$) — this is a direct consequence of $\sin^{-1}x$ being defined as the inverse of the domain-restricted sine function, not the full periodic sine function, so the identity $\sin^{-1}(\sin x)=x$ is only guaranteed within the principal value domain of sin(x) itself.

Class 12 Mathematics Chapter 2 – Solutions and Notes

For complete step-by-step answers and a quick summary, check the Class 12 Mathematics Chapter 2 Solutions and Class 12 Mathematics Chapter 2 Revision Notes.

See also: Chapter 1 | Chapter 2

Practice more: Chapter 1

Quick revision: Chapter 1