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VCE Specialist Mathematics ½

Advanced Trigonometric Functions Exam Skills [3.5]

Homework

Admin Info & Homework Outline:

Student Name	
Questions You Need Help For	
Compulsory Questions	Pg 02-Pg 16

Section A: Compulsory Questions

Sub-Section [3.5.1]: Simplify the Composition of Inverse Trigonometric Functions

Question 1

a. Simplify $\sin\left(\arcsin\left(\frac{1}{5}\right)\right)$.

b. Simplify $\sin(\arctan(2))$.

c. Simplify $\cos\left(\arcsin\left(\frac{3}{5}\right)\right)$.

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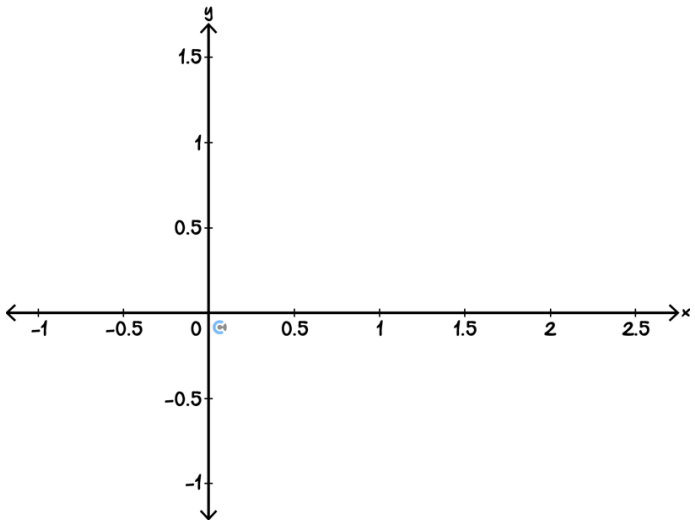
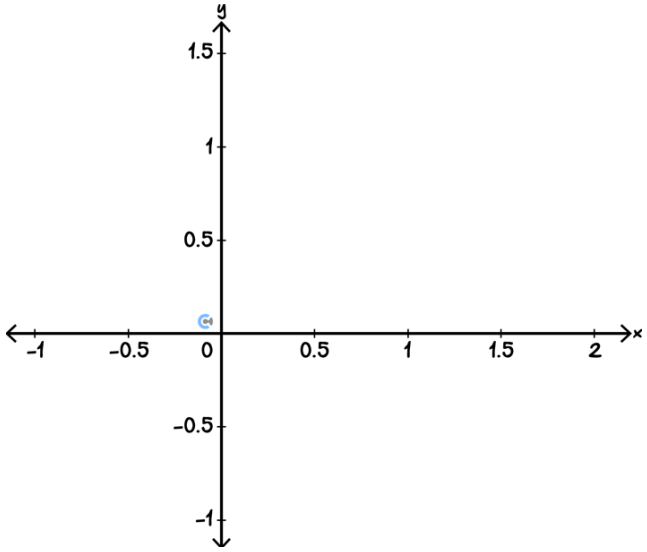
Question 2

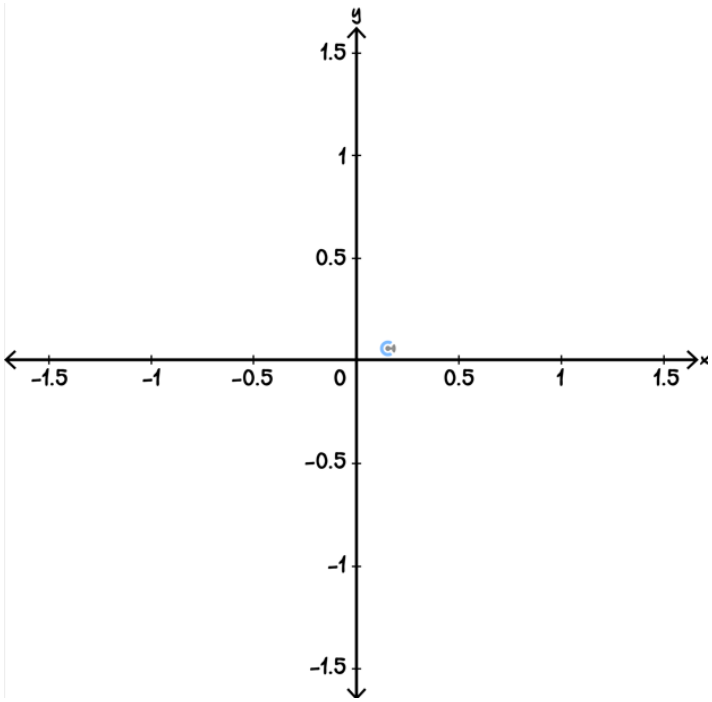
a. Simplify and sketch the graph of $f(x) = \cos(\arcsin(x-1))$.



b. Simplify and sketch the graph of $f(x) = \sin(\arccos(2x+1))$.



c. Simplify and sketch the graph of $\tan(\arcsin(x))$.



Question 3

a. Simplify and state the maximal domain of $f(x) = \tan(\arcsin(2x - 1)) + \cos(\arctan(x + 2))$.

b. Simplify and state the maximal domain of $f(x) = \sin(\arccos(1 - x^2)) + \cos(\arcsin(x - 1))$.

c. Simplify and state the maximal domain $f(x) = \tan(\arcsin(2x + 1)).\cos(\arctan(3x))$.

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Sub-Section [3.5.2]: Simplify $a\cos(x) + b\sin(x)$

Question 4

a. Express $\sin(x) + \cos(x)$ in the form $r\sin(x + \alpha)$.

b. Express $3\sin(x) + \sqrt{3}\cos(x)$ in the form $r\sin(x + \alpha)$.

c. Express $2\cos(x) + \sqrt{2}\sin(x)$ in the form $r\cos(x - \alpha)$.

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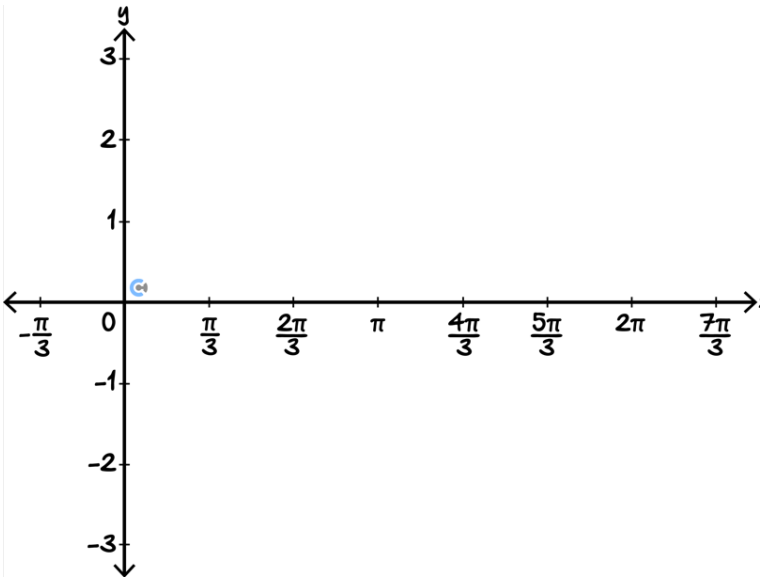
Question 5

a. Solve $\sin(x) - \sqrt{3}\cos(x) = 1$ for $0 \leq x \leq 2\pi$.

b. Solve $3\sin(x) - \sqrt{3}\cos(x) = \sqrt{3}$ for $0 \leq x < 2\pi$.

c. Sketch the graph of $f(x) = \sqrt{3}\cos(x) - \sin(x)$ for $0 \leq x \leq 2\pi$. Label all turning points, endpoints and axes intercept with coordinates.



Question 6

a. Find the maximum and minimum value of $f(x) = 5\sin(x) + 12\cos(x)$.

b. Solve $2\sin\left(x-\frac{\pi}{6}\right)+2\sqrt{3}\cos\left(x-\frac{\pi}{6}\right)=2$ for $0\leq x\leq 2\pi$.

c. Show that for $a>0$.

$a\sin(2x)-b\cos^2(x)=\sqrt{4a^2+b^2}\cos(x)\sin(x-\alpha)$, where $\alpha=\arctan\left(\frac{b}{2a}\right)$.

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Sub-Section [3.5.3]: Apply Product-to-Sum and Sum-to-Product Identities to Simplify Trigonometric Expressions

Question 7

a. Express $\sin(4\theta)\cos(2\theta)$ as a sum or difference.

b. Express $2\cos(3A)\cos(5A)$ as a sum or difference.

c. Express $\cos(4A)\sin(2A)$ as a sum or difference.

d. Express $\sin(2\alpha) + \sin(2\beta)$ as a product.

e. Express $\cos(2x) + \cos(2y)$ as a product.

f. Express $\sin(x + h) - \cos(x)$ as a product.

Question 8

a. Solve $\sin(3\theta) + \sin(\theta) = 0$ for $0 \leq \theta \leq 2\pi$.

b. Solve $\cos(4x) + \cos(2x) = 0$ for $0 \leq x \leq \pi$.

c. Solve $\sin(x) - \sin\left(\frac{3\pi}{4} - x\right) = 0$ for $0 \leq \theta \leq 2\pi$.

Question 9

a. Express $|a|\sin(x) - |a|\sin(3x)$ as a product and hence find its maximum and minimum values in terms of a.

b. If $\alpha + \beta + \gamma = \pi$, show that $\cos(\alpha) + \cos(\beta) + \cos(\gamma) = 1 + 4\sin\left(\frac{\alpha}{2}\right)\sin\left(\frac{\beta}{2}\right)\sin\left(\frac{\gamma}{2}\right)$.

c. Solve the equation $\sin(3x) + \sin(x) - \sin(4x) = 0$ for $x \in [0, 2\pi]$.

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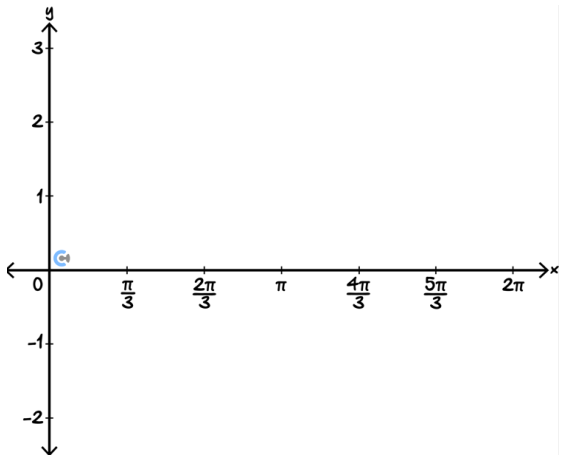
Sub-Section: The 'Final Boss'

Question 10

a. Solve the equation $\sin(2x) + \sin(4x) = 0, x \in [0, \pi]$.

b. Consider the function $f: [0, 2\pi] \to \mathbb{R}, f(x) = \sqrt{3}\cos\left(x - \frac{\pi}{6}\right) + \cos\left(x + \frac{\pi}{3}\right)$.

i. Sketch the graph of f on the axes below. Label all axes intercepts, turning points and endpoints with coordinates.



ii. Use your sketch to solve the equation $f(x) = 1$.

iii. Hence, find $\{x : f(x) > 1\}$.

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