

AP Precalculus
Trigonometric Inequalities

Trigonometric Inequalities | APPC-U03-P18

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for closed interval to tolerance, interval to tolerance, interval union to tolerance, correct intersection and counterexample, correct interval and boundary counterexample and correct set and boundary counterexample.

8 PDFs and a README; 111 buyer pages.

AP Precalculus

Trigonometric Inequalities

Name: _____ Date: _____ Class: _____

Answer each question and record the matching bank letter. Give exact values. A value without its unit is not a complete answer.

Certified numerical evidence locates the crossings of $\sin x$ and $0.2x + 0.1$ at 0.125411 and 2.498473 on $[0, 4]$. Solve the nonstrict inequality to the nearest thousandth.

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Supplied evidence	Value
equality points	0.125410601 2.498473192

Condition or evidence	Supplied value
Original inequality	$\sin x \geq 0.2x + 0.1$
Requested precision	nearest thousandth
Given shape evidence	the difference is nonnegative exactly between the crossings
Given window	$[0, 4]$

Bank label: _____

Solve $-\sin(2x - \frac{\pi}{2}) \geq 0$ on $[0, \pi]$. Track the output reversal before mapping the inner-angle intervals.

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Condition or evidence	Supplied value
Original inequality	$-\sin(2x - \pi/2) \geq 0$
Input interval	$[0, \pi]$

Bank label: _____

Solve $-2 \cos x + 1 \leq 0$ on $[0, 2\pi)$. Show the order reversal caused by division by -2 .

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Condition or evidence	Supplied value
Original inequality	$-2 \cos x + 1 \leq 0$
Input interval	$[0, 2\pi)$

Bank label: _____

Solve $\sin x(1 + \cos x) \geq 0$ on $[0, 2\pi]$. Use that $1 + \cos x$ never becomes negative but does vanish at π .

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Condition or evidence	Supplied value
Original inequality	$\sin x(1 + \cos x) \geq 0$
Input interval	$[0, 2\pi]$

Bank label: _____

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Name: _____ Date: _____ Class: _____

Answer each question and show your reasoning in the workspace. Give exact values rather than decimals unless the question supplies a decimal. A value without its unit is not a complete answer.

Solve $\sin x < 0$ OR $\cos x \leq 0$ on $[0, 2\pi)$. Decide which boundaries are contributed by only one condition.

Solve $\sin x < 0$ OR $\cos x \leq 0$ on $[0, 2\pi)$. Decide which boundaries are contributed by only one condition.

Condition or evidence	Supplied value
Given conditions	$\sin x < 0$
	$\cos x \leq 0$
Logical connective	OR
Input interval	$[0, 2\pi)$

During $0 \leq t \leq 12$ hours, a temperature follows $T(t) = 50 + 10 \sin(\pi \frac{t}{6})$. When is $T > 55$, and for how many total hours?

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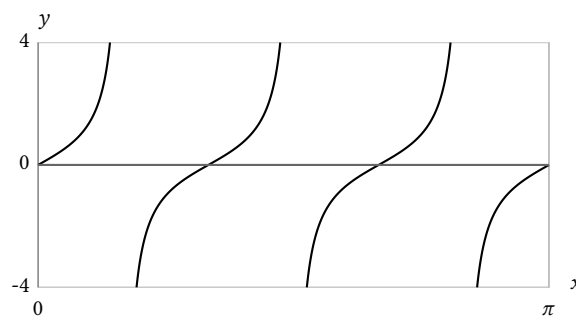
Condition or evidence	Supplied value
Required condition	$T > 55$
Given model	$T(t) = 50 + 10 \sin(\pi \frac{t}{6})$
Time interval	$[0, 12]$ hours

For $0 \leq t \leq 10$, $V(t) = 12 + 4 \cos(\pi \frac{t}{5})$. When is $V \leq 8$, and what is the total duration?

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Condition or evidence	Supplied value
Required condition	$V \leq 8$
Given model	$V(t) = 12 + 4 \cos(\pi \frac{t}{5})$
Time interval	$[0, 10]$ hours

Solve $\tan(3x) < 0$ on $[0, \pi]$, marking the three scaled poles before reading signs.



Condition or evidence	Supplied value
Original inequality	$\tan(3x) < 0$
Input interval	$[0, \pi]$

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Name: _____ Date: _____ Class: _____

Begin at START. Answer the card, then find the matching final answer at the top of another card. Use the recording sheet for your reasoning. Visit each card once and continue to FINISH.

Incoming: $[0, 0.125] \cup [2.498, 4]$

Solve $\tan x \geq -\sqrt{3}$ on $[0, \pi)$, treating the two sides of $\frac{\pi}{2}$ as separate branches.

Solve $\tan x \geq -\sqrt{3}$ on $[0, \pi)$, treating the two sides of $\frac{\pi}{2}$ as separate branches.

Condition or evidence	Supplied value
Original inequality	$\tan x \geq -\sqrt{3}$
Input interval	$[0, \pi)$

Your response: _____

Incoming: $[-2\pi, \pi]$

Let $\alpha = \arccos(0.2)$. Solve $\cos x \leq 0.2$ on $[0, 2\pi)$ in terms of α .

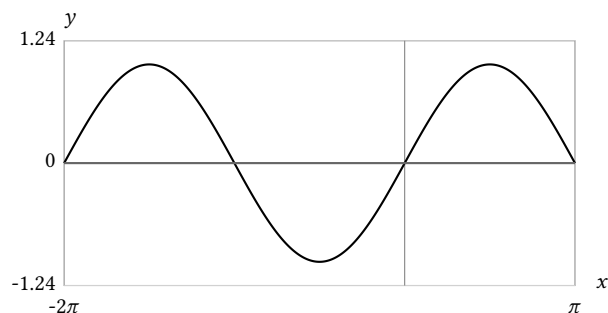
Let $\alpha = \arccos(0.2)$. Solve $\cos x \leq 0.2$ on $[0, 2\pi)$ in terms of α .

Condition or evidence	Supplied value
Original inequality	$\cos x \leq 0.2$
Input interval	$[0, 2\pi)$

Your response: _____

Incoming: $(\frac{\pi}{2}, \pi)$

Solve $\sin x \geq 0$ on $[-2\pi, \pi]$, using signed cycles and all equality zeros.

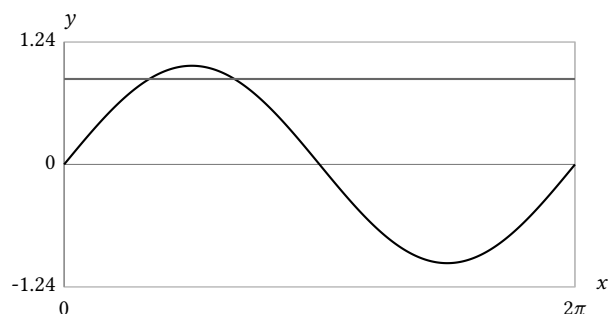


Condition or evidence	Supplied value
Original inequality	$\sin x \geq 0$
Input interval	$[-2\pi, \pi]$

Your response: _____

Incoming: $[-2, 2]$

Solve $\sin x > \frac{\sqrt{3}}{2}$ on $[0, 2\pi]$.



Condition or evidence	Supplied value
Original inequality	$\sin x > \frac{\sqrt{3}}{2}$
Input interval	$[0, 2\pi]$

Your response: _____

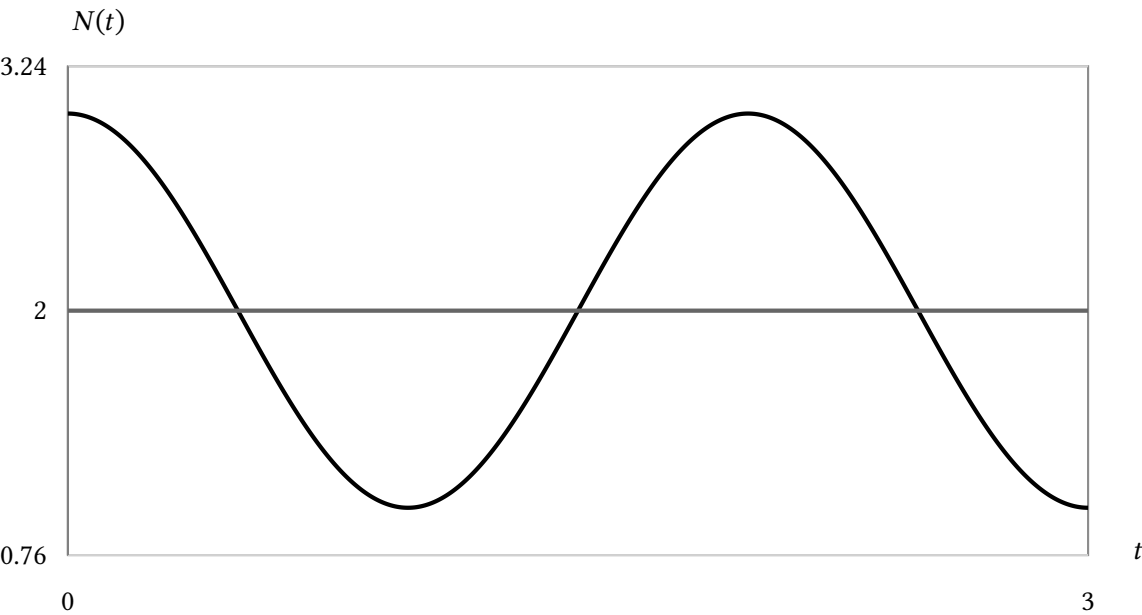
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Name: _____ Date: _____ Class: _____

Evaluate the supplied statement or method. Say whether it is correct, repair it if it is not, and verify the result exactly. Not every prompt contains an error.

For $0 \leq t \leq 3$, $N(t) = 2 + \cos(\pi t)$. Find when $N > 2$ and add the unequal visible window lengths. First choose and justify a valid method. Method A: Add the actual lengths of the two admitted time windows. Method B: Multiply the number of windows by a common assumed length.



Condition or evidence	Supplied value
Required condition	$N > 2$
Given model	$N(t) = 2 + \cos(\pi t)$
Time interval	$[0, 3]$ hours

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Full Worked Solutions - excerpt

Worked example

Problem. Determine the solution set of $\cos x > 1$ on $[0, 2\pi]$ without solving an equality first.

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Condition or evidence	Supplied value
Original inequality	$\cos x > 1$
Input interval	$[0, 2\pi]$

Answer. $\emptyset$

Explanation and check.

Cosine's maximum value is 1, so it can never be strictly greater than 1. The solution set is empty.

Worked example

Problem. Solve $-3 \sin x + 2 < -1$ on $[0, 2\pi]$, reversing the inequality when the sine term is isolated.

Solve $-3 \sin x + 2 < -1$ on $[0, 2\pi]$, reversing the inequality when the sine term is isolated.

Condition or evidence	Supplied value
Original inequality	$-3 \sin x + 2 < -1$
Input interval	$[0, 2\pi]$

Answer. $\emptyset$

Explanation and check.

Isolation gives $\sin x > 1$. Since the upper endpoint of sine's range is 1, the strict inequality is impossible.