

AP Precalculus
Polar Models in Context

Polar Models in Context | APPC-U03-P30

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for feasibility decision, two model choices and noninterchangeability, supported model, admissibility decision, feasibility and repair and decision.

8 PDFs and a README; 56 buyer pages.

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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.

A boundary circle centered at $(3, 0)$ with radius 3 satisfies $r^2 = 6r \cos \theta$. Find its nonzero radial model and the angles where it gives a forward boundary point. 	An accepted model $r = 5 - \sin \theta$ is explicitly valid only for $0 \leq \theta \leq \pi$. A report requests the modeled location at $\theta = 7\frac{\pi}{6}$. What should be reported?
Models A and B have equal held-out RMSE 0.18. In two safety-critical directions A's residuals are 0.08 and 0.11, while B's are 0.32 and 0.29; tolerance there is 0.15. Which model is validated for the safety use? 	A signed radial signal is $r = 5 \cos \theta$, and $\theta = \pi \frac{t-2}{4}$ so that the polar axis is reached at $t = 2$s. Express r as a function of t.
A radius graph has maxima at 0 and π and minima at $\frac{\pi}{2}$ and $3\frac{\pi}{2}$. Which candidate fits: $r = 5 + 2 \cos \theta$, $r = 5 + 2 \cos(2\theta)$, or $r = 5 + 2 \sin(2\theta)$? 	Radar gives the storm edge's distance from a station for every bearing at one instant. Choose a representation for drawing the current edge, then decide whether the same data can predict when the edge reaches a town.

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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.

A device claims that $d(\theta) = 2 \cos \theta$ is its nonnegative distance to an obstacle for every $0 \leq \theta \leq 2\pi$. Is the model physically admissible as stated?

An unlabeled polar loop is used to claim that a vehicle moved more slowly where the curve bends sharply. Diagnose the claim.

A student claims: “Model B has the smaller mean absolute error because it exactly matches the last observation more closely.” Diagnose the first invalid step or assumption, give the corrected conclusion, and justify the correction. Then complete or verify the underlying task: Held-out radii are 5.0, 4.2, 3.1, 4.1. Models A and B predict (4.9, 4.0, 3.2, 4.3) and (5.4, 4.1, 2.7, 4.0). Which has the smaller mean absolute radial error?

A scanner can measure at most 10 m, but a proposed all-bearing model is $r = 7 + 4 \cos \theta$. Is the model within the hardware range?

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Full Worked Solutions - excerpt

Worked example

Problem. A rotating sensor obeys $r = 2 + \cos \theta$ and $\theta = \pi t$, with t in seconds. Write its radius as a function of time.

Answer. $r(t) = 2 + \cos(\pi t)$

Explanation and check.

Substitute the supplied angle law $\theta = \pi t$ into the radial rule.

Worked example

Problem. A circular safety boundary has model $r = 6$. What boundary point corresponds to $\theta = \pi$?

Answer. $(-6, 0)$

Explanation and check.

At angle π , cosine is -1 and sine is 0 , so $(r \cos \theta, r \sin \theta) = (-6, 0)$.