

Precalculus
Polar Coordinates and Graphs

6-topic bundle | 576 problems | Four activity formats

-
- 01 Equivalent Polar Coordinates**
View individual product and its full preview
 - 02 Polar and Rectangular Coordinate Conversion**
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 - 04 Polar Symmetry and Curve Tracing**
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 - 05 Features of Polar Equations**
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 - 06 Polar Rates of Change and Radial Motion**
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-

In every topic

Answer Bank Challenge	24 tasks
Grid Rounds	24 tasks
Match & Move	24 cards
Error Analysis & Strategy	24 tasks
Quick Answer Key and Full Worked Solutions	included
Teacher / Parent Use Guide and Terms of Use	included

Product previews

The following preview pages show the cover, all four activity formats, and worked examples for each included resource, in the listed order.

48 PDFs and 6 READMEs; 751 buyer PDF pages across the 6 products.

Preview pages are not included in the buyer page count. Check the list against resources you already own.

This is a fixed collection of the listed products. Purchase includes the existing individual resource files. To open a product's online preview, follow its title link and select View Preview.

AP Precalculus
Equivalent Polar Coordinates

Equivalent Polar Coordinates | APPC-U03-P23

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
02	Grid Rounds	24 tasks
03	Match & Move	24 cards
04	Error Analysis & Strategy	24 tasks
05	Quick Answer Key	96 answers
06	Full Worked Solutions	96 solutions
07	Teacher / Parent Use Guide	included
08	Terms of Use & License	included

Topic focus

Across 96 tasks this topic asks for diagnosis and corrected pair, same or different, distance and location, one pair, one polar pair and equivalence group.

8 PDFs and a README; 157 buyer pages.

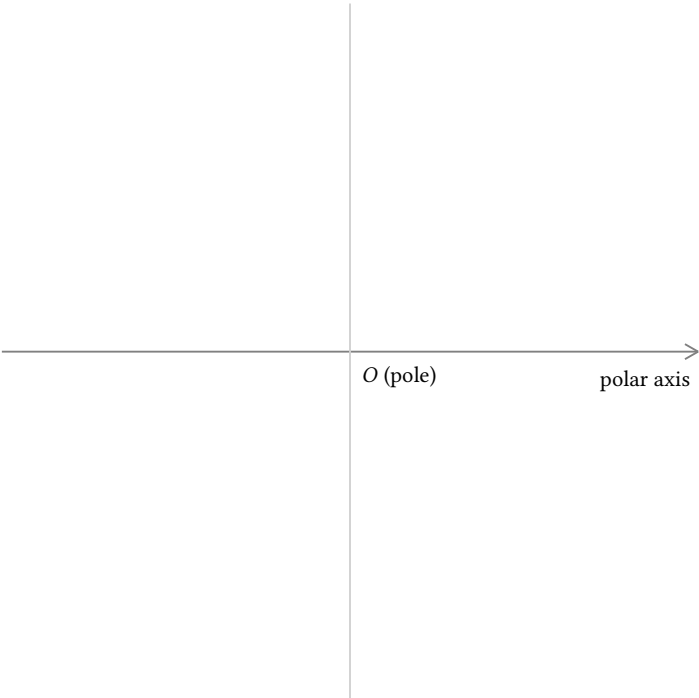
AP Precalculus

Equivalent Polar Coordinates

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.

Find the signed radius r that makes $(r, 5\frac{\pi}{6})$ equivalent to $(5, 11\frac{\pi}{6})$.



Condition or evidence	Supplied value
Incomplete polar record	$(r, 5\frac{\pi}{6})$
Known polar record	$(5, 11\frac{\pi}{6})$

Bank label: _____

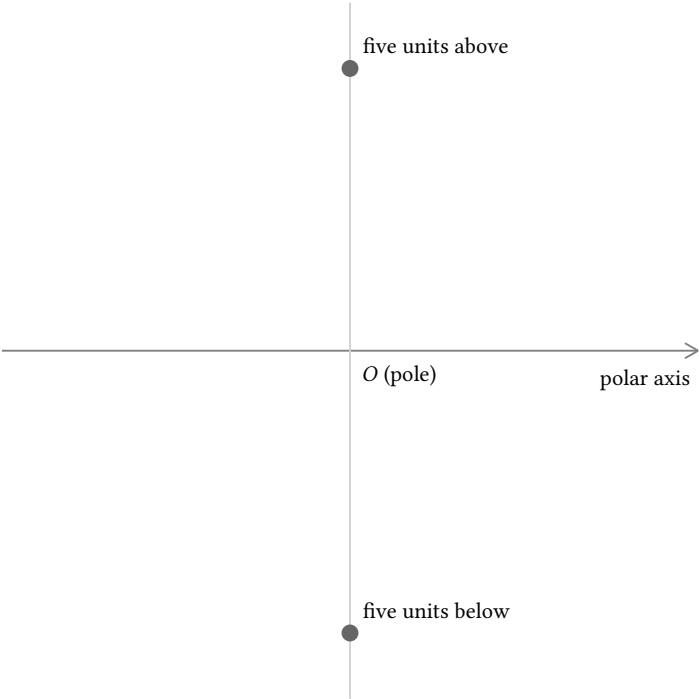
AP Precalculus

Equivalent Polar Coordinates

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 plot offers points five units above and five units below the pole. Which one represents $(-5, \frac{\pi}{2})$?



Condition or evidence	Supplied value
Candidate points	
	five units above
	five units below
Given polar record	$(-5, \frac{\pi}{2})$

AP Precalculus

Equivalent Polar Coordinates

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: $\theta = -3\frac{\pi}{10}$

An equivalent pair for $(7, 4\frac{\pi}{3})$ is required to have $\theta = \frac{\pi}{3} + 2k\pi$. What must r be for every integer k ?

Solve the card and move only to the card whose incoming header matches the entire requested response.

Condition or evidence	Supplied value
Given angle form	$\theta = \frac{\pi}{3} + 2k\pi$
Incomplete polar record	(r, θ)
Known polar record	$(7, 4\frac{\pi}{3})$

Your response: _____

AP Precalculus

Equivalent Polar Coordinates

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 $(-a, \frac{\pi}{6})$ with $a = -5$, evaluate the radius before interpreting the point. Correct the claim that the visible minus sign automatically reverses the ray. Justify the comparison by distinguishing signed radius, ordinary distance and actual location.

Compare the stated cases, methods, or representations and justify the conclusion using the supplied conditions.

Condition or evidence	Supplied value
Assumption	$a = -5$
Given polar record	$(-a, \frac{\pi}{6})$
Student claim to examine	The written minus sign always means a negative radius.

Equivalent Polar Coordinates

Full Worked Solutions - excerpt

Worked example

Problem. Fill in r so the table entry $(r, 13\frac{\pi}{6})$ names the same point as $(3, \frac{\pi}{6})$.

Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Candidate	Reference
$(r, 13\frac{\pi}{6})$	$(3, \frac{\pi}{6})$

Answer. $r = 3$

Explanation and check.

The angles differ by 2π , so the radius retains both its magnitude and sign.

Worked example

Problem. Complete the row $(r, 0)$ so it is equivalent to $(-8, \pi)$.

Solve the card and move only to the card whose incoming header matches the entire requested response.

Condition or evidence	Supplied value
Incomplete record	$(r, 0)$
Known record	$(-8, \pi)$

Answer. $r = 8$

Explanation and check.

The negative radius reverses the π ray to the 0 ray at distance 8, so the second pair uses $r = 8$.

AP Precalculus
Polar and Rectangular Coordinate Conversion

Polar and Rectangular Coordinate Conversion | APPC-U03-P24

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
02	Grid Rounds	24 tasks
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07	Teacher / Parent Use Guide	included
08	Terms of Use & License	included

Topic focus

Across 96 tasks this topic asks for polar pair plus check, polar coordinates, polar pair with quadrant check, rounded polar coordinates, rounded coordinates and positive-radius polar pair.

8 PDFs and a README; 154 buyer pages.

AP Precalculus

Polar and Rectangular Coordinate Conversion

Name: _____ Date: _____ Class: _____

Answer each question and record the matching bank letter. Give exact values. Give the whole requested response, including any reasoning the question asks for.

A point has rectangular form $(3, y)$, polar radius 5, and lies above the x -axis. Complete the missing coordinate.

Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Condition or evidence	Supplied value
Condition	$y > 0$
Given polar radius	5
Incomplete rectangular record	$(3, y)$

Bank label: _____

For $(-5, 2)$, find positive-radius polar coordinates to the nearest tenth of a degree. Explain the quadrant correction and check the signs of the two projections.

Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

x	y
-5	2

Condition or evidence	Supplied value
Required angle interval	$0^\circ \leq \theta < 360^\circ$
Precision	nearest tenth of a degree

Bank label: _____

Convert the measured point $(0.4, -6)$ to positive-radius polar form using the stated rounding. Preserve the quadrant near the negative y -axis.

Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

x	y
0.4	-6

Condition or evidence	Supplied value
Required angle interval	$0^\circ \leq \theta < 360^\circ$
Angle precision	nearest tenth
Radius precision	nearest hundredth

Bank label: _____

A calculator returns a reference angle near 20.6° for $(-8, -3)$. Produce the correct polar angle, radius, and a sign check by reprojection.

Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Condition or evidence	Supplied value		
Required angle interval	$0^\circ \leq \theta < 360^\circ$		
Given rectangular point	<table><tr><td>−8</td></tr><tr><td>−3</td></tr></table>	−8	−3
−8			
−3			
Precision	Given angle θ nearest tenth degree Radius nearest hundredth		
Given calculator ratio angle	about 20.6°		

Bank label: _____

AP Precalculus

Polar and Rectangular
Coordinate Conversion

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. Give the whole requested response, including any reasoning the question asks for.

A positive-radius point has $\theta = 3\frac{\pi}{2}$ and $y = -4$. Determine r and the missing x -coordinate.

Show a complete response in the numbered workspace, preserving requested exactness, units, interval endpoints, and justification.

Condition or evidence	Supplied value
Given angle θ	$3\frac{\pi}{2}$
Radius convention	positive
Given x -coordinate	missing
Given y -coordinate	-4

AP Precalculus

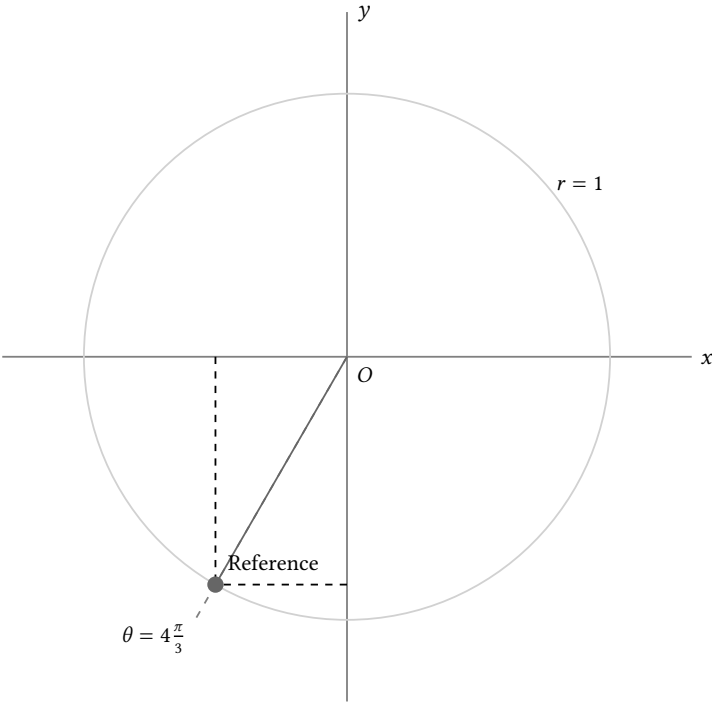
Polar and Rectangular
Coordinate Conversion

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: $(11, 3\frac{\pi}{2})$

Convert $(-9, 4\frac{\pi}{3})$ and explain why both coordinates become positive.



$\cos \theta$	$\sin \theta$
$-\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$

Condition or evidence	Supplied value
Given quadrant to verify	I
Given polar record	$(-9, 4\frac{\pi}{3})$

Your response: _____

AP Precalculus

Polar and Rectangular
Coordinate Conversion

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.

A student converts $(4, \frac{\pi}{6})$ to $(2, 2\sqrt{3})$. Identify the swapped roles and repair the ordered pair.

Identify the error or first invalid step, give the corrected result, and state a brief mathematical reason.

Condition or evidence	Supplied value
Given polar record	$(4, \frac{\pi}{6})$
Student rectangular result to examine	$(2, 2\sqrt{3})$

Polar and Rectangular Coordinate Conversion

Full Worked Solutions - excerpt

Worked example

Problem. A point has rectangular form $(3, y)$, polar radius 5, and lies above the x -axis. Complete the missing coordinate. Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Condition or evidence	Supplied value
Condition	$y > 0$
Given polar radius	5
Incomplete rectangular record	$(3, y)$

Answer. $y = 4$

Explanation and check.

From $3^2 + y^2 = 5^2$, $y^2 = 16$. The upper-half-plane condition selects $y = 4$ rather than -4 .

Worked example

Problem. A point has radius 10, $y = -6$, and lies left of the y -axis. Reconstruct x .

Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Condition or evidence	Supplied value
Condition	$x < 0$
Given polar radius	10
Incomplete rectangular record	$(x, -6)$

Answer. $x = -8$

Explanation and check.

The norm equation gives $x^2 + 36 = 100$, so $x = \pm 8$. The left-half-plane condition selects $x = -8$.

AP Precalculus

Polar Graphs from Tables

Polar Graphs from Tables | APPC-U03-P25

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for two new rows and adequacy explanation, two radius values, ordered rows, directed partial trace, polar graph and directed trace.

8 PDFs and a README; 93 buyer pages.

AP Precalculus

Polar Graphs from Tables

Name: _____ Date: _____ Class: _____

Answer each question and record the matching bank letter. Give exact values. Give the whole requested response, including any reasoning the question asks for.

Complete the radius column for $r = 2$ at $\theta = 0, \frac{\pi}{2}$, and π, preserving the given angle order. _____ Bank label: _____	For $r = 1 + \sin \theta$, evaluate the outputs at $0, \frac{\pi}{2}$, and π and place them in the same order. _____ Bank label: _____
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AP Precalculus

Polar Graphs
from Tables

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. Give the whole requested response, including any reasoning the question asks for.

Plot the ordered table for $r = 1$ and add an arrow showing the direction as θ increases from 0 to 2π. Required response <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>0</td><td>1</td></tr> <tr><td>$\frac{\pi}{2}$</td><td>1</td></tr> <tr><td>π</td><td>1</td></tr> <tr><td>$3\frac{\pi}{2}$</td><td>1</td></tr> <tr><td>2π</td><td>1</td></tr> </table> 	0	1	$\frac{\pi}{2}$	1	π	1	$3\frac{\pi}{2}$	1	2π	1	Sketch only the portion traced by $r = 2$ for $0 \leq \theta \leq \frac{\pi}{2}$, marking both endpoint statuses.
0	1										
$\frac{\pi}{2}$	1										
π	1										
$3\frac{\pi}{2}$	1										
2π	1										
The $\theta - r$ graph is the horizontal line $r = 3$ for one full turn. Which plane trace matches, and why is the line $y = 3$ not the same graph? 	The listed samples for $r = \sin(2\theta)$ are all zero. Explain why they do not show the trace, then evaluate the proposed extra input $\frac{\pi}{4}$. Required response <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>0</td><td>0</td></tr> <tr><td>$\frac{\pi}{2}$</td><td>0</td></tr> <tr><td>π</td><td>0</td></tr> </table> 	0	0	$\frac{\pi}{2}$	0	π	0				
0	0										
$\frac{\pi}{2}$	0										
π	0										
Use the ordered rows for $r = \theta$ to construct the trace on $[0, \frac{\pi}{2}]$ and describe its direction. Required response <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>0</td><td>0</td></tr> <tr><td>$\frac{\pi}{4}$</td><td>$\frac{\pi}{4}$</td></tr> <tr><td>$\frac{\pi}{2}$</td><td>$\frac{\pi}{2}$</td></tr> </table> 	0	0	$\frac{\pi}{4}$	$\frac{\pi}{4}$	$\frac{\pi}{2}$	$\frac{\pi}{2}$	Evaluate $r = 2 \cos \theta - 1$ at the four listed angles. Keep zero and negative outputs unchanged for later plotting. The supplied angles, in order, are $\theta = 0, \frac{\pi}{3}, \pi, 3\frac{\pi}{2}$. 				
0	0										
$\frac{\pi}{4}$	$\frac{\pi}{4}$										
$\frac{\pi}{2}$	$\frac{\pi}{2}$										

AP Precalculus

Polar Graphs
from Tables

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: $(0, 1), (\frac{\pi}{4}, 0), (\frac{\pi}{2}, -1), (\pi, -1)$ Determine the plane arc traced by $r = -1$ for $0 \leq \theta \leq \frac{\pi}{2}$.

Required response

0	-1
$\frac{\pi}{2}$	-1

Your response: _____

Incoming: The upper arc from filled $(2, 0)$ through $(1, 1)$, approaching but not including the pole.Complete the table for $r = 3 \cos \theta$ at $\frac{\pi}{6}, \frac{\pi}{2}$, and $5\frac{\pi}{6}$.

Your response: _____

Incoming: An outward quadrant-III curve from $(-1, 0)$ to $(0, -\frac{3}{2})$, with both endpoints filled.Determine the portion traced by $r = -1$ for $-\pi \leq \theta \leq \frac{\pi}{2}$, including its direction.

Required response

$-\pi$	-1
$-\frac{\pi}{2}$	-1
0	-1
$\frac{\pi}{2}$	-1

Your response: _____

Incoming: A three-quarter unit-circle arc from $(1, 0)$ through $(0, 1), (-1, 0)$, to $(0, -1)$.Sketch the windowed trace of $r = \theta + \pi$ from $\theta = -\pi$ to $\theta = -\frac{\pi}{2}$.

Required response

$-\pi$	0
$-3\frac{\pi}{4}$	$\frac{\pi}{4}$
$-\frac{\pi}{2}$	$\frac{\pi}{2}$

Your response: _____

AP Precalculus

Polar Graphs from Tables

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.

A student replaces the negative output of $r = \cos \theta$ by its magnitude. Repair the $\theta = \pi$ row and state where that signed-radius point plots.

Required response

0	1
$\frac{\pi}{2}$	0
π	1

A student submits the horizontal $\theta - r$ graph as the plane trace of $r = 2$. Explain the coordinate-system confusion and replace it with the correct polar graph.

Polar Graphs from Tables

Full Worked Solutions - excerpt

Worked example

Problem. Evaluate $r = 2 + \sin \theta - \cos \theta$ at the four quadrantal angles.

Answer. $(0, 1), (\frac{\pi}{2}, 3), (\pi, 3), (3\frac{\pi}{2}, 1)$

Explanation and check.

Insert the four sine-cosine pairs $(0, 1), (1, 0), (0, -1)$, and $(-1, 0)$ into the rule.

Worked example

Problem. Compute $r = 2 \sin \theta + \cos(2\theta)$ at the four quadrantal angles.

Answer. $(0, 1), (\frac{\pi}{2}, 1), (\pi, 1), (3\frac{\pi}{2}, -3)$

Explanation and check.

Substitution gives $0 + 1, 2 - 1, 0 + 1$, and $-2 - 1$, respectively.

AP Precalculus
Polar Symmetry and Curve Tracing

Polar Symmetry and Curve Tracing | APPC-U03-P26

96 problems · Four activity formats

01	Answer Bank Challenge	24 tasks
02	Grid Rounds	24 tasks
03	Match & Move	24 cards
04	Error Analysis & Strategy	24 tasks
05	Quick Answer Key	96 answers
06	Full Worked Solutions	96 solutions
07	Teacher / Parent Use Guide	included
08	Terms of Use & License	included

Topic focus

Across 96 tasks this topic asks for sufficient interval and retrace explanation, symmetry conclusion, once-through subinterval and retrace explanation, pole and nonpole multiplicities, pole multiplicity and nonpole verdict and partial/full/retraced judgment.

8 PDFs and a README; 156 buyer pages.

AP Precalculus

Polar Symmetry and Curve Tracing

Name: _____ Date: _____ Class: _____

Answer each question and record the matching bank letter. Give exact values. Give the whole requested response, including any reasoning the question asks for.

On $r = 2 \sin(3\theta)$, show that $\theta = \frac{\pi}{6}$ and $\theta = 7\frac{\pi}{6}$ represent the same petal tip and give its Cartesian coordinates.
Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Given θ	Given r
$\frac{\pi}{6}$	2
$7\frac{\pi}{6}$	-2

Condition or evidence	Supplied value
Original polar rule	$r = 2 \sin(3\theta)$
Given target point	distance 2 on ray $\frac{\pi}{6}$

Bank label: _____

How many times does $r = 2 + 2 \cos \theta$ visit the pole on $0 \leq \theta < 2\pi$? Distinguish that count from the closed-curve endpoint convention.
Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Condition or evidence	Supplied value
Original polar rule	$r = 2 + 2 \cos \theta$
Given equation for zero radius	$\cos \theta = -1$

Bank label: _____

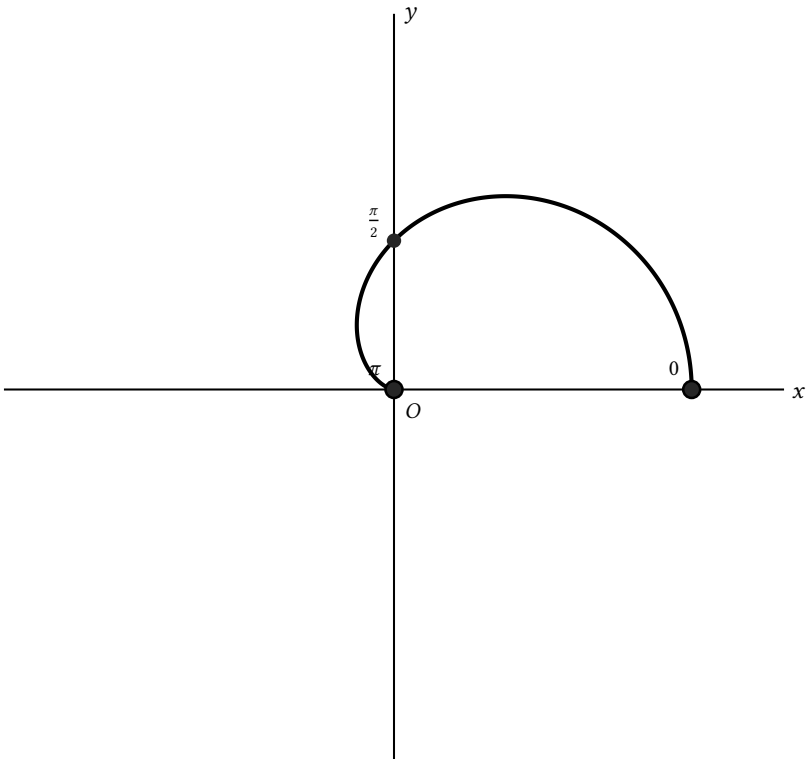
AP Precalculus

Polar Symmetry and Curve Tracing

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. Give the whole requested response, including any reasoning the question asks for.

For $r = 1 + \cos \theta$ on $0 \leq \theta \leq \pi$, describe the direction of travel through the three labeled anchors as θ increases.



Given parameter	Given point or location
0	(2, 0)
$\frac{\pi}{2}$	(0, 1)
π	pole

Condition or evidence	Supplied value
Original polar rule	$r = 1 + \cos \theta$

AP Precalculus

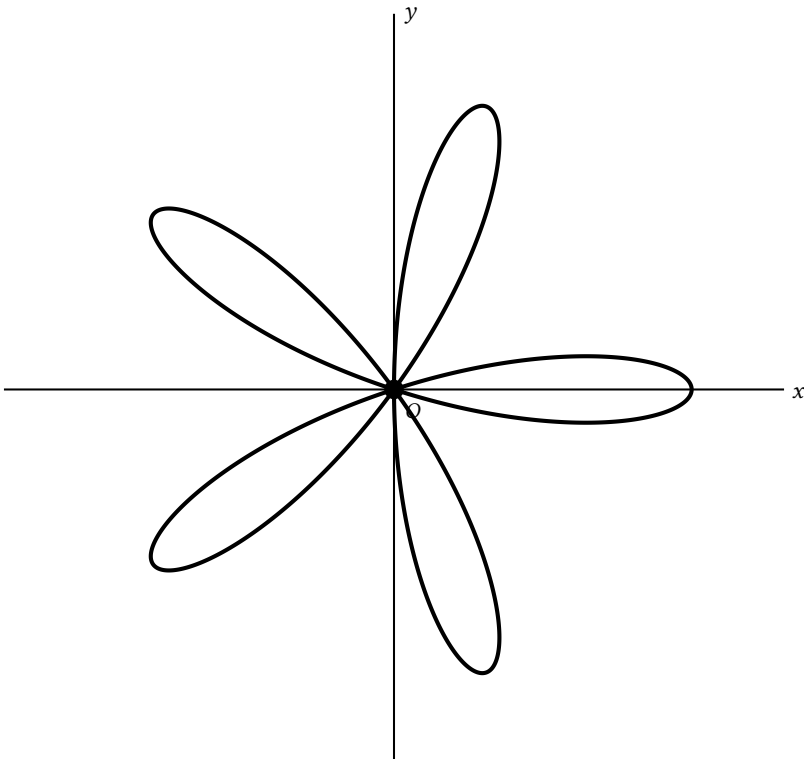
Polar Symmetry and Curve Tracing

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.

START

Determine whether $-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$ is sufficient to trace every petal of $r = \cos(5\theta)$ once. Justify with a half-turn correspondence rather than a memorized rule.



Condition or evidence	Supplied value
Half turn relation	$r(\theta + \pi) = -r(\theta)$
Interval length	π
Original polar rule	$r = \cos(5\theta)$

Your response: _____

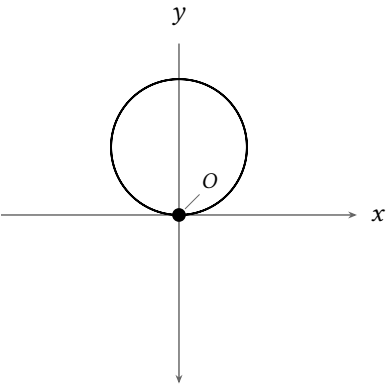
AP Precalculus

Polar Symmetry and Curve Tracing

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.

A student says $r = \sin \theta$ needs all of $[0, 2\pi]$ for one trace because $\sin \theta$ has period 2π . Repair the claim using signed-radius equivalence.



Condition or evidence	Supplied value
Half turn relation	$r(\theta + \pi) = -r(\theta)$
Original polar rule	$r = \sin \theta$
Student claim to examine	A full 2π parameter interval is required because the radius has period 2π .

Polar Symmetry and Curve Tracing

Full Worked Solutions - excerpt

Worked example

Problem. Which parameters repeat the closing point of $r = 4$ on the closed interval $0 \leq \theta \leq 2\pi$?

Solve the problem, then match the entire requested response to one unused entry in the Answer Bank.

Condition or evidence	Supplied value
Given common-point reference	$(4, 0)$
Original polar rule	$r = 4$

Answer. $\theta = 0$ and $\theta = 2\pi$ both give $(4, 0)$.

Explanation and check.

The radius is 4 at both coterminal endpoint angles, so the two polar pairs locate the same point.

Worked example

Problem. A polar table contains $(\theta, r) = (\frac{\pi}{3}, 2)$ and $(4\frac{\pi}{3}, -2)$. Do the rows locate the same point? Give the coordinate.

Solve the card and move only to the card whose incoming header matches the entire requested response.

θ	Given r
$\frac{\pi}{3}$	2
$4\frac{\pi}{3}$	-2

Answer. Yes; both locate $(1, \sqrt{3})$.

Explanation and check.

The angles differ by π and the radii are opposites, so the polar pairs are equivalent. Converting the first gives $(2 \cos(\frac{\pi}{3}), 2 \sin(\frac{\pi}{3})) = (1, \sqrt{3})$.

AP Precalculus
Features of Polar Equations

Features of Polar Equations | APPC-U03-P27

96 problems · Four activity formats

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Topic focus

Across 96 tasks this topic asks for minimum distance and locations, distance and parameter, ordered exact parameter list, closest point and distance, distance and location and distinct coordinate set.

8 PDFs and a README; 83 buyer pages.

AP Precalculus

Features of
Polar Equations

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.

In the family $r = a + \cos \theta$, choose a so that the curve reaches the pole at $\theta = \pi$. Bank label: _____	For $r = a + 2 \sin \theta$ with $a \geq 2$, determine a if the greatest distance from the pole is 5. Bank label: _____
Determine a in $r = a + \sin \theta$ if every radius is negative and the closest distance to the pole is 2. Bank label: _____	At what parameter does $r = 5\theta$ reach the pole on $-1 \leq \theta \leq 1$? Bank label: _____

AP Precalculus

Features of Polar Equations

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.

Find every θ in $0 \leq \theta \leq \pi$ for which $r = 2 \sin \theta$ is zero, and name the plane point reached.

AP Precalculus

Features of
Polar Equations

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.

START For $0 \leq \varphi < 2\pi$, the curve $r = 3 + 3 \cos(\theta - \varphi)$ has its cusp at the pole when $\theta = 5\frac{\pi}{6}$. Find φ. Your response: _____	Incoming: $\varphi = 11\frac{\pi}{6}$. Choose a in $r = 2 + a \cos \theta$ so that $\theta = 0$ is a pole parameter. Verify the resulting zero. Your response: _____
Incoming: -2 Find a if $r = a + 4 \cos \theta$ must pass through the pole at $\theta = 2\frac{\pi}{3}$. Your response: _____	Incoming: $a = 2$. For $k > 0$, the curve $r = k(1 - \cos \theta)$ has farthest distance 10. Determine k. Your response: _____

AP Precalculus**Features of
Polar Equations****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.

A table row gives $(\theta, r) = (\frac{\pi}{4}, -7)$, and a student reports a distance of -7 . Correct both the distance and the plotted direction.

A student finds seven zero parameters for $r = \sin(3\theta)$ on $0 \leq \theta \leq 2\pi$ and reports seven different poles. Correct the feature count.

Features of Polar Equations

Full Worked Solutions - excerpt

Worked example

Problem. Choose a in $r = 2 + a \cos \theta$ so that $\theta = 0$ is a pole parameter. Verify the resulting zero.

Answer. -2

Explanation and check.

At $\theta = 0$ the radius is $2 + a$. Setting it to zero gives $a = -2$, and substitution yields $r(0) = 2 - 2 = 0$.

Worked example

Problem. For $k > 0$, the curve $r = k(1 - \cos \theta)$ has farthest distance 10. Determine k .

Answer. $k = 5$.

Explanation and check.

The factor $1 - \cos \theta$ is largest at $\theta = \pi$, where it equals 2. Thus the farthest distance is $2k$, and $2k = 10$ gives $k = 5$.

AP Precalculus
Polar Rates of Change and Radial Motion

Polar Rates of Change and Radial Motion | APPC-U03-P28

96 problems · Four activity formats

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06	Full Worked Solutions	96 solutions
07	Teacher / Parent Use Guide	included
08	Terms of Use & License	included

Topic focus

Across 96 tasks this topic asks for supported or undetermined with alternative, estimated radius, exact signed rate and interpretation, local closest or farthest, local feature and inward and outward intervals.

8 PDFs and a README; 108 buyer pages.

AP Precalculus

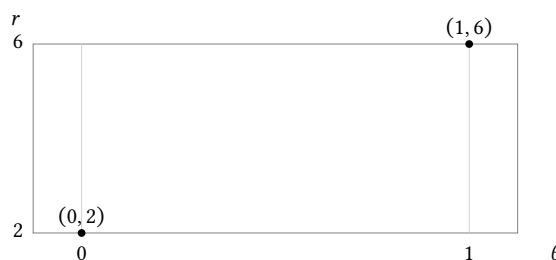
Polar Rates of Change and Radial Motion

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.

Throughout an angle interval, r is negative and increases from -7 toward -2 . Is the point moving inward or outward relative to the pole?

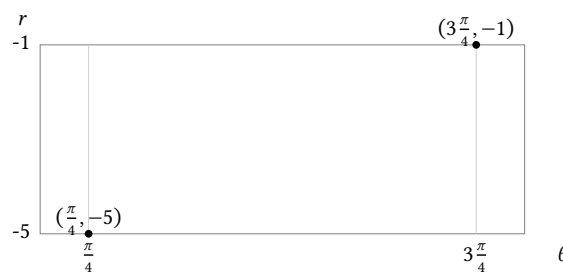
Using the average rate between the two table rows, estimate r at $\theta = \frac{1}{2}$. Is the result necessarily exact?



0	2
1	6

Near $\theta = a$, a radius graph stays positive and has a local minimum $r = 2$. What distance feature does the polar point have at a ?

Compute the average signed-radius rate from $\theta = \frac{\pi}{4}$, where $r = -5$, to $\theta = 3\frac{\pi}{4}$, where $r = -1$.



$\frac{\pi}{4}$	-5
$3\frac{\pi}{4}$	-1

AP Precalculus

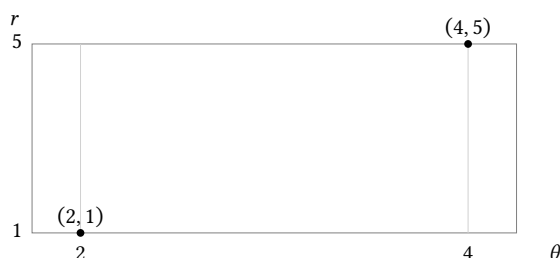
Polar Rates of Change
and Radial Motion

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: $r(90^\circ) \approx 4$.

A table gives $r(2) = 1$ and $r(4) = 5$. Use the average rate to estimate $r(3)$, and say whether the estimate must be exact.



2	1
4	5

Your response: _____

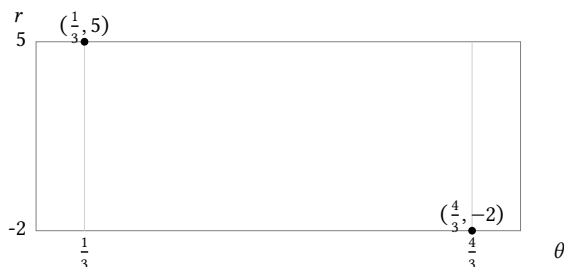
Incoming: Signed-radius rate 2; distance rate $\frac{4}{3}$ radial units per radian.

For $r = 2^\theta$, find the average radial rate from $\theta = 0$ to $\theta = 1$.

Your response: _____

Incoming: Both rates are -3 radial units per radian.

Find the average radial rate from $r(\frac{1}{3}) = 5$ to $r(\frac{4}{3}) = -2$.

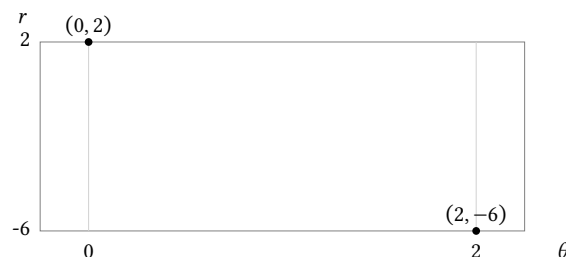


$\frac{1}{3}$	5
$\frac{4}{3}$	-2

Your response: _____

Incoming: The estimate is 10 and the actual radius lies in $[9.5, 10.5]$.

A diagram labels $r = 2$ at $\theta = 0$ and $r = -6$ at $\theta = 2$. Find the average radial and distance rates.



0	2
2	-6

Your response: _____

AP Precalculus

Polar Rates of Change
and Radial Motion

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.

A student computes $\frac{5-2}{90-30} = \frac{1}{20}$ and labels it radial units per radian. Repair the interpretation.

Required response

30°	2
90°	5

Polar Rates of Change and Radial Motion

Full Worked Solutions - excerpt

Worked example

Problem. A signed radius rises from 2 to 12 at average rate 5. What is the angular interval width?

Answer. $\theta_2 - \theta_1 = 2$ radians.

Explanation and check.

The radius change is 10. Dividing change by rate gives a width of 2 radians.

Worked example

Problem. For $r = 2^\theta$, find the average radial rate from $\theta = 0$ to $\theta = 1$.

Answer. 1 radial unit per radian.

Explanation and check.

The radius changes from 1 to 2 over one radian, so the secant quotient is 1.