

Precalculus · Polar Coordinates and Parametric Equations · Worksheet

Common Core N-CN.B.4, F-IF.C.7 · mathovore.fr

Name: _____ Date: ____/____/____ Score: _____

This precalculus polar parametric worksheet gives 22 problems on polar coordinates and parametric equations, ordered from easy to hard, with a separate answer key.

These 22 problems practice polar and parametric ideas from Precalculus, aligned with Common Core N-CN.B.4 and F-IF.C.7: plotting points, converting between polar and rectangular form, and graphing circles, roses and limaçons.

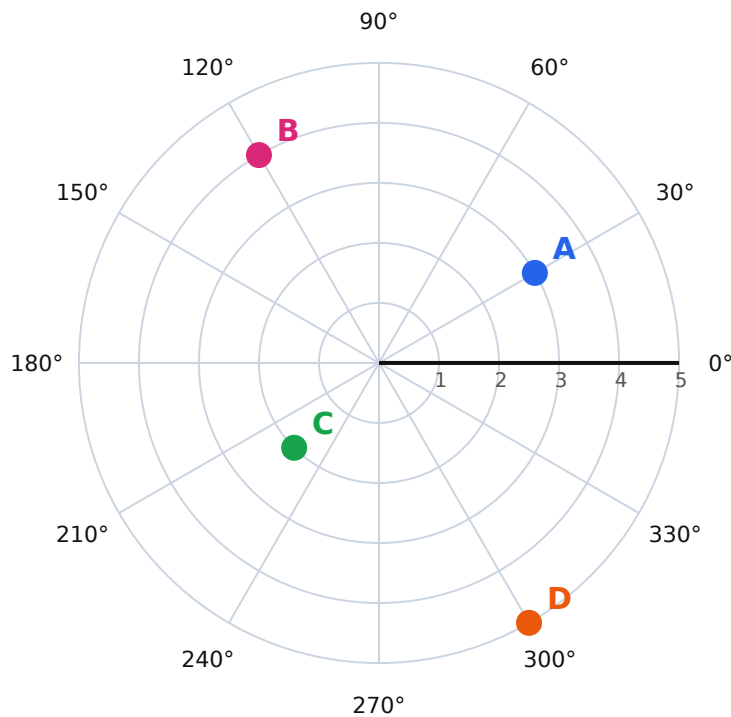
The last problems use parametric equations for motion, such as a soccer kick and a Ferris wheel, and ask you to eliminate the parameter. Work from easiest to hardest and show every step.

PrecalculusCommon Core: N-CN.B.4 · F-IF.C.7

Precalculus Polar Parametric Worksheet: problems 1-5

Problem 1: Read points on a polar grid

Read the polar coordinates (r, θ) of points A, B, C and D from the graph. Use $r > 0$ and $0^\circ \leq \theta < 360^\circ$.



Four points on a polar grid with rings every 1 unit.

Problem 2: Convert polar to rectangular

Convert each polar point to rectangular coordinates.

- $\left(4, \frac{\pi}{3}\right)$
- $\left(6, \frac{3\pi}{4}\right)$
- $(5, \pi)$
- $\left(2, -\frac{\pi}{2}\right)$

Problem 3: Convert rectangular to polar

Convert each rectangular point to polar coordinates with $r > 0$ and $0 \leq \theta < 2\pi$.

- $(3, 3\sqrt{3})$
- $(-4, 0)$
- $(-5, 5)$
- $(2, -2\sqrt{3})$

Problem 4: Rewrite equivalent polar pairs

Rewrite each polar pair so that $r > 0$ and θ is between 0 and one full turn, keeping the same units.

- $(-2, 70^\circ)$
- $(5, -45^\circ)$

- c. $(-4, \frac{\pi}{6})$
- d. $(3, 5\pi)$

Problem 5: Distance between polar points

Find the exact distance between the two points. Use $d^2 = r_1^2 + r_2^2 - 2r_1r_2\cos(\theta_2 - \theta_1)$.

- a. $(4, 20^\circ)$ and $(6, 80^\circ)$
- b. $(5, 10^\circ)$ and $(5, 130^\circ)$

Precalculus Polar Parametric Worksheet: problems 6-10

Problem 6: Rectangular equations to polar form

Write each rectangular equation in polar form.

- a. $x = 4$
- b. $y = x$
- c. $x^2 + y^2 = 25$
- d. $x^2 + y^2 = 6y$

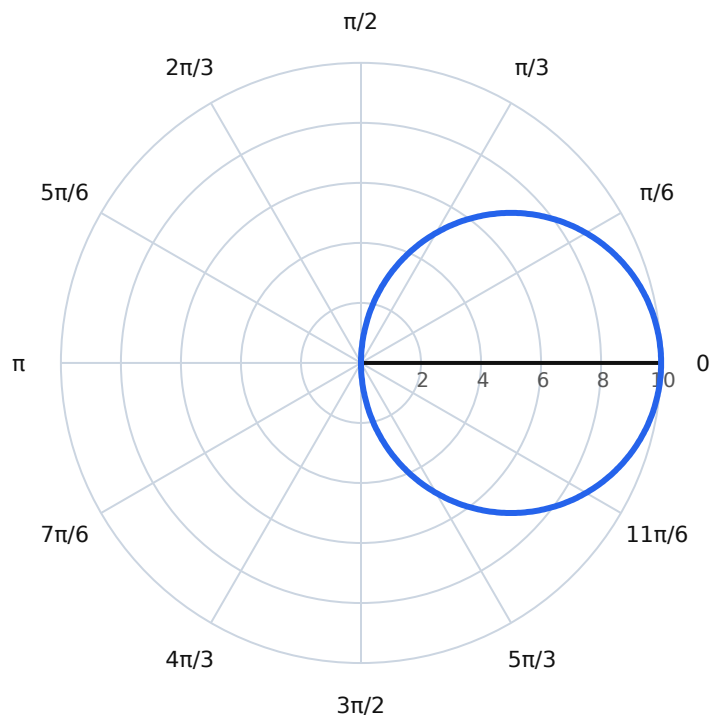
Problem 7: Polar equations to rectangular form

Write each polar equation as a rectangular equation.

- a. $r = 7$
- b. $\theta = \frac{\pi}{3}$
- c. $r = 8\sin\theta$
- d. $r = 2\cos\theta + 2\sin\theta$

Problem 8: Identify a polar circle

State the center and radius of the circle graphed for $r = 10\cos\theta$, then write its rectangular equation.



Graph of $r = 10 \cos \theta$ with rings every 2 units.

Problem 9: Complete a cardioid table

Complete the table for $r = 2 + 2 \cos \theta$. Then name the graph and state the greatest value of r .

θ	0	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{3\pi}{2}$	$\frac{5\pi}{3}$
r								

Problem 10: Classify polar graphs

Name the type of graph for each equation. For a limaçon, say whether it has an inner loop, a dimple or neither. For a rose, give the number of petals.

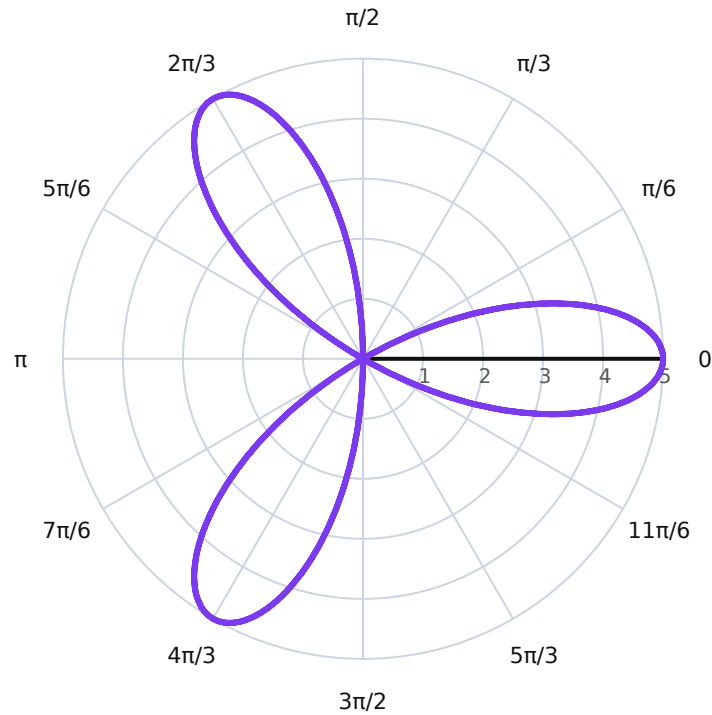
- $r = 3 + 3 \sin \theta$
- $r = 2 + 4 \cos \theta$
- $r = 3 + 2 \cos \theta$
- $r = 5 + 2 \cos \theta$
- $r = 5 \cos 3\theta$
- $r = 3 \sin 2\theta$

Precalculus Polar Parametric Worksheet: problems 11-15

Problem 11: Find the tips of a rose

Use the graph of $r = 5 \cos 3\theta$ to state the number of petals and the petal length. Then find every

θ with $0 \leq \theta < 2\pi$ for which $r = 5$.



Graph of $r = 5 \cos 3\theta$.

Problem 12: Pole crossings of a rose

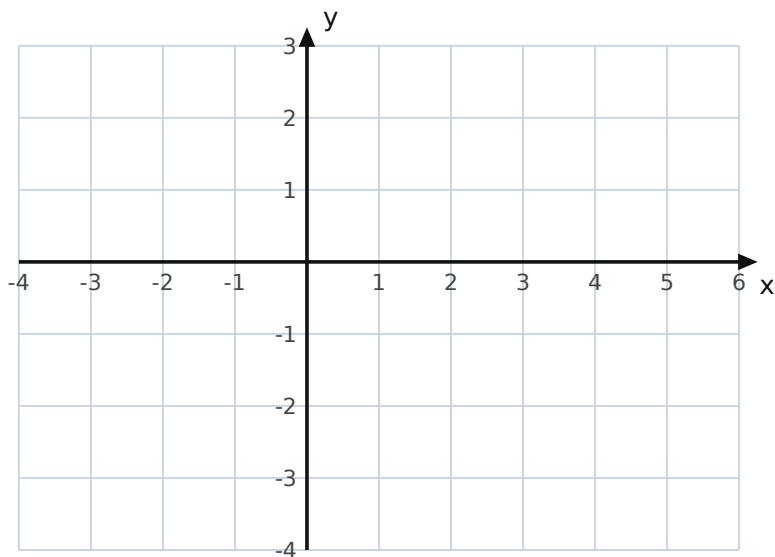
For $r = 4 \cos 2\theta$, find every θ in $[0, 2\pi)$ at which the graph passes through the pole. Then state the number of petals and the angles where $r = 4$.

Problem 13: Limaçon with an inner loop

For $r = 2 + 4 \cos \theta$, find the greatest value of r , the angles in $[0, 2\pi)$ at which the graph passes through the pole, and the rectangular point that corresponds to $\theta = \pi$.

Problem 14: Make a table of parametric points

For $x = 2t + 1$ and $y = t^2 - 3$, find the point for each value $t = -2, -1, 0, 1, 2$. Plot the points on the grid and connect them in order of increasing t .



Blank grid for plotting the five points.

Problem 15: Eliminate the parameter, linear

Eliminate the parameter and write y in terms of x .

- a. $x = 3t - 2$, $y = t + 4$
- b. $x = 5 - 2t$, $y = 4t + 1$

Precalculus Polar Parametric Worksheet: problems 16-20

Problem 16: Eliminate the parameter, quadratic

Eliminate the parameter and identify the curve. Let t be any real number.

- a. $x = t^2$, $y = 2t - 1$
- b. $x = t + 3$, $y = t^2 - 6t + 5$

Problem 17: Eliminate the parameter, ellipse

For $x = 4\cos t$ and $y = 3\sin t$ with $0 \leq t \leq 2\pi$, eliminate the parameter, then find the points for $t = 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}$.

Problem 18: Shifted circle from parametric equations

Eliminate the parameter for a point that moves along $x = 2 + 3\cos t$, $y = -1 + 3\sin t$, $0 \leq t \leq 2\pi$. Then state the center and radius, and find the starting point and the point at $t = \pi$.

Problem 19: Soccer kick

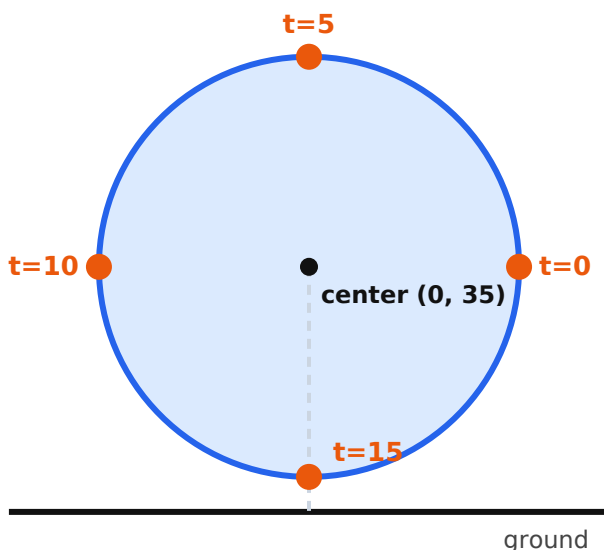
Answer each part for a soccer ball kicked by Maya. Its position after t seconds is $x = 24t$,

$$y = 40t - 16t^2, \text{ in feet.}$$

- Find the height of the ball at $t = 1$.
- Find the time at which the ball lands.
- Find how far the ball travels horizontally before it lands.
- Find the maximum height of the ball.
- Eliminate the parameter to write y in terms of x .

Problem 20: Ferris wheel

Answer each part about the ride Diego takes on a Ferris wheel of radius 30 ft whose center is 35 ft above the ground. His position is $x = 30\cos\frac{\pi t}{10}$, $y = 35 + 30\sin\frac{\pi t}{10}$, with t in seconds.



The wheel and Diego's position at four times.

- Find the time for one full turn.
- Find his position at $t = 5$.
- Find his lowest height above the ground.
- Eliminate the parameter.
- Find the first time his height is 50 ft.

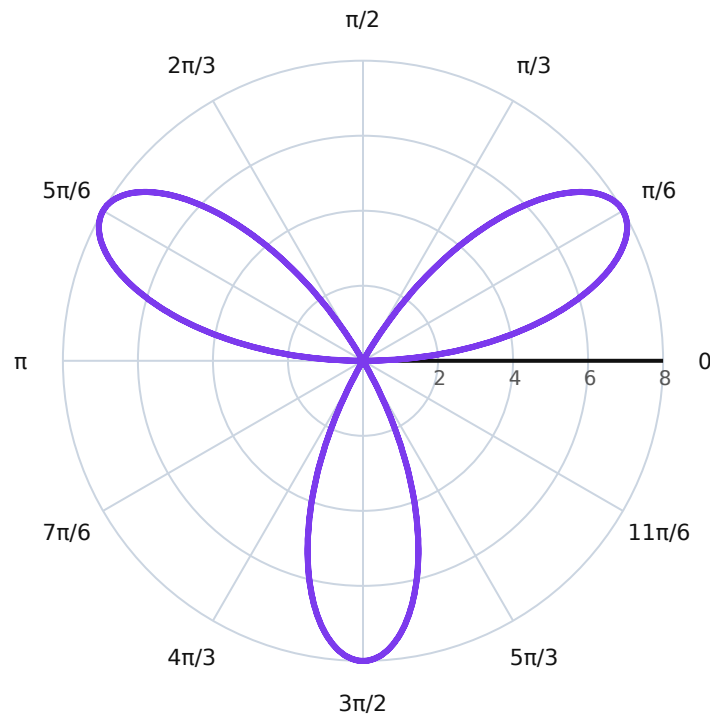
Precalculus Polar Parametric Worksheet: problems 21-22

Problem 21: Radar stations

A radar station at the pole detects two boats. Boat 1 is at $(12 \text{ mi}, 40^\circ)$ and boat 2 is at $(9 \text{ mi}, 100^\circ)$. Find the rectangular coordinates of boat 1 to the nearest hundredth, and find the exact and approximate distance between the boats.

Problem 22: Rose flower bed

Answer each part for the flower bed Priya designs, shaped like the rose $r = 8\sin 3\theta$, with distances in feet and the pole at the center.



The rose $r = 8 \sin 3\theta$.

- How many petals does the bed have?
- Find the angles in $[0, 2\pi)$ at which the petal tips lie.
- Find the distance between two neighboring tips.
- Priya runs edging along the straight segments joining the three tips. Find the total length of edging.

How to use this precalculus polar parametric worksheet

Print this precalculus polar parametric worksheet as a PDF, solve every problem on paper, then compare with the answer key.

