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Find the cartesian coordinates of the points whose polar coordinates are given (4 π/2). Find the cartesian coordinates of the points whose polar coordinates are given (2 π/4).

7.3.1 locate points in a plane using polar coordinates. 7.3.2 convert points between rectangle and polar coordinates. 7.3.3 sketches polar curves from certain equations. 7.3.4 converts equations between rectangular and polar coordinates. 7.3.5 identify symmetry in polar curves and equations. the rectangular coordinate system (or Cartesian plane) provides a dot mapping medium to ordered couples and ordered pairs at points. this is called a one-to-one mapping from points in the plane to ordered pairs. the polar coordinate system provides an alternative method of mapping points of ordered pairs. in this section we see that in some circumstances, the polar coordinates can be more useful than rectangular coordinates. to find the coordinates of a point in the polar coordinate system, consider figure 7.27. the pp point has Cartesian coordinates (x, y.) (x, y.) the line segment that connects the origin to the pp point measures the distance from the origin to the pp and has r.R. length the angle between the positive xx axis and the line segment has measured Î¸.î¸. This observation suggests a natural correspondence between the coordinate pair (x, y) (x, y) and the rr and î¸.î¸. this correspondence is the basis of the polar coordinate system. Note that each point of the Cartesian plan has two values (from which the term mating ordered) associated with it. in the polar coordinate system, each point also has two values associated with it: rr and î¸.î¸. figure 7.27 an arbitrary point in the Cartesian plan. using the trigonometry of the rectifier triangle, the following equations are true for the p: p: Cosî¸ = xrsox = rcosî¸ = xrsox = rcosî¸ = yrsoy = rsinî¸ =¸.sinî¸ = yrsoy = rsinî¸. Moreover, r2 = x2 + y2andtanî¸ = yx.r2 = x2 + y2andtanî¸ = yx. each point (x, y) (x, y) in the Cartesian coordinate system can therefore be represented as an ordered pair (r, Î¸) (r, Î¸) in the polar coordinate system. the first coordinate is called radial coordinate and the second coordinate is called angular coordinate. every point in the plane can be represented in this form. Note that the Tanî¸ = y / xtanî¸ = y / x has an infinite number of solutions for any ordered pair (x, y.) (x, y.) however, if we limit the solutions to the values between 00 and 2ï € 2ï €, we can assign a unique solution to the dial where the original point is located (x, y) (x, y.) then the corresponding value of r is positive, given a pp point in the plane with Cartesian coordinates (x, y) (x, y) and polar coordinates (r, î¸), (r, î¸), the following conversion formulas keep true: x = rcosî¸ threshold = rsinî¸, x = rcosî¸andy = rsinî¸, r2 = x2 + y2andtanî¸ = yx.r2 = x2 + y2andtanî¸ = yx. These formulas can be used to convert from rectangles to polar or from polar coordinates to rectangles. convert each of thepoints in polar coordinates. (1.1) (1.1) (i.e. 3.4) (= 3.4) (0.3) (0.3) (53, Ã¢'5) (53, Ã' 5) Convert each of the following points into rectangular coordinates. (3, Ã¯ â¯ / 3) (3, Ã¯ â¯¬ / 3) (2,3Ã¯ â¯¬ / 2) (2,3 â¯¬ / 2) (6, â¯5Ã¯ â¯¬ / 6) (6, â¯5Ã¯ â¯¬ / 6) Use x = 1x = 1 and e in Equation 7.8: r2=x2+y2=12+12r=2andtanÎ¸=yx=11=1Î¸=Ï4.r2=x2+y2=12+12r=2andtanÎ¸=yx=11=1Î¸=Ï4. Therefore this point can be represented as (2,Ï4) (2,Ï4) in the polar coordinates. Use x=â¢3x=â¢3 and y=4y=4 in Equation 7.8: r2=x2+y2= (â¢3) 2+ (4) 2r=5andtanÎ¸=yx=â¢¢43Î¸=-arctan (43) â¢2.21.r2=x2+y2= (â¢3) 2+ (4) 2r=5andtanÎ¸=yx=43=-2.2a. Therefore this point can be represented as (5,2.21) (5,2.21) in the polar coordinates. Use x=0x=0 and y=3y=3 in Equation 7.8: r2=x2+y2=(3) 2+ (0) 2=9+0r=3andtanÎ¸=yx=30.r2=x2+y2= (3) 2+ (0) 2=9+0r=3andtanÎ¸=yx=30. The direct application of the second equation leads to the division of zero. The graph of the point (0.3) (0.3) on the rectangular coordinate system shows that the point is on the positive y-axis. The angle between the positive x-axis and the positive y-axis is Ï2.Ï2. Therefore this point can be represented as (3,Ï2) (3,Ï2) in the polar coordinates. Use x=53x=53 and y=â¢¢5y=â¢5 in Equation 7.8: r2=x2+y2= (53) 2+ (â¢5) 2=75+25r=10andtanÎ¸=yx=553=â¢¢Ã¢33Î¸=Ï6=x2+y2= (53) 2+ (â¢5) 2= 75+25r=10andtanÎ¸= Use r=3r=3 and Î¸=Ï3Î¸=Ï3 in Equation 7.7: x=rcosÎ¸=3cos (Ï3) =3 (12) =32andy=3sin (Ï3) =3 (32) =332.x=rcosÎ¸=3cos (Ï3) = 3 (12) =32andy=rsinÎ¸=3sin (3) Therefore this point can be represented as (32.332) (32.332) in rectangular coordinates. Use r=2r=2 and Î¸=3Ï2Î¸=3Ï2 in Equation 7.7: x=rcosÎ¸=2cos (3Ï2) =2 (0) =0andy=2sin (3Ï2) =2 (âÂ1) =2.x=rcosÎ¸=2cos (3Ï2) =2 (0) =0andy=rsin1) =0andy=rsin1) =1 Î¸=2 Therefore this point can be represented as (0,âÂ2) (0,âÂ2) in the rectangular coordinates. Use r=6r=6 and Î¸=â¯5Ï6Î¸=â¯5Ï6 in equation 7.7: x=rcosÎ¸=6 (â¯5Ï6) =6 (â¯32) =6 (â¯33andy=6ÏrsinÎ¸=6 (â¯5Ï6) =6 So this point can be represented as (â¯33,â¯3) (â¯33,â¯3) in the rectangular coordinates. Convert (â¢8,â¢8) (â¢8,â¢8) to polar coordinates and (4,2Ï3) (4,2Ï3) to rectangular coordinates. The polar representation of a point is not unique. For example, the polar coordinates (2,Ï3) (2,Ï3) and (2,7Ï3) (2,7Ï3) both represent the point (1,3) (1,3) in the rectangular system. Also, the value of rr can be negative. Therefore, the point with the polar coordinates (âÂ2.4Ï3) (âÂ2.4Ï3) also represents the point (1,3) (1,3) (1,3) in the rectangular system, as we can see using Equation 7.8: x=rcosÎ¸=-2cos (4Ï3) =â¢2 (âÂ12) =1â¢=1 ey=rsinÎ¸=â 2sin (4Ï3) â¯2â¯2=2 (32) =3 Each point on the plane has an infinite number of representations in the polar coordinates. However, each point on the plane has only one representation in the rectangular coordinate system. Note that the polar representation of a point in the plane also has a visual interpretation. Specifically, rr is the direct distance that the point is from the origin, andmeasure the angle that the line segment from origin to point does with the positive xx axis. Positive angles are measured counterclockwise and negative angles are measured clockwise. The polar coordinate system appears in the following figure. Figure 7.28 The polar coordinate system. The line segment from the center of the chart that goes right (called the positive axis x in the Cartesian system) is the polar axis. The central point is the pole, or the origin, of the coordinate system, and corresponds to r=0.r=0. The inner circle shown in Figure 7.28 contains all points a distance of 1 unit from the pole, and is represented by the equation r=1.r=1. Then r=2r=2 is the set of points 2 units from the pole, and so on. The line segments emanating from the pole correspond to fixed angles. To trace a point in the polar coordinate system, start with the angle. If the angle is positive, then measure the angle from the polar axis counterclockwise. If it is negative, then measure it clockwise. If the value of rr is positive, move that distance along the terminal radius of the angle. If it is negative, pass along the radius that is in front of the terminal radius of the given angle. It plots each of the following points on the polar plane. (2,π4)(2,π4) (−3,2π3)(−3,2π3) (4,5π4)(4,5π4)(4,5π4) The three points are drawn in the following figure. Figure 7.29 Three points in the polar coordinate system. Blade (4,5π3) (4,5π3) and (−3,−7π2) (−3,−7π2) on the polar plane. Now that we know how to track points in the polar coordinate system, we can discuss how to track curves. In the rectangular coordinate system, we can graph a y=f(x)y=f(x) function and create a curve in the Cartesian plane. In a similar way, we can chart a curve that is generated by a r=f(θ).r=f(θ). The general idea behind the graphics of a function in the polar coordinates is the same as a graph of a function in the rectangular coordinates. Start with a list of values for the independent variable (θ(θ in this case) and calculate the corresponding values of the dependent variable r.r. This process generates a list of ordered pairs, which can be traced in the polar coordinate system. Finally, connect the points, and take advantage of any pattern that might appear. The function can be periodic, for example, indicating that only a limited number of values are required for the independent variable. Create a table with two columns. The first column is for θ,θ, and the second column is for r.r. Create a list of values for θ. Calculate the corresponding rr values for each θ.θ. It plots each ordered pair (r,θ)(r,θ) on coordinate axes. Connect points and search for a model. Watch this video for more information about polar curve sketches. Graphics the curve defined by the r=4sinθ.r=4sinθ function. Identify the curve and rewrite the equation in rectangular coordinates. Since the function is a multipleSine function, it it Periodic with period 2ï €, 2ï €, then use the values for Î¸Î¸ between 0 and 2ï € .2ï €. The result of steps 1-3 appears in the following table. Figure 7.30 shows the graph based on this table. Î¸3 ï € .4 ï €. The graph of function r = 4 sin î¸ r = 4 sin î¸ is a circle. This is the chart of a circle. The equation r = 4sinî/r = 4sinî¸ can be converted into rectangular coordinates multiplying both sides for R.R. for the first time. This gives equation R2 = 4Sinî¸.r2 = 4Sinî¸. Use the facts that R2 = x2 + y2r2 = x2 + y2 and y = rsinî¸. Yes'. This x2 + y2 = 4y.x2 + y2 = 4y. To put this equation in a standard form, subtract 4Y4Y on both sides of the equation and complete the square: x 2 + y 2 Â '4 y = 0 x 2 + (y 2 Â' 4 y) = 0 x 2 + (y 2 Â '4 y + 4) = 0 + 4 x 2 + (y Â' 2) 2 = 4. x 2 + y 2 Â '4 y = 0 x 2 + (y 2 Â '4 y) = 0 x 2 = 1 = 2 = 2 = 4 = 2 = 2 = 2 = 2 = 2 = 4 = 4 = 4 = 2 = 2 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 2 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 = 4 Create a graph of the curve defined by the function r = 4 + 4cosî¸.r = 4 + 4cosî¸. The graph in Example 7.12 was that of a circle. The equation of the circle can be transformed into rectangular coordinates using the processing formulas coordinated in equation 7.8. Example 7.14 provides some examples of functions to transform from rectangular polar coordinates. Rewriting each of the following equations in rectangular coordinates and identify the chart. Î¸ = ï € 3î¸ = ï € 3 r = 3r = 3 r = 6cosî¸'8sinî/r = 6cosî¸'8sinî¸ Take the tangent of both sides. This dÃ tanî¸ = tan (ï € / 3) = 3.tanî¸ = tan (ï € / 3) = 3. From Tanî¸ = y / xtanî¸ = y / x we can replace the left side of this y / x.y / x equation. This dÃ y / x = 3, y / x = 3, which can be rewritten as y = x3.y = x3. This is the equation of a straight line that crosses the origin with a slope 3.3. In general, any polar equation of the shape Î¸ = Kî¸ = K represents a straight line through the pole with a slope equal to Tank.tank. First, square both sides of the equation. This dÃ R2 = 9.r2 = 9. Then replace R2R2 with X2 + Y2.x2 + Y2. This gives equation x2 + y2 = 9, x2 + y2 = 9, which is the equation of a circle focused on the origin with radius 3. In general, any polar equation of the shape r = kr = k where k â ¨ A positive constant represents a radius k circle centered at the origin. (Note: when crouching both sides of an equation you can introduce new points involuntarily. This should always be taken into consideration. However, in this case, we do not introduce new points. For example, (Â'3, ï € 3) (â 3, Ï 3) is the same point (3,4Ï 3). Multiply both sides of the equation r.r. This leads to r2=6rcosÎ¸â¤8rsinÎ¸.r2=6rcosÎ¸â¤8rsinÎ¸. Then use the formulas r2=x2+y2,x=rcosÎ¸,y=rsinÎ¸.r2=x2+y2,x=rcosÎ¸,y=rsinÎ¸. This gives r2=6 (rcosÎ¸) â¤8 (rsinÎ¸) x2+y2=6xâ¤8y.r2=6 (rcosÎ¸) â¤8 (rsinÎ¸) x2+y2=6xâ¤8y. To put this equation in a standard form, first move the variables from the right side to the left side, then complete the square. (x2+y2=6x2"+y2+y2+8y=0 (x2â ¢6x) + (y2+8y) =0 (x2â ¢6x+9) + (y2+8y+16) =9+16 (xâ¤3) 2+(y+4) 2=25.x2+y2=6x8yx2â¤6 This is the equation of a circle with center to (3,' ¢4) (3,â ¢4) and radius 5. Note that the circle passes through the origin since the center is 5 units. Rewrite the r=secÎ¸tanÎ¸r=secÎ¸tanÎ¸ in rectangular coordinates and identify its chart. We have seen several examples of curve charts defined by polar equations. A summary of some common curves is provided in the tables below. In each equation, a and b are arbitrary constants. Figure 7.31 Figure 7.32 A cardioid is a particular case of lime (pronounced "lee-mah-son"), in which a=ba=b or a=â¤b.a=â¤b. Rose is a very interesting curve. Note that the r=3sin2Î¸r=3sin2Î¸ has four petals. However, the graph of r=3sin3Î¸r=3sin3Î¸ has three petals as shown. Figure 7.33 R = 3 sin 3 Î . r = 3 sin 3 Î . If the coefficient of Î¸Î¸Î¸ is equal, the graph has double of the petals of the coefficient. If the coefficient of Î¸Î¸Î¸ is odd, then the number of petals is equal to the coefficient. You are encouraged to explore why this happens. Even more interesting graphs emerge when the coefficient of Î¸ is not a whole. For example, if it is rational, then the curve closes, that is, it ends where it started (Figure 7.34 (a)). However, if the coefficient is irrational, the curve never closes (figure 7.34 (b)). Although it may seem that the curve is closed, a closer examination reveals that the petals just above the x positive axis are slightly thicker. This is because the petal does not exactly match the starting point. Figure 7.34 Polar rose graphs of functions with (a) rational coefficient and (b) irrational coefficient. Note that the rose in the part (b) would actually fill the whole circle if drawn in full. Since the curve defined by the graph of r=3sin (^Î¸) r=3sin (^^^Î¸) never closes, the curve represented in Figure 7.34 (b) is only a partial representation. In fact, this is an example of space filling curve. A space filling curve is a curve that actually occupies a two-dimensional subset of the real plane. In this case the curve occupies the radius circle 3 centered at the origin. Let's remember the chamber nautilus introduced in the opening of the chapter. This creature shows a spiral when half the outer shell is cut off. It is possibleA spiral using rectangular coordinates. Figure 7.35 shows a spiral in rectangular coordinates. How can we mathematically describe this curve? curve? 7.35 How can we mathematically describe a spiral chart? While the P point travels around the spiral in anti-clockwise direction, its distance from origin increases. It is assumed that the distance d is a constant multiple k of the angle θ that the line segment OP does with the positive x-axis. Therefore d(P,O)=kθ,d(P,O)=kθ, where OO is the origin. Now use the distance formula and some trigonometry: (b) (b) (c) (c)) (c) (c)) (c) (c) (c) (c) (c) (c) (c)) (c) (c) (c)) (c) (c) (c) (c) (c) (c) (c) (c)) (c) (c) (c) (c) (c)) (c) (c)))) (c) (c) (c)) (c) (c))))) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c))))) (c)))) (c) (c) (c) (c) (c) (c) (c) (c)) However, if we use polar coordinates, the equation becomes much easier. In particular, d(P,O)=r,d(P,O)=r, and θ is the second coordinate. Therefore the equation for the spiral becomes r=kθ.r=kθ. Note that when θ=0θ=0 we also have r=0,r=0, then the spiral emanates from the origin. We can remove this restriction by adding a constant to the equation. Then the equation for the spiral becomes r=a+kθr=a+kθ for arbitrary constants aa and k.k. This is indicated as an Archimedean spiral, after the Greek mathematician Archimedes. Another type of spiral is the logarithmic spiral, described by the r=a·bθ.r=a·bθ function. A graph of the r=1.2(1.25θ)r=1.2(1.25θ) function is indicated in Figure 7.36. This spiral describes the shape of the shell of the chamber nautilus. Figure 7.36 A logarithmic spiral is similar to the shape of the nautilus shell chambered. (credit: modification of Jitze Couperus' work, Flickr) Suppose a curve is described in the polar coordinate system by r=f(θ).r=f(θ). Since we have formulas of conversion from polar coordinates to rectangles given by x=rcosθy=rsinθ,x=rcosθy=rsinθ, you can rewrite these formulas using the x=f(θ)cosθy=f(θ)sinθ.x=f(θ)cosθy=f(θ)sinθ) function. This passage gives a parameterization of the curve in rectangular coordinates using θ as a parameter. For example, the spiral formula r=a+bθr=a+bθ from Figure 7.31 becomes x=(a+bθ)cosθy=(a+bθ)sinθ.x=(a+bθ)cosθy=(a+bθ)sinθ. The range θ from −∞−∞ to ∞∞∞ generates the entire spiral. When you study symmetry of functions in rectangular coordinates (i.e., in the y=f(x)),y=f(x) form), we talk about symmetry with respect to the y axis and symmetry with respect to the origin. In particular, if f(−x)=f(x)f(−x)=f(x)=f(x) for all xx in the f,f domain, then ff is a uniform function and its graph is symmetrical to the y axis. If f(−x)=−f(x)f(−x)=−f(x) for all xx in the f,f domain, then ff is an odd function and its graph is symmetrical to the origin. Determining which types of symmetry exhibit a chart, we can learn more about the shape and appearance of the chart. SymmetryRevealing also other properties of the function that generates the graph. The symmetry in the polar curves works in a similar way. Consider a curve generated by the function r = f (Ã®Â¸) r = f (Ã®Â¸) in the polar coordinates. The curve is symmetrical on the polar axis if for each point (r, Ã®Â¸) (r, Ã®Â¸) on the graph, is also the point (r, Ã ¢ 'Ã®Â¸) (r Ã ¢ 'Ã®Â¸) on the graph. Similarly, the equation r = f (Ã®Â¸) r = f (Ã®Â¸) is unchanged by replacing with Â¸Ã®Â¸ Ã Ã ¢ 'Ã®Â¸.Ã ¢' Ã ®ã. The curve is symmetrical on the pole if for each point (r, Ã®Â¸) (r, Ã®Â¸) on the graph, the point (r, Â Â Â Â ¬ +) (r, Ã ¯ â ¬ + a a) is also turned on the graph. Similarly, the equation r = f (Ã®Â¸) r = f (Ã®Â¸) is unchanged when replacing RR with Ã ¢ 'r, Ã ¢' r, or Ã®Â¸Â¸ + A with â ¬ ¬ â Ã ay + to A. The curve is symmetric on the vertical line A = A â Ã ¬ 2a A = Â Ã ¬ 2 if for each point (r, Ã®Â¸) (r, Ã®Â¸) on graph, the point (r, Â Â ¬ Ã ¢ 'Ã®) (r, Â Â ¬ Ã ¢' Ã®Â¸) is also on the graph. Similarly, the equation r = f (Ã®Â¸) r = f (Ã®Â¸) is unchanged when Ã®Â¸Ã®Â¸ is replaced by Â Ã ¢ 'Ã®Â¸ .Â â ¬ ¢ Ã 'Ã®Â¸. The following table shows examples of each type of symmetry. Find the symmetry of pink defined by the equation r = 3sin (2Ã®Â¸) r = 3sin (2Ã®Â¸) and create a chart. Suppose that the point (r, Ã®Â¸) (r, Ã®Â¸) on both the r = 3sin graph (2Ã®Â¸) .r = 3sin (2Ã®Â¸). To test the symmetry on the polar axis, first try to replace with Â¸Ã®Â¸ Ã Ã ¢ 'Ã®Â¸.Ã ¢' Ã®Â¸. This gives r = 3sin (2 (Ã ¢ 'Ã®Â¸)) = Ã ¢' 3sin (2Ã®Â¸) .r = 3sin (2 (Ã ¢ 'Ã®Â¸)) = Ã ¢' 3sin (2Ã®Â¸). © Since this changes the original equation, this test is not satisfied. However, returning to the original equation and replacing with RR Ã ¢ 'Ã king Â¸Ã®Â¸ with Â Ã ¢' Ã®Â¸Â¸ Ã ¢ 'Ã®Â¸ yields Ã ¢' r = 3sin (2 (Â Ã ¬ Ã ¢ 'Ã®Â¸)) Ã ¢' r = 3sin (27 â ¬ Ã ¢ '2Ã®Â¸) Ã ¢' r = 3sin (Ã ¢ '2Ã®Â ¸) Ã ¢ 'r = Ã ¢' 3sin2Ã®Â¸.Ã 'r = 3SIN (2 (Â Ã ¬ A' A)) Â »Ã ¢ 'r = 3sin (2A to ¬ Ã ¢ '2Ã®Â¸) Ã ¢' r = 3sin (Ã ¢ '2Ã®Â¸) Ã ¢' r = Ã '3sin2Ã®Â¸. Multiply both sides of this equation Ã ¢ '1Ã ¢' 1 gives r = 3sin2Ã®Â¸, r = 3sin2Ã®Â¸, which is the original equation. What shows that the graph is symmetric with respect to the polar axis. To test the symmetry with respect to the pole, the first RR substitution with Ã ¢ 'r, Ã ¢' r, which rendisce Ã ¢ 'r = 3sin (2Ã®Â¸) .Ã ¢' r = 3sin (2Ã®Â¸) . Multiply both sides of Ã ¢ '1 gives r = Ã ¢' 3sin (2Ã®Â¸), r = Ã '3sin (2Ã®Â¸), which is not agree with the original equation. Therefore, the equation does not pass the test for this symmetry. However, the return to the original equation and replacing with Ã®Â¸Ã®Â¸ A A + A A A + A â ¬ â ¬ DÃ 3SIN r = (2 (Â A + A â ¬)) = 3SIN (2A + 2A to ¬) = 3 (SIN2Ã Â¸COS2Ã¯ â ¬ + cos2Ã®Â¸sin2Ã¯ â ¬) = 3sin2Ã® Â¸.r = 3sin (2 (Ã®Â¸ + Â Â ¬)) = 3sin (2Ã®Â¸ + 2A to ¬) = 3 (sin2Ã®Â¸cos2Ã¯ â ¬ + cos2Ã® Â¸sin2Ã¯ â ¬) = 3sin2Ã®Â¸. © Since this is in agreement with the original equation, the graph is symmetrical of the pole. To test the symmetry with respect to the vertical line Ã â ¬ A = A 2, A = A 2 Ã â ¬ 2, first replace both with rr Ã ¢ 'Ã ¢' king Ã®Â¸ Ã®Â¸ with Ã ¢ 'Ã®Â¸.Ã ¢' Ã Â. Ã ¢ 'r = 3sin (2 (Ã ¢' Ã®Â¸)) Ã ¢ 'r = 3sin (Ã ¢' 2Ã®Â¸) Ã ¢ 'r = Ã' 3sin2Ã®Â¸.Ã ¢ 'r = 3sin (2 (Ã ¢ 'AA)) Â »Ã ¢' r = 3sin (Ã ¢ '2Ã®Â¸) Ã ¢' r = Ã '3sin2Ã®Â¸. Multiply both sides of this equation Ã ¢ '1Ã ¢' 1 gives r = 3sin2Ã®Â¸, r = 3sin2Ã®Â¸, It is the original equation. Therefore the graphic is symmetrical on the vertical line ÃžÂ¸ = Ã¯ â¸¬ 2.ÃžÂ¸ = Ã¯ â¸¬ 2. This chart has symmetry with respect to the polar axis, to the origin and to the vertical line That crossing the pole. For The function, tabulate the values of Ã®Â¸Ã®Â¸ between 0 and Ã¯ â¸¬ / 2Ã¯ â¸¬ / 2 and then reflect the resulting graph. ÃžÂ¸Ãžâ¸ â¸¬ 00 00 Ã¯ â¸¬ 6 Ã¯ â¸¬ 6 332 â € 2,6332 â € 2.6 Ã¯ â¸¬ 4Ã¯ â¸¬ 4 33 Ã¯ â¸¬ 3Ã¯ â¸¬ 3 332 2.6332 â € 2.6 Ã¯ 2 Ã â¸¬ 2 00 This gives a pink petal, as shown in the following chart. Figure 7.37 The graph of the equation between ÃžÂ¸ = 0 ÃžÂ¸ = 0 and ÃžÂ¸ = Ã¯ â¸¬ / 2. ÃžÂ¸ = Ã¯ â¸¬ / 2. Reflecting this image In the other three quadrants dies the whole graph as shown. Figure 7.38 The entire graph of the equation is called a four-petal rose. Determine the graphics of the graph determined by the equation R = 2COS (3ÃžÂ¸) R = 2COS (3ÃžÂ¸) and create a graph. SECTION 7.3 Exercises in the following exercises, trace the point whose polar coordinates are provided before the construction of the ÃžÂ¸Ã®Â¸ corner and then marking the distance R along the radius. 125. 126. (Â¸ '2, 5 Ã¯ â¸¬ 3) (Ã ¢ 2, 5 Ã¯ â¸¬ 3) 127. (0, 7 Ã¯ â¸¬ 6) (0, 7 Ã ¯ â¸¬ 6) 128. (Ã ¢ 4, 3 Ã¯ â¸¬ 4) (Ã ¢ '4, 3 Ã¯ â¸¬ 4) 129. 130. (2, 5 Ã¯ â¸¬ 6) (2, 5 Ã¯ â¸¬ 6) 131. For the following exercises, it considers the underlying polar chart. Give two series of polar coordinates for each point. 132. 133. 134. 135. For the following exercises, the rectangular coordinates of a point are provided. Find two sets of polar coordinates for the point in (0.2Â â¸¬]. (0.2Â â¸¬]. Round with three decimals. 136. 137. 138. 139. 140. 141. For the following Exercises, find rectangular coordinates for the point given in polar coordinates. 142. (2, 5 Ã¯ â¸¬ 4) (2, 5 Ã¯ â¸¬ 4) 143. (Ã ¢ '2, Ã¯ 6 Â ¬) (Ã ¢ '2, Ã¯ 6) 144. 145. (1, 7 Ã¯ â¸¬ 6) (1, 7 Ã¯ â¸¬ 6) 146. (Ã¸3, 3 Ã¯ â¸¬ 4) (Ã ¢ '3, 3 Ã¯ â¸¬ 4) 147. 148. (ã,' 4.5, 6.5) (ã, '4.5, 6.5) for the following exercises, determine whether the graphics of the Polar equation are symmetrical compared to the XX axis, axis or origin. 149. R = 3 sin (2 ÃžÂ¸) R = 3 sin (2 Ã®Â¸) 150. R 2 = 9 COS Ã®Â¸ R 2 = 9 COS Ã®Â¸ 151. R = COS (Ã®Â¸ 5) R = COS (Ã®Â¸ 5) 152. 153. R = 1 + COS Ã®Â¸ R = 1 + COS Ã®Â¸ For the following exercises, describe the graph of each polar equation. Confirm each description by converting into a rectangular equation. 156. 157. For the following exercises, convert the rectangular equation to the polar shape and sketch the his grap h. 158. x 2 + y 2 = 16 x 2 + y 2 = 16 159. x 2 Ã¸ 'y 2 = 16 x 2 ã' y 2 = 16 for the following exercises, convert the rectangular equation in polar form and Draw your chart. 161. 162. For the following exercises, convert the polar equation in a rectangular form and draw its chart. 163. 164. 166. R = cradle Ã®Â¸ CSC Ã®Â¸ R = cradle Ã®Â¸ CSC Ã®Â¸ For the following exercises, sketch of a chart of the polar equation and identify any symmetry. 167. R = 1 + sin Ã®Â¸ R = 1 + sin Ã®Â¸ 168. R = 3 Ã ¢ '2 COS Ã®Â¸ R = 3 Ã¸' 2 COS Ã®Â¸ 169. R = 2 Ã ¢ '2 sin ÃžÂ¸ r = 2 Ã ¢' 2 sin Ã®Â¸ 170. r = 5 Ã ¢ '4 sin Ã®Â¸ r = 5 Ã ¢' 4 sin Ã®Â¸ 171. R = 3 COS (2 Ã®Â¸) R = 3 COS (2 Ã®Â¸) 172. R = 3 sin (2 Ã®Â¸) R = 3 SIN (2 Ã®Â¸) 173. R = 2 COS (3 Ã®Â¸) R = 2 COS (3 Ã®Â¸) 174. R = 3 COS (Ã®Â¸ 2) R = 3 COS (Ã®Â¸ 2) 175. R 2 = 4 COS (2 Ã®Â¸) R 2 = COS (2 Ã®Â¸) 176. R 2 = 4 sin Ã®Â¸ R 2 = 4 sin Ã®Â¸ 178. [t] The graph of r = 2cos (2ÃžÂ¸) sec (Ãžâ ¸) .R = 2COS (2ÃŽÂ¸) SEC (ÃžÂ¸). It is called a stunning. Use a graphic utility to draw the graph, and, from the graph, determine the asymptote. 179. [t] Use a graphic utility and sketch of the graph of R = 62SINÃ®â ¸Ã ¢ '3COSÃ®Â¸.R = 62SINÃ®Â¸.Ã ¢' 3COSÃ®Â¸. 180. [T] Use a graphic utility for graph R = 11Ã ¢ 'CosÃ®Â¸ .R = 11Ã ¢' CosÃ®Â¸. 181. [T] Use the technology for graph R = ESIN (Ã®Â¸) Ã ¢ '2COS (4Ã®Â¸) .R = ESIN (Ã®Â¸) Ã ¢' 2COS (4Ã®Â¸). 182. [t] Use the technology to trace R = sin (3Ã®Â¸7) R = sin (3Ã®Â¸7) (use the range 0 â € ÃžÂ Â¤ Â Â Â Â â¸¬) .0 â € ÃžÂ¤ ÃžÂ¸â¸ 14Ã¯ â¸¬). 183. Without using technology, sketch the polar curve ÃžÂ¸ = 2Ã¯ â¸¬ 3.ÃžÂ¸ = 2Ã¯ â¸¬ 3. 184. [t] Use a graphic utility to trace R = Ã ®Â¸sinÃ®Â¸R = ÃžÂ¸sinÃ®Â¸ for Ã ¢ Ã Ã¯ â¸¬ Ã ¢ Ã ¢ ÃžÂ¸ â € œâ € â € ¢ 'Ã¯ â¸¬ Ã ¢ â € œâ € â € œâ € â € œâ € â € œ¬. 185. [T] Use the technology to trace R = EÃ ¢ '0.1Ã®Â¸R = EÃ ¢' 0.1Ã®Â¸ for Ã ¢ '10 â € Ãž Ãž Ãž â € ™ 10.ã, ' 10 â € ™ Ãž Ãž â € ™ â € ™ 10. 186. [t] there is a curve known as Ã ¢ â¸¬ â "black hole.Ã ¢ â¸¬ uses technology to trace r = ¢ ¢ 0.01Ã®Â¸R = Ã ¢ '0.01Ã®Â¸ for Ã¸100 â € Ãž Ã®Â¸Ã ¢ â € œ100.Ã¸,100 â € ™ Žâ¤ ÃžÂ¸ â € œ100. 187. [t] Use the results of the previous two problems to explore the graphs of R = ¢ '0.001Ã®Â¸R = ¢' 0.001Ã®Â¸ ¢ ¢ ¢ '0.0001Ã®Â¸R = EÃ ¢ '0.0001Ã®Â¸ for | ÃžÂ¸ |> 100. | ÃžÂ¸ |> 100. | ÃžÂ¸ |> 100. | ÃžÂ¸ |> 100.

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