Clinton high school football schedule 2020

There are unlimited polar curves. Each equation rrr and ρ\thetaτ can be drawn as a polar curve. The following examples are some of the best known types of polar curves: Replacing the equation cosine,text%-cosine function with the sine\text{sine}sine function creates the same shape even though it is rotated. In most cases, this rotation π2\frac{\pi} {2}2π radians counterclockwise. Lines: The line has a very simple equation in the polar form, provided that the line passes through the pole. ρ=π6\theta=\frac{\pi}{6}ρ=6π The general form equation for the line that passed through the Pole is ρ=α,\theta=\alpha=α, where α\alphaα is an angle with a positive xxx axis. Note that this equation does not contain the rrr parameter. This means that the line may extend indefinitely outside the pole, but the angle it makes with a positive xxx axis remains constant α.\alpha.α. Note that any line ρ=α+πk\theta=\alpha+\pi k大=α+πk is the same as the line ρ=α\theta=\alpha=α any integer.k.k. Circles: The circle centered on the pole has a very simple equation in polar form. r=2r=2r=2 The general form equation in the middle of Pole is r=a,r=a,r=a, where aaa is the radius of the circle. Cardioids: Cardioid is a heart-shaped curve formed by tracking the path of the point attached to the circle, as it rolls around another circle with the same radius. r=1+cosr=1+\cos{\theta}r=1+cosτ Cardioid in general form, the equation is r=a+acosn,r=a+a\cos{\theta},r=a+acos大, where aaa is the radius of the circles described in the definition. Limaçons: Limaçon is a more general form of cardioid. When the guide is formed from a track traced by a point attached to the circle, the limaçons are formed from a track determined by any point attached to the circle. This point could be round (it would create cardio), or it could be at any point inside or outside the circle (it would create a different limaçon curve). Like cardio, the path is traced around rolling around with the same radius. r=1.5+cosr=1.5+\cos{\theta}r=1.5+cosτ r=0.5+coseer=0.5+\cos{\theta}r=0.5+cosi limaçon's general form equation is r=a+, because,r=a+b\cos{\theta},r=a+bcoson, where the ratio ba\frac{b}{a}ab describes the limaçon shape: as ba <> <> <1, then= the= point= is= inside= the= circle.= the= limaçon= will= have= a= smoothed= heart= shape.= as= ba\frac{b}{a}ab = approaches= 0,0,0,0,= the= shape= of= curve= will= approximate= ba=1,\frac{b}{a}=1,ab =1, then= the= point= traced= is= on= the= circle.= the= limaçon= will= have= a= cardioid= shape.= if= ba=>1,\frac{b}{a}>1,ab >1 , the point to be monitored is outside the circle. Limaçon has an internal loop. As ba\frac{b}{a}ab grows larger, the internal cycle grows to a larger curve size and</1,>approximately the circle. Rose curves: The rose curve is a sinusoid curve in the polar coordinates. Such curves have flower shape and loops of these curves are called petals. r=cos(39)r=\cos(3\theta)r=cos(3n) The overall form equation of the rose curve is r=acos(kη),r=a\cos(k\theta), r=acos(kη), where aaa is the magnitude of each petal, and faq is an integer that determines how many petals there are: If the faq is odd, the number of petals k.k.k. If the faq is even, the number of petals is 2k.2k.2k. The rose curve can also be described by the following equation: r=a+because(kη).r=a+b\cos(k\theta).r=a+because(kη). This equation is very similar to the limaçon equation; the only difference is the parameter faq. Changing the parameters aaa and bbb affects both the shape of the curve and the number of petals. Replacing the combination\text{cosine}withine sine\text{sine}sine function rotates the curve π2k\frac{\pi}{2kπ radians counterclockwise (this is different from most other polar curves rotated by π2\frac{\pi} {2}2 radπians). Archimedian spirals: The Archimedian spiral is a spiral-shaped curve that extends endlessly outwards to the pole. r=ρ2πr=\frac{\theta}{2\pi}r=2πππ Archimedian general form equation is r=a+b&r=a+b\theta.r=a+bn. The parameter aaa affects the original position of the coil, and the bbb parameter affects the distance between the spiral revolutions. Lemniscates: Lemniscate is a figure of eight shaped curves. This is the point locus where the distance and two points (foci) product is a constant quantity. r=cos(29)r=\sqrt{\cos(2\theta)}r=cos(2n) Lemniscate's general form equation is r2=a2cos(29),r^2=a^2\cos(2\theta),r2=a2cos(2), where aaa is the size of a single crown page. The combination of the function\text{cosine}with the sine\text{sine}sine rotates the curve π4\frac{\pi} {4}4π radian counterclockwise (this is different from most other polar curves rotated by π2\frac{\pi}{2}2 radians). Cone sections: In the context of polar curves, a cone section is a point locus, where the ratio of distance point (called focus) to distance to line (directrix) is a constant quantity. This constant relationship is called the eccentricity of the cone section. r=11+cos{1}{1+\cos{\theta}}r=1+cos大1 The general form of the cone section is r=l1+ecosn,r=\frac{l}{1+e\cos{\theta}},r=1+ecos大l , where the ethos is the eccentricity of the conical section, and Lll is the length of the rectum of the semi-openness (the distance along the y-axis from the pole to the curve). Using the equation above, the cone object is always in focus. Directrix is line x=1ex=\frac{1}{e}x=e1 polar form)))) The different ee values give different types of cone partitions: if e=0,e=0,e=0, there is a curve. If 0 <> <> <> <> <> <1, then= the= curve= is= an= ellipse.= if= e=1,e=1,e=1, then= the= curve= is= a= parabola.= if= e=>1,e>1,e>1, is hyperbolo. r = sin (2ρ) − 1.7 This is a real graph using polar coordinates. Okay, I admit to adding an eye and a smile. :-) Don't miss polar charts with an interactive applet. We'll use the computer to draw the charts in this section. You will also learn how to sketch some of them on paper because it will help you understand how graphs work in polar coordinates. Don't worry about all the hard-looking algebra in the second part of the answers - it's just there to show that the polar regions are much easier than the rectangular coordinates of these graphs. We convert them using what we learned in the last part, Polar coordinates. The useful background curves of polar coordinates work very much in the same way as vectors. See: Vector definitions Examples Download graph paper Draw all of the following functions with polar coordinates, and then convert each equation to rectangular coordinates. Example 1: r = 2 + 3 sin λ (This polar graph is called limacon from the Latin word snail.) Answer If we don't have a computer and we need to sketch the function on paper, we need to set up a table of values as follows: θ (degrees) '0°' '30°' '60°' '90°' '120°' '150°' '180°' θ (radians) '0' 'π/6' 'π/3' 'π/2' '(2π)/3' '(5π)/6' 'π' r = 2 + 3 sin θ '2' '3.5' '4.60' '5' '4.6' '3.5' '2' θ (degrees) '180°' '210°' '240°' '270°' '300°' '330°' '360°' θ (radians) 'π' '(7π)/6' '(4π)/3' '(3π)/2' '(5π)/3' '(11π)/6' '2π' r = 2 + 3 sin θ '2' '0.5' '-0.60' '-1' '-0.60' '0.5' '2' The first 7 points from this table are (2, 0○), (3.5, 30○), (4.60, 60○), (5, 90○), (4.6, 120○), (3.5, 150○), and (2, 180○). We draw these dots (they are numbered) on a polar graph. I have also shown arrows in the direction you need to go when connecting points. Recall: Negative r means we have to be on the other side of origin. Here's the full schedule. 0°30°60°90°120°150°210°240°240°270°330°012345R = 2 + 3 sin ρ, limacon. By converting a rectangular form again, we convert our polar function into a rectangular form so that we can see how much easier the polar form has certain functions. r = 2 + 3\ sin\ ρ Ristkülikukujul, see on: 'sqrt(x^2+y^2)=2+3y/sqrt(x^2+y^2)' 'x^2+y^2=2sqrt(x^2+y^2)+3y' 'x^2+y^2-3y=2sqrt(x^2+y^2)' '(x^2+y^2-3y)^2=4((x^2+y^2)^2=4((x^2+y^2)'(2+y^2-3y)^2=4((x^2+y^2)'(x^2+y^2-3y)^2=4((x^2+y^2)'(2=4(2sqrt(x^2+y^2)'(2+y^2-3y)^2=4(2sqrt(x^2+y^2)'(x^2+y^2-3y)^2=4((x^2+y^2)^2=4((x^2+y^2)'(x^2+y^2-3y)^2=4((x^2+y^2-3y)^2=4((x^2+y^2)'(2=x^2+y^2)' 'x^4+2x^2y^2+y^4-6y(x^2+y^2)+' '9y^2' '=4(x^2+y^2)' 'x^4+2x^2y^2+y^4-6y(x^2+y^2)-' '4x^2+' '5y^ 2' '=0' Notice how much easier the polar form is rectangular form. Here's another example of limacon: Example 2: r = 3 cos 2T Answer What if you can't use the computer to draw a graph? </1,> </1,> table of values as follows: I put on degrees and radian equivalents. θ (degrees) 0○ 30○ 60○ 90○ 120○ 150○ 180○ θ (radians) '0' 'π/6' 'π/3' 'π/2' '(2π)/3' '(5π)/6' 'π' 'r = 3\ cos\ 2θ' '3' '1.5' '-1.5' '-3' '-1.5' '1.5' '3' θ (degrees) 210○ 240○ 270○ 300○ 330○ 360○ θ (radians) '(7π)/6' '(4π)/3' '(3π)/2' '(5π)/3' '(11π)/6' '2π' 'r = 3\ cos\ 2θ' '1.5' '-1.5' '-3' '-1.5' '1.5' '3' The first 7 points from this table are (3, 0°), (1.5, 30°), (-1.5, 60°), (-3, 90°), (-1.5, 120°), (1.5, 150°), and (3, 180°). Placing these first 7 points on the polar coordinate network gives us the following: Let's start at point 1 (3, 0°) and move around the graph, increasing the angle and changing the distance from the baseline (determined by replacing the angle r = 3 cos 2. I've drawn arrows to show the direction we need to go to get to the next point. Recall: Negative r means we have to be on the other side of origin. I've only drawn the first 7 points above to keep the graph simple. It is clear that we should calculate more than that number of points to get a good sketch. (You would need at least twice as many points as I have in the table above - every 15° would be enough.) Here's the full schedule. 0°30°60°90°120°150°210°240°270°300°330°0123Rography = 3 cos (2n). [The graph above has angles in radians where π radians = 180°. For more information, see Radians.] Note that the curve is fully drawn when ρ takes all values between 0 and 2π. Conversion polaris to rectangular coordinates Next, here's the answer to convert to rectangular coordinates. Why? We're turning this function into rectangular coordinates to see how much easier it is to write in polar coordinates. r = 3\cos\2τ to convert to rectangular coordinates we use the fact that cos 2ρ = cos2 ρ - sin2 ρ. So r = 3 cos 2ρ = 3 (cos2 ρ - sin2 ρ). Now, because 'cos\theta=x/r', 'sin\theta=y/r' and r^2=x^2+y^2', we have 'cos^2theta=(x^2)/(r^2)=(x^2)/(x^2+y^2)' and sin^2theta=(y^2)/(r^2)=(y^2)/(x^2)/(x^2)/(x^2)/(x^2+y^2)' Having a positive square root r^2=x^2+y^2 gives us: r=sqrt(x^2+y^2)' So r = 3 cos\ 2λ in polar coordinates is equivalent to r=3 (cos^2theta-sin^2theta)' 'sqrt(x^2+y^2)=3(x^2/(x^2+y^2)-y^2/(x^2+y^2))' 'sqrt(x^2 2+y ^2)=3/(x^2+y^2)(x^2-y^2)' '(x^2+y^2)^(3/2)=3(x^2-y^2) in rectangular sisal coordinates. We see that our equation in polar coordinates, r = 3 cos 26, is much simpler than the rectangular equivalent. Example 3: r = sin ρ − 1 (This is called cardioid because it is heart-shaped. This is a specific case of limacon.) Answer We need a sketch r = sin theta-1. Using the same process for previous examples: for the curve above, if ρ = 0, r = -1, so that the curve begins on the left side of the origin. to convert to a rectangular form to a rectangular shape, we use r2 = x2 + y2 and 'sin^2theta=(y^2)/(r^2)=(y^2)/(x^2+y^2)' in rectangular form, r = sin ρ − 1 is: 'sqrt(x^2+y^2)=y/sqrt(x^2+y^2)-1' 'x^2+y^2=y-sqrt(x^2+y-sqrt(x^2+y-sqrt(x^2+y-sqrt(x^2+y^2 x^2+y^2)' 'x^2+y^2-y=-sqrt(x^2+y^2)' '(x^2+y^ 2-y)^2=x^2+y ^2' 'x^4+2x^2y^2y^2y(x^2+y^2)+y^2' '=x^2+y^2' 'x ^4+2x^2y^2y^2y(x^2+y^2^2)-x^2' Example 4: r = 2.5 Answer We consider sketch r = 2.5 In this example , we do not see in ρ function what we have been given. This means the radius, r is constant, regardless of the value angle ρ takes. Here's a graph: 0°30°60°120°120°180°210°240°270°330°0123R = 2,5, limacon. What is the equivalent of rectangular coordinates? We're turning this function into rectangular coordinates to see how much easier it is to write in polar coordinates. r = 2.5 to convert to rectangular coordinates we use r2 = x2 + y2 In this example r = 2.5, so r^2= 6.25. So it gives us: x2 + y2 = 6.25 Not surprisingly, it is similar to the equation of the round we received in the Circle part in the past. Example 5: r = 0,2 ρ This is an interesting curve called Archimedeanspiral. As ρ increases, so does r. Answer See also Equiangular Spiral. Later, we'll learn how to find the length of the Archimedean spiral. Example 6: r = sin (20) − 1.7 This is the face I drew at the top of this page. We're not even trying to find the equivalent of rectangular coordinates! This graph features a play in the next interactive applet. Interactive graph Explore the charts above using this interactive graph. Use the slider below the graph to track the curves. See what happens when you go beyond the normal domain of these charts (i.e. if theta is less than 0 or greater than theta =2pi). Use the option field at the top of the graph to change the function. Select a function: Copyright © www.intmath.com application Check out Polar coordinates and cardio microphones for the application of polar coordinates. Page 2 0A graph with polar coordinates For certain functions, rectangular coordinates (using the x axis and y axis) are very uncomfortable. In rectangular coordinates, we describe the dots as a certain distance along the x-axis and a certain distance on the y axis. However, certain functions are very complex when we use a rectangular coordinate system. Such functions can be much simpler in the polar coordinate system, allowing us to describe and describe certain functions very conveniently. Polar coordinates work in much the same way as we have seen in trigonometry (radians and arc length, where we used r and ρ) and the polar form of complex numbers (where we also saw r and λ). Vectors also use the same idea. [For more information, see Vectors 2 dimensions.] Conversion of polar and rectangular coordinates in polar coordinates, points are a certain distance (r) from the pole (origin) and at a certain angle (ρ) from the positive horizontal axis (the so-called polar axis). The coordinates of the polar coordinates point are spelled as follows :r, ρ) The graph of the point (r, ρ) is as follows: the point described in the polar coordinates(2, (3π)/4) looks like this: the use of polar graph papers in polar coordinates. NOTE: Angles may be in degrees or radians for polar coordinates. Download graph paper Example 2 Draw points in the Arctic Circle: a) (2, 60°) b) (4, 165°) c) (3, 315°) The answer Converting Polar and rectangular coordinates Conversion from polar to rectangular coordinate is the same idea as converting a rectangular shape to a polarform in complex numbers. [Learn how to convert rectangular and polar forms to the complex numbers chapter.] From Pythagoras, we have: r2 = x2 + y2 and basic trigonometry gives us: tan\theta = y / x = r cos ρ y = sin λ So this is the same type of thing that we had complicated numbers. We can use the calculator directly to find the equivalent values. Example 3 Converts rectangular coordinates given by code '(2.35, -7.81)' to polar coordinates. Answer Using calculator, we have: (2.35, -7.81)' rectangular ≡'(8.16, -73,3^@)' Sketch to check your response! (The ≡ means is identical to equal.) Example 4 Converts polar coordinates given as '(4.27, 168^@)' rectangular coordinates. Answer Calculator we have: (4.27, 168o) polar ≡ (−4.18, 0.888) rectangular sketch to check your answer! Page 3 Parabola has many applications in situations where: Radiation often needs to be concentrated at a single point (e.g. radio telescopes, pay TV dishes, solar radiation collectors); or Radiation must be transmitted from one point to a wide parallel beam (e.g. headlight reflectors). Here is an animation that shows how parallel radio waves are collected by a parabolic antenna. Parallel rays are reflected from the antenna and meet at a point (red dot, marked F) called focus. Click See more to see more examples. Every time you do it, the dish becomes flattery. Make sure that focus point F moves beyond the cup every time you start it. Parabola definition Parabola is defined as a point locus that moves so that it is always as far away from a fixed point (called focus) and a given line (called directrix). [Word history means points that match this condition. You'll see some backgrounds under Distance from point to line.] The following graph has a parabola focus (0, p). Directrix is the line y = -p. Focal length is |p| (Distance from source to focus and from source to directrix. We take absolute value because distance is positive.) Point (x, y) indicates any point Curve. The distance (x, y) to focus (0, p) is the same as the distance (x, y) from directrix. The symmetry axis of this parabola is the y axis. Formula Parabola - vertical axis Addition from the top of our chart, we can see that distance d = y + p. xy(x, y)(0, p)y = −pppypfocus:directrix:ddNote that d = y + p. Now, using the distance formula for total points (0, p) and (x, y) and equalising this with our value d =y+p, we have 'sqrt((x-0)^2+(y-p)^2)=y+p' Squaring both sides gives: (x − 0)2 + (y − p)2 = (y + p)2 Simplification gives us the formula parabola: x2 = 4py In a more familiar form where y = left, we can write it as follows: y = x ^ 2 / (4p) where p is the focal length of the parabola. Now let's see what the points locus means proportionally from point to line. All color-coded line segments have the same length in this arachnid-like graph: each colored segment has the same length. Don't miss Interactive Parabola Charts, where you can explore concepts such as focus, Directrix and peak. Example 1 - Parabola vertical axis Download graph paper Sketch parabola 'y=x^2/2' Find focal length and show focus and directrix in your graph. The focal length answer is found by equating y 'y=x^2/(4p) to the general expression and our specific example: y=x^2/2. So the focus is '(0,5)' and directrix is line y = -0,5. Our curve is as follows: 12-1-20.511.5-0.5xy(0, 0.5)y = -0.5focus:directrix:Parabola y = 0.5x2. Note: Although the sides look like they become straight as x increases, in fact they are not. The side of the parabola just get steeper and steeper (but never vertical, either). Arch Bridges – The Almost Parabolic Gladesville Bridge in Sydney, Australia was the longest single span concrete curved bridge in the world when it was built in 1964. The arch shape is almost parabolic, as you can see in this picture with the top graph y = - x2 (Negative means feet parabola face down.) [In fact, such bridges are usually associated with a problem, but it falls outside the scope of this chapter. See Is Gateway Arch parabola?] Parabolas with horizontal axis We can also have a situation where parabolic horizontal: xy(x, y) (p, 0)x = −pfocus:directrix:Parabola horizontal axis. In this case, we have a relationship: (not working) y2 = 4px [In relation, there are two or more y values for each x value. On the other hand, the function has only one y value for each x value.] The symmetry axis of the graph above is the x axis. Example 2 - Parabola with horizontal axis draws a curve and finds the parabola equation with focus (−2,0) and directrix x = 2. Response to Shift Vertex parabola from Origin It's a similar concept to the case when we shifted from mid-round origin. To shift the tip of the parabola (0,0) to (h, k) changes every x equation (x − h) and each y changes (y − k). So if the parabola axis is vertical and the tip is (h, k), we have (x − h)2 = 4p(y - k) xy(h, k)x = 2focus:directrix:Parabola (x - h)2 = 4p(y − k) in the above case, the vertical line of the symmet+s through point (h, k) is x = h. If the parabola axis is horizontal and the tip is (h, k), the equation (y − k)2 = 4p(x − h) xy(h) x = 2focus:directrix:Parabola (y - k)2 = 4p(x − h) in the above case is the horizontal axis of symmetry through point (h, k) which is y = k. Exercises 1. Sketch 'x^2= 14y' reply 2. Looks for a parabolic equation with a top (0.0) on the x-axis and passing through (2, -1). The curve answer must be as follows because we know it has a horizontal axis and passes '(2, -1)': Parabola, peak (0.0), passes (2, -1). So we need to use the general formula parabola horizontal axis: y ^ 2 = 4px We need to find p. We know that the curve passes through '(2, -1)', so we replace: (-1)^2= 4(p)(2) '→ '1 = 8p' → p = 1/8. So the required equation is 'y^2=x/2'. 3. Above, we found that the parabolic equation with the axis parallel to the tip (h, k) and the y axis is (x − h)^2= 4p(y − k). Sketches a parabolic with (h, k) being ' (-1,2) and p= -3. The answer we have at the top '(-1.2) and p = -3 (so parabola is upside down). The peak is (-1, 2) because we know the focal length is | (p) | =3, which is we don't really need to find the equation, only as an exercise: using '(x − h)^2 = 4p(y − k) ' We have: '(x + 1)^2 = 4(-3)(y − 2) 'x^2 + 2x + 1 = -12y + 2 4' '12y = -x^2 − 2x − 1 + 24' y = (-x^2 − 2x + 23)/12' Useful article and graph interactive See also: How to draw y^2 = x − 2?, with a broad explanation of the how to manipulate parabolic charts, depending on the given given. Also, don't miss the interactive Parabola Graphs, where you can explore parabolas by moving them around and changing parameters. Applications Parabolas Application 1 - Antennas Parabolantenni have a cross-section width of 12 m and a depth of 2 m. Where should the receiver be placed for the best reception? Answer Parabolic antenna width 12 m, height 2m. The receiver must be placed in the focus of the parabolic dish for the best reception, as the incoming signal is concentrated in the focus. We place the parabola tip of origin (comfort) and use the equation parabola to get focal length (p) and thus the necessary point. In general, the equation parabola vertical axis is x^2 = 4py. We see that parabola (6, 2). Replacing, we have: (6)^2 = 4p(2)' So p = 36/8 = 4.5 So we need to place the receiver 4.5 meters from the peak, along the axis of symmetry parabola. Parabola equation is: 'x^2 = 18y ' This is 'y = x^2 /18' Application 2 - Projectiles Golf Ball has dropped and regular strobe light illustrates its movement as follows ... We observe that it's a parabola. (Well, very close). What's the parabola equation a golf ball looks for? Answer First, we can get a set of data points by observing the ball height at different times of the graph (I have used the bottom as a data point for each lap): t 0 2 4 6 8 10 12 16 h 0.2 4.3 8.2 10.9 12.3 12.5 11.6 9.5 6.0 Using Scientific Notebook, we can model motion data points. Using one of the statistical tools of the scientific notebook (Fit Curve to Data), we can: y = -0.51429 + 2.804x - 0.15013x^2 Here is the graph model we found: 2468101214161820-2123456789101111213-1xyParabolic palliic golf initiative. We can use it to find out where the ball is at any time on the move. For example, if t = 2,5, golf ball height 5,6 m. We can also predict when this next bounce (around this time 18.5) by solving y = 0. You can also use the Microsoft Excel module parabola to use the model curves in Excel. After you draw points, right-click one of the dots and select Add trendline. Select Polynome, step 2. In Options you can get Excel to display the equation in the parabola chart. Tapered section: Parabola All graphs in this chapter are examples of tapered sections. This means that we get every shape, slicing the cone at different angles. How can we parabola slicing the cone? We start with a double cone (2 on the right of circular cones placed at the top): When we slice the cone parallel to the bevelled edge of the cone, the resulting shape is parabola, as shown. Page 4 The cooling towers of the nuclear power plant have a hyperbolic cross-section. [Image source: Flickr.] Hyperbola is a pair of symmetrical open curves. This is what we get when we slice a couple of vertical joined cones into a vertical plane. How to create hyperbole? Take 2 fixed points A and B and let them be 4a units apart. Now, take half of this distance (i.e. 2a units). Now move along the curve so that at any point of the curve (distance A) − (distance B) = 2a units. The curve, which results in hyperbole. The curve has two parts. Let's see how it works with some examples. Example 1 Allow the distance between points A and B to be 4 cm. For convenience, we place our fixed points A and B on the number line (0, 2) and (0, -2) so that they are 4 units away. In this case a = 1 cm and 2a = 2 cm. Now we're going to start chasing the curve, so P's the point on the curve. distance PB − distance PA '= 2 cm. Let's start with (0, 1)'. One of the paragraphs P is given below, so that PB − PA = 2. If we continue, we will get a blue curve: Now, continuing our curve on the left side of the axis gives us the following: We also have another part of hyperbole on the other side of the x-axis, this time using: distance PA − distance PB = 2. The typical point P is shown again, and we can see the lengths given that PA − PB = 2. We observe that the curves almost change directly close to the limbs. In fact, the lines y=x/sqrt3 and y=-x/sqrt3 (the red dotted lines below) are asymptote: [Asymptom is the line that forms a barrier to the curve. The curve approaches the asymptote, but does not touch it.] In example 1, points (0.1) and (0, -1) are called hyperbole peaks, while points (0,2) and (0, -2) are hyperbolic foci (or focus). Our hyperbolic equation for hyperbola, for which the a = 1 we 1. We call this example of north-south opening hyperbole. Where did this hyperbolic equation come from? The formula is derived from the distance formula and the requirement (in this example) that distance PB – distance PA = 2. Here's the evidence. Proof For any point P(x, y) on the hyperbola, 'text(distance)\ PB=sqrt(x^2+(y+2)^2' 'text(distance)\ PA=sqrt(x^2+(y-2)^2' Since PB − PA = 2 in our example, then: 'sqrt(x^2+(y+2)^2)-sqrt(x^2+(y-2))=2' Rearrange: 'sqrt(x^2+(y+2)^2)=sqrt(x^2+(y-2))+2' Square both sides: 'x^2+(y+2)^2' '=[x^2+(y-2)^2]' '+4sqrt(x^2+(y-2)^2)+4' Expand brackets and simplify: '2y-1=sqrt(x^2+(y-2)^2' Square both sides again: 4y2 − 4y + 1 = x2 + y2 − 4y + 4 Simplifying gives the equation of our hyperbola: 'y^2-x^2/3=1' The asymptotes (the red dotted boundary lines for the curve) are obtained by setting the above equation equal to '0' , instead of 1. 'y^2-x^2/3=0' It gives us 2 lines: 'y=-x/sqrt3' and 'y=x/sqrt3' Interactive graph See interactive graph of this example and others on this page, here: Hyperbola interactive graphs. North-South hyperbolic general equation Hyperbolic with a focal length of 4a (distance 2 between the column) and passes through the y axis (0, c) and (0,-c), we define b2 = c2 − a2 Using the distance formula generally similar to the above example, we can get a general form of north-south hyperbola: y ^2/a^2-x^2/b^2=1 Example 2 Here's another example of north-south hyperbole. This equation is: y2 − x2 = 1 North-South hyperbole (green) with its asymptotes (magenta color). As in example 1, this hyperbole passes 1 and -1 on y-axis, but has a different equation and different shapes (and different asymptote). Where's 2 phocis for this hyperbole? We need to find the value of c. Control (equation of this hyperbole), we see a = 1 and b = 1. Using the above formula, we have: b2=c2 − a2 Both 12=12 c2=2 c=±√2 So the points of this hyperbole are A(0,√2) and B(0,√2). East-West opening Hyperbola Reversing x- and y-variables in our second example above, we get the following equation. Example 3 x2 − y2 = 1 It gives us east-west opening hyperbola, as follows. Our curve passes through x-axis '-1' and 1, and once again the asymptoids are lines y = x and y = −x. East-West hyperbola (green) with its asymptoids (magenta color). The general formula for east-west hyperbole is given as follows: 'x^2/a^2-y^2/b^2=1' Note that x and y are the opposite compared to the north-south hyperbolic formula. Don't miss an interactive graph of this example and others on this page, here: Hyperbola interactive graphs. The technical definition of Hyperbola A hyperbola is the location of points where the difference in distance between the two fixed foci is constant. This technical definition is one way of describing what we did in example 1 above. Hyperbolas in the wild throw 2 stones into the pond. The resulting concentric waves meet the hyperbolic shape. More forms of the equation Hyperbola There are some different formulas for hyperbola. Considering the hyperbolic center '(0,0)', the equation is either: 1. North-south aperture hyperbola: 'y^2/a^2-x^2/b^2=1' Slopes of Asymptotes are given as follows: '+-a/b' 2. East-west aperture hyperbola: 'x^2/a^2-y^2/b^2=1' Asymptootide slopes are as follows: +-b/a' In examples above, examples 2 and 3, both a and b were equal to 1, so the highs were just ± 1 and our asymptoids were the lines y = x and y = −x. What effect will it have if we change a and b? Example 4 Sketch hyperbola 'y^2/25-x^2/4=1' Answer first, we understand that it is a north-south opening hyperbole with a = 5 and b = 2 . This looks similar to example 1 above, which was also a north-south opening of hyperbole. We need to find: y-intercepts (no x-intercepts in this example) aymptootes y-intercepts: Just let x = 0 in the equation given question: y^2/25-x^2/4=1 We have: y^ 2/25=1 Resolution gives us 2 values (as expected): y = -5 and y = 5 Me an alternative note, hyperbolics are units from the center of hyperbolics. In this example, this means that our peaks are x = 0 and y = -5 and y = 5. Aymptotes: We have a north-south opening of hyperbola, so slopes asymptotic are given +-a/ b In this example a = 5 and b = 2. Thus, the slopes of the asymptoids are simply: -5/2 and 5/2. Equations asymptotes, as they pass through (0.0), are given as follows: y = -(5x)/2 and y = (5x)/2 So we are ready to add the above information to our graph: Asymptotes and 'y'-intercepts (& tops in this case). All that remains is to stop the weapons of hyperbole, ensuring that they are closer and closer to the asymptodes, as follows: North-South hyperbola (green) with their asymptodes (magenta color). Further forms in the equation Hyperbola (1) Possibly the easiest equation hyperbola is given in the following example. Example 5 - Equilateral Hyperbola xy = 1 It is known as equilateral or rectangular hyperbole. Rectangular hyperbole. Assymptoids are x and y axes. Note that this hyperbole is in the northeast, southwest of the opening hyperbole. Compared to other hyperbooles we have seen so far, the axes of hyperbole are rotated to 45°. Asymptoids are also x and y axes. Hyperbolic axis has no origin (2) Our hyperbole may not be middle-born (0.0). In this case, we use the following formulas: Opening north-south to hyperbola center (h, k), we have: ((y-k)^2)/a^2-((x-h)^2)/b^2=1' For east-west opening in the middle of hyperbola (h, k), we have: (x-h)^2)/a^2-(y-k)^2)/b^2=1 Example 6 - Hyperbola with Axes Shifted Sketch hyperbola ((x-2)^2)/36-((y+3)^2)/64=1 Response We mark, that it is an east-west opening hyperbola with = 6 and b = 8. The center of this hyperbole is (2, -3) because h = 2 and k = -3 in this example. The best approach is to ignore the shifts (for now) and figure out other parameters of hyperbola. So I assume (in this part) that hyperbola is actually X ^2/36+Y^2/64=1, and I use capital letters X and Y. Parabola tops are found when Y = 0. This gives us X = -6 or X = 6. Asymptols have a slope '-8/6 = -4/3', OR 8/6 = 4/3. Now we can sketch aymptotes and peaks, remembering to shift everything so that the center is (2, -3): 51015-5-10-1551015-5-10-15-20xymAsptotes and peaks (-4,-3) and (8,-3). Now hyperbola: 3. We could expand our equations hyperbola into the following form: Ax ^ 2 + Bxy + Cy ^ 2 + Dx + Ey + F = 0 ' (such that B ^2>4AC) In previous examples on this page, there was no xy-run involved. As we saw in example 5, when we have xy-term, it has an effect on rotating axes. We no longer have north-south or east-west opening weapons - they could open up in any direction. Example 7 - Hyperbola with Shifted and Rotated Axes Graph hyperbola x2 + 5xy − 2y2 + 3x + 2y + 1 = 0 is as follows: Shifted and rotated hyperbole. We can see that the hyperboles have been reversed and shifted (0,0). [Further analysis falls outside the scope of this Section.] Exercise Sketch hyperbola 'x^2/9-y^2/16=1' Answer This is east-west hyperbole, with a = 3 and b = 4. It looks similar to the east-west opening of Example 3, above. x-intercepts: Letting y = 0 in the equation given question, and we have: x^2/9=1 Resolution gives us: x = -3 and x = 3 Aymptotes: We have east-west opening hyperbola, so slopes asymptotes are given +-b / a in this example a = 3 and b = 4. So the slopes of asymptoids are simply: -4/3 and 4/3. Equations for asymptotes as they pass through '(0, 0)'are given as follows: y = -(4x)/3 and y = (4x)/3 Including the above information in our graph: Asymptotes (magenta in colour) and peaks. Completing hyperbola: East-West hyperbola (green) in your asymptotes (magenta color). Tapered section: Hyperbola How can we hyperbole slicing the cone? We begin with a double cone (2 on the right of circular cones placed at the top of the top): When we slice 2 cones vertically, we get hyperbola, as shown. Page 5 Horizontal main axis Vertical main axis Center disp, which is not the origin Of orbiting satellites (including the earth rotating around the sun and the moon around us) observe the elliptical path. Many buildings and bridges use ellipse as a pleasant (and strong) shape. The bridge of the elliptical arch One of the property ellipses is that the sound (or any radiation) begins in one focus of the ellipse reflected so that it can be heard clearly in another focus. You'll see what that means in the next animation. Copyright © www.intmath.com ellipses with a horizontal base axis with a horizontal base axis (blue) indicating a smaller axis of magenta colour. The ellipty equation with the horizontal main axis provides: x^2/a^2+y^2/b^2=1, where a is the length from the centre of the ellipse to the end of the main axis and b is the length from the average to the end of the lower axis. Ellipt (horizontal axis) 'x^2/a^2+y^2/b^2=2=2=1' koldion (-c,0) and (c,0) where c is given as c=sqrt(a^1 The top on-site elliptism is (-c,0) and (c,0) and (c,0) where c is given as: c=sqrt(a^2-b^2 The ellipse peak indicators are (−a, 0) and (a, 0). x y (0, (b) (0, 0, 100,000 -b) Ellipse showing the peaks and fireplaces. Ellipsis as locus The ellipsis is defined as a point (x,y) locus that moves so that the sum of its distances from two fixed points (so-called foc or focus) is constant. We can produce an ellipse by attaching the ends of a piece of string and keeping the pencil tightly within the string limits, as follows. Let's start with these 2 foci: We pin the ends of the string foci and start drawing, keeping the string tight: Our full ellipse is formed: Download graph paper Example 1 - Ellipse horizontal major axis Find coordinates for the tops and foci 'x ^ 2/100 + y ^ 2/64= 1' Sketch curve. Answer here: a^2= 100, so a = ± 10, so the peaks are '(-10,0) and (10,0). Now 'c=sqrt(a^2-b^2)' '=sqrt(100-64)' =6' So foci is '(-6,0)' and '(6,0). Ellipse with the main vertical axis Means that the height of the ellipse is greater than the width. If the base axis is vertical, the formula changes: 'x^2/b^2+y^2/a^2=1' We always select our a and b so as > b. The main axis is always associated with a. Example 2 – Ellipse with the main vertical axis – Scroll to draw a curve using peaks and column coordinates 25x^2+y^2=2=2=25. Answer '25x^2+y^2=25' 'x^2+(y^2)/25=1' So b = 1 and a = 5. In this example, the main axis is vertical. So the top is (0, -5) and (0.5). To find C, we continue as before: c=sqrt(a^2-b^2)' '=sqrt(25-1) '=sqrt24' '=4.899' So the fireplace is '(0, -4.9)' and '(0, 4.9)'. The fireplaces (green dots) are very close to the peaks of this ellipse. Example 3 Find an ellipse equation with a small length of 8 and a peak (0,-5). Answer We conclude that a = 5 and b = 4. So the ellipse equation is: x^2/16+y^2/25=1 Eccentricity Ellipse eccentricity is a measure of how elongated it is. When eccentricity approaches 0, the curve becomes more circulating and when it approaches 1, elongated. We can calculate eccentricity using a formula: text (eccentricity)=c/a Real Example The Sun The Earth revolves around the sun's elliptical orbit, where the sun is one foci. (Keppler discovered it in 1610). The half-based axis is about 149,597,871 km long and it is known that the ratio c/a is equal to 1/60. (i) What are the largest and least distances from the Earth's sun? ii) How far is the sun's second focus? (The half-based axis is half the length of the main axle. In our example, it is (almost) the average distance from the sun from Earth, and is also known as one A.U., or astronomical unit.) The answer to the closest sun is when we are the tip closest to the sun (point (point (150, 0) in the chart below) and the furthest we are when we are at the second tip (point (−150, 0)). x y Earth ellipse with a smaller axis length of 8 and a top (0,-5). Note: On the schedule I have exaggerated the shape of an elliptical orbit (I squashed it a little bit so it looks elliptical) and positions 2 foci are shown much farther than they really are. In the diagram above, the items are in millions of kilometres. Distance a = OA = 149,597,871 is the length of the half-base axis of our ellipse. We have assumed that the sun is in focus on the right, under c, 0). The peaks are A (149 597 871, 0) and B (−149 597 871,0). We need to find a C to tell you where the foci is. 'c=a/60' '=(1\495\97871)/60' '=2,493,298' So foci is at '(-2\493\298,0)' and (2\493\298,0). The closest we are to the sun is a-c = 149\597\871 − 2\493\298 = 104\573\km The furthest from the sun (distance B from the sun) is: OB+ c = a + c' '= 149\597\871 + 2\493\298' ' =152 091 169\km ii Part Foci is 2 × c = 2 × 2\493\298 = 4\986\ 596 km away. The sun's radius is about 1\400\000 km, so 2. Our orbit is almost round. (Eccentricity is very small at 1/60). Ellipt note graph: The graph of the ellipse above was to find b as follows: 'b=sqrt(a^2-c^2)' '=sqrt(149\597\871^2-2\493 \ 298^2)' '=149\577\092' Using the Ellipsi formula, 'x^2/a^2+y^2/b^2=1' required curve is 'x^2/(149\597\871^2)+y^2/(149\ 577\ 092^2)=1' Ellipses with a center other than other cones, we can move the ellipse so that its axes are not on the x-axis and on the y axis. We do this in solving certain problems of convenience. For a horizontal main axis, when we move to the intersection point of the main and smaller axes (h, k), we have: ((x-h)^2)/a^2+((y-k)^2)/b^2=1' The Ellipse is as follows: Ellipse with the central part (h, k). Example 4 Draw an ellipse with an equation ((x-1)^2)/25+((y+2)^2)/9=1' Answer We first observe that the center of the ellipse is '(1, -2). The length of the main axle is 10 (from a = 5) and the small axle is 6 length (from b = 3). So the sketch is: Cone section: EllipseHow can we get an ellipse slicing cone? We start with a double cone (2 right circular cones placed at the top): When we slice one of the cones at an angle on the side of the cone, we get an ellipse, as seen in the eye from above (right). Page 6 Ring, centre (0, 0), radius r. The centre line of the circle (0,0) and the radius is the equation: x2 + y2 = r2 This means that any point of the circle (x, y) gives a radius square when it is replaced by a circle equation. These formulas are a direct result of the Pythagoras formula for the hypotenus length of the right triangle. Download graph paperExample 1 Sketch round x2 + y2 = 4. Find the center and radius first. Answer Sketch circle (x − 2)2 + (y − 3)2 = 16 Find the center and radius first. Answer Example 3 Draw a circle (x + 4)2 + (y − 5)2 = 36 Reply b. The general circle form Equation, which can be written in the following format (with constants D, E, F) represents the circle: x2 + y2 + Dx + Ey + F = 0 This is called the general circle form. Example 4 Find the center and radius of the circle x2 + y2 + 8x + 6y = 0 Draw a circle. Answer Please check filling square first ... Our goal is to get the equation in the form: (x − h)2 + (y − k)2 = r2 We will finish the square x-related part and y-related part, at the same time. 'x^2+y^2+8x+6y=0' Group x parts together and y-parts are proxy: '(x^2+8x)+(y^2+6y)=0' Done x and y parts. '(x^2+8x+16)+(y^2+6y+9)' '=16+9' '=25' '(x+4)^2+(y+3)^2=5^2' It is now in the required format and we can specify the center and radius of the circle. So the center of the circle is (−4, -3) and the radius is 5 units. 2-2-4-6-8-1024-2-4-6-8xy(−4, -3)r = 5Ring, center (−4, −3), radius 5. Note that the circle passes (0.0). This makes sense because: radius of circle 5 Considering the right triangle formed between points (−4, −3), (0, -3) and (0.0), we can apply the pythagoras theorem and obtain: (−4)2 + (−3)2 = (5)2 the circular formula following pythagoras theorem. Exercises 1. Circle equation with centre line (3/2, -2) and radius 5/2. Response center '(3/2, -2)' with a radius of 5/2. General form of the circle equation: '(x-h)^2+(y-k)^2=r^2' Equation required for this case: '(x-3/2)^2+(y-(-2))^ 2=(5/2)^2' (x-3/2)^2+(y+2)^2=(5/2)^2' It does not need to be expanded because it is the most useful form of the equation. 2. Specify the middle and radius, and then discard the circle: 3x2 + 3y2 − 12x + 4 = 0 Reply We will finish the square as we did in the earlier example above. First we collect the X-parts and the y parts together, then divide it by 3. '3x^2+3y^2-12x+4=0' '3x^2-12x+3y^2+4=0' 'x^2-4x+y^2+4/3=0' Then we finish the square on x-part. We don't have to do this y part because there is no single y y concept (only y2 term). '(x^2-4x+4)+y^2+4/3=4' (x-2)^2+y^2=4-4/3' (x -2)^2+y^2=8/3' So the circle has a center '(2,0)' and a radius of 'sqrt(8/3)~~1.63'. Circle, centre (2, 0), radius 1,63. 3. Find the cutting points x2 + y2 − x − 3y = 0 with a line y = x − 1. The answer Resolve 2 equations at the same time by replacing the expression y = x -1 to x^2+y^2-x-3y=0 (See its background: An algebraic solution for equation systems systems.] We have: 'x^2+(x-1)^2-x-3(x-1)=0' 'x^2+x^2-2x+1-x-3x+3=0' '2x ^2-6x+4=0' 'x^2-3x+2=0' '(x-1)(x-2)=0' So we can see that the x solutions are x = 1 or x = 2. It gives the corresponding y-values y = 0 and y = 1. So the points at the intersection are: (1, 0) and (2) 1). We see that our answer is the correct sketch situation: 12-1123-1xy (0.5, 1.5)(1,0)(2, 1)Circle, center (2, 0), radius 1.58. Exercise for you Where does not (0.5, 1.5) for the middle of the circle? Conpered Section: Ring How can we circle the slicing cone? All the lines and curves in this chapter are conpered sections, which means that curves are formed when we cut the cone at a certain angle. When we slice a cone with a plane at right angles to the cone axis, a circle of shape has formed. Page 7 Line with tilt m and y-intercept b. The line tilt-cutting form (also known as gradient, y-intercept form) is presented in: y = mx + b tells us that the slope of the line is m and the y-intersection of the line is b. Example 1 123-1-21234567xy12y = 2x + 4Line inclination '2' and y-eavesdropping 4. On line y = 2x + 4 is slope m = 2 and y-paragraph b = 4. We don't have to create a table of values to outline this line. From y-eavesdropping (y = 4), we sketch our line by going up 2 units for every 1 item we go right (because the slope is in this example 2). To find x-eavesdropping, we let y = 0. 2x + 4 = 0 'x = -2' We notice that it is a function. This is every value x that we have gives one corresponding value y. For more information about features and graphs, see Features and graphs. x y inclination = m '(x_1,y_1)' line with inclination m and passes (x1, y1). We also need other forms of straight lines. A useful form is a point-tilt form (or point-gradient form). We use this form when we need to find the equation line passing through the point (x1, y1) tilt m:y − y1 = m (x − x1) Find the equation line that passes through (-2, 1)' inclination -3. Answer General Form Straight Line Download graph paper Another form of straight line that we come across is a generic form: Ax + Author + C = 0 It can be useful for drawing lines by finding y-eavesdropping (put x = 0) and x-intercept (pane 'y = 0). We also use a general form to find perpendicular distance from point to line. Example 3 Draw 2x + 3y + 12 = 0. Answer If 'x =0', we have: '3y + 12 = 0', so y = -4. If 'y = 0', we have: 2x + 12 = 0, so x =-6. So the line is: 12-1-2-3-4-5-612-1-2-3-4-5xyDrida 2x + 3y + 12 = 0. Note that the y-interception is -4 and the x-interception is -6. Exercises 1. What is the equation of a line perpendicular to the lines bound (4, 2) and (3, -5) and passes (4, 2)? [Need a reminder? See Perpendicular lines on the slopes.] The answer Line that connects (4, 2) and (3, -5) is the slope m=(-7)/(-1)=7' and is shown as a green dotted line. 123456-1-2-3-4-5-61234-1-2-3-4-5-6xy(4, 2)(3, -5)Perpendicular lines. We need to find the equation magenta (pink) line. The slope of the line perpendicular to the green dotted line is '-1/7.' Line through '(4, 2)' with a gradient of '-1/7' is the formula: y-2=-1/7(x-4)' '=-x/7+4/7' y=-x/7+2 4/7'. If 4x − ky = 6 and 6x + 3y + 2 = 0 is perpendicular, what is the k value? Answer (2) Inclination 4x − ky = 6 can be calculated by re-expressing it in the form of a tilt-cutting point: y=4/kx-6/k' So we can see the slope is 4/k. Kalle '6x + 3y + 2 = 0' can also be calculated by expressing it again in the form of tilt-eavesdropping: y =(-6)/3x-2/3=-2x-2/3' So we can see the slope is -2. For the lines to be crossed, we need 4/kxx-2=-1' It gives k = 8. The resulting line is 4x-8y=6, which we can simplify 2x-4y=3.Here is a graph of the situation: 1 2 -1 -2 -3 -4 -5 -6 1 2 3 4 -1 -2 -3 -3 -5 x y '6x+3y+2=0' Perpendion lines Cone section: Straight line Each of the lines and curves in this chapter has cone sections, which means the curves are formed when we slice the cone at a certain angle. How do we get a straight line from the slicing of the cone? Let's start with a double cone (2 right circular cones placed at the top): When we slice a double cone by the plane just by touching one edge of the double cone, the intersection is a straight line, as shown. On page 8 of perpendicular routes, the product of these slopes is –1. Mathematically, let's say if the line has a slope m1 and the other line has a slope of m2, then the lines are perpendicular if m1 × m2= –1 The example on the right is the slopes of the lines 2 and -0,5 and we have: 2 × -0,5 = -1 So the lines are perpendicular. Opposite Mutual Another way to find the slope of the cross line is to find the opposite of the reciprocal slope of the original line. In plain English, this means that the original inclination is reversed and take it negative. Interactive graph - cross lines You can explore the concept of cross lines in the following JSXGraph (this is not a fixed image). Drag any of the points A, B or C and follow the slope of the longline 2 per line m1, m2. If you hold down the Shift key, you can move the chart up and down, left to right, and then drag the chart. Sometimes overlapping labels. It can't help! If you're wrong, you can always update the page. What if one of the lines is parallel to the y axis? For example, line y = 3 is parallel to the x axis and has a slope of '0'. Line x = 3.6 is parallel to the y axis and has an undefined inclination. The lines are clearly crossed, but we can't find these slopes product. In this case, we cannot draw a conclusion from the slope product, but we can see immediately from the graph that the lines are perpendicular. The same is the case for x and y axes. These are perpendicular, but we can't calculate the two slope product because the y-axis slope is undefined. Exercise 1 On line L is slope 'm = 4'. a) What is the slope of the line parallel to L? b) What is the slope of the line perpendicular to L? Answer (a) Since the parallel lines have the same inclination, the slope is 4.b) Using m1 × m2 = -1, where m1 = 4, we get a m2 value: m_2 =-1/(m_1)' '=-1/4' Exercise 2 Line Passes (-3, 9) and (4, 4). The second line passes (9, -1) and (4, -8). Are the lines parallel or crossed? Answer Line out (-3.9) and (4,4) is slope 'm_1 =(4-9)/(4-(-3))=(-5)/7' Line through '(9,-1)' and '(4,-8) is tilt 'm_2 <8> =(-8-(-1))/(4-9)=(-7)/((-5)=7/5' Now 'm_1m_2=(-5)/7xx7/5=-1' Since the slope product is −1, we conclude, that the lines are crossed. Note: We could have outlined the lines to determine whether they were parallel or cross. Page 9 Of Me a rectangular triangle with a hypotentus length c, as shown: Recall Pythagoras Theorem, which tells us the length of the longest half (hypotenuse) on the right triangle: c = sqrt (a ^ 2 + b ^ 2) We use it to find the distance between two points (x1, y1) and (x2, y2) on the descartesian (x-y) level: x y Point B (x2, y1) at right angles. We can see that: the distance between points A(x1, y1) and B(x2, y1) is simply x2 − x1 and points C(x2, y2) and B(x2, y1) is just y2 − y1. x y Distance (x1, y1) to (x2, y2). Using Pythagoras' Theorem we can develop a formula for distance e. Distance Formula Distance (x1, y1) and (x2, y2) are given: d = sqrt ((x_2-x_1) ^ 2 + (y_2-y_1) ^ 2 Note: Do not worry about which point you choose (x1, y1) (it may be the first or second point given) because the answer works the same. Interactive graph - distance formula You can explore the concept of the distance formula for the following interactive graph (this is not a fixed image). Drag either point A (x1, y1) or C (x2, y2) to see how the distance formula is working. Length AB = x2 − x1 Length BC = y2 − y1 Length Copyright © www.intmath.com Example 1 Download graph between paperPoints (3, -4) and (5, 7). Answer Here, x1 = 3 and y1 = −4; x2 = 5 and y2 = 7 So the distance is given as follows: d=sqrt((x_2-x_1)^2+(y_2-y_1)^2)' '=sqrt((5-y_1)^2)' '=sqrt((5-y_1)^2)' 3)^2+(7-(-4))^2)' =sqrt(4+121)' '=11.18' Example 2 Find points (3, -1) and -2, 5 distance. Answer This time x1 = 3 and y1 = −1; x2 = −2 and y2 = 5 So the distance is given: d=sqrt((x_2-x_1)^2+(y_2-y_1)^2)' '=sqrt(((-2-3)^ 2+(5-(-1)^2)' '=sqrt(25+36)' '=sqrt61' '=7.8102' Example 3 What is the distance (−1, 3) and (−8, -4)? Answer In this example x1 = −1 and y1 = 3; x2 = −8 and y2 = −4 So the distance is given: d=sqrt((x_2-x_1)^2+(y_2-y_1)^2)' '=sqrt(((-8-(-1))')^2+(-4 -3)^2)' '=sqrt(49+49)' '=sqrt98' '=9.899' Example 4 Find k if distance (k,0) to (0, 2k) is 10 units. Answer This is the situation: Using the distance formula, we have: d=sqrt(x_2-x_1)^2+(y_2-y_1)^2)' '=sqrt((2k-0)^2+(0-0 k)^2)' '=sqrt(4k^2+k^2)' '=sqrt(5k^2)' Now 'sqrt(5k^2)=10' both 5k^2=100, giving: k2 = 20 so k = + -sqrt (20)~~+-4.472 We received 2 solutions, so there are 2 possible results as follows :

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