How to find axis of symmetry equation

All parabolas have exactly one axis of symmetry (unlike circles, which have many symmetric axes). If the vertex of a parabola is \(k,l)\), then its symmetry axis has the equation \(x=k\). Detailed description of the diagram We can find a simple formula for the value \(k\) in terms of quadratic coefficients. As usual, we completed the rectangle: \begin{align*} y &= ax^2 + bx + c\\ &= a\Big[x^2 + \dfrac{b}{a}x + \dfrac{c}{a}\Big]\\ &= a\Big[\Big(x+\dfrac{b}{2a}\Big)^2 + \dfrac{c}{a} - \Big(\dfrac{b}{2a}\Big)^2\Big]. \end{align*} We can now see that the \(x\)-coordinate of vertex is \(-\dfrac{b}{2a}\). Thus the symmetry axis equation is \[x = -\dfrac{b}{2a}. \] We can also find the formula for \(y\)-vertex coordinates, but it is easier just to replace the vertex \(x\)-coordinates into the original equation \(y=ax^2+bx+c\). Sketch the parabola \(y=2x^2+8x+19\) by finding vertex and \(y\)-intercept. It also states the equation of the symmetry axis. Do parabolas have \(x\)-intercepts? Solutions Here \(a=2\), \(b=8\) and \(c=19\). So the symmetry axis has the equation \(x=-\dfrac{b}{2a}=-\dfrac{8}{4}=-2\). We replace \(x=-2\) into the equation to find \(y = 2\times (-2)^2 + 8\times (-2) + 19 = 11\), so that the vertex is in \((-2,11)\). Finally, put \(x=0\) we see that \(y\)-intercept is 19. No \(x\)-intercepts. A detailed description of the Diagram of Parabola has a vertex in \((1,3)\) and passes the point \((3,11)\). Find the equation. Next 3-Page exercise screencast - Content - Quadratic Formulas and Discrete Learning Outcomes Identify vertex, symmetry axis, [latex]y[/latex]-intercept, and the minimum or maximum parabolic value of the graph. Identification of quadratic functions written in general and vertex form. Given the quadratic function in a common form, find vertex. Specify the domain and range of quadratic functions by identifying vertex as maximum or minimum. The graph of the quadratic function is a U-shaped curve called a parabola. One important feature of the graph is that it has an extreme point, called vertex. If the parabola is open, the vertex represents the lowest point on the chart, or the minimum value of the quadratic function. If the parabola opens down, the vertex represents the highest point on the chart, or the maximum value. In both cases, vertex is a turning point on the chart. The graph is also symmetrical with vertical lines drawn through vertex, called symmetry axis. [latex]y[/latex]-intercept is the point at which a parabola crosses the wick [latex]y[/latex]-. [latex]x[/latex]-intercepts are points where the parabola crosses the [latex]x[/latex]-axis. If any, the intercept [latex]x[/latex]-represents zero, or root, of the quadratic function, the value the [latex]y=0[/latex]. Specify the vertex, symmetry, zero, and y-intercept parabolic axes shown below. Quadratic Function Equation a common quadratic function presents a function in the form of [latex]f\left(x\right)=a{x}^{2}+bx+c[/latex] where [latex]a[/latex], [latex]b[/latex], and [latex]c[/latex] are real numbers and [latex]ae 0[/latex]. If [latex]a>0[/latex], the parabola opens up. If [latex]a<0[atex],= the= parabola= opens= downward.= we= can= use= the= general= form= of= a= parabola= to= find= the= equation= for= the= axis= of= symmetry.= the= axis= of= symmetry= is= defined= by= [latex]x=-\dfrac{b}{2a}[/latex]. if= we= use= the= quadratic= formula,= [latex]x=\dfrac{-b\pm \sqrt{{b}^{2}-4ac}}{2a}[/latex],= to= solve = [latex]a{x}^{2}+bx+c=0[/latex] for= the= [latex]x[/latex]-intercepts,= or= zeros,= we= find= the= value= of = [latex]x[/latex] halfway= between= them= is= always= [latex]x=-\dfrac{b}{2a}[/latex], the= equation= for= the= axis= of= symmetry .= the= figure= below= shows the= graph= of= the= quadratic= function= written= in= general= form= as= [latex]y={x}^{2}+4x+3[/latex]. in= this= form,= [latex]a=1,\text{ }b=4[/latex], and= [latex]c=3[/latex]. because= [latex]a=>0[/latex], the parabola opens up. The symmetry axis is [latex]x=-\dfrac{4}{2\left(1\right)}=-2[/latex]. This also makes sense because we can see from the graph that the vertical line [latex]x=-2[/latex] divides the graph in half. Vertex always occurs along the symmetry axis. For parabolas that open up, vertex occurs at the lowest point on the chart, in this case, [latex]\left(-2,-1\right)[/latex]. [latex]x[/latex]-intercepts, points where the parabola crosses the [latex]x[/latex] axis, occurs in [latex]\left(-3,0\right)[/latex] and [latex]\left(-1,0\right)[/latex]. The standard quadratic function renders functions in the form of [latex]f\left(x\right)=a{\left(x-h\right)}^{2}+k[/latex] where [latex]\left(h,\text{ }k\right)[/latex] is vertex. Since vertex appears in the standard form of quadratic functions, it is also known as the vertex form of the quadratic function. Given the quadratic function in its general form, find vertex parabola. One of the reasons we might want to identify a parabolic vertex is that this point will tell us where the maximum or minimum output value occurs, [latex]k[/latex], and where it occurs, [latex]h[/latex]. If we are given the general form of quadratic function: [latex]f(x)=ax^2+bx+c[/latex] we can define vertex, [latex](h,k)[/latex], by doing the following: Identify [latex]a[/latex], [latex]b[/latex], and [latex]c[/latex]. Find [latex]h[/latex], coordinates [latex]x[/latex]-from vertex, with substitutions [latex]a[/latex] and [latex]b[/latex] to [latex]h=-\dfrac{b}{2a}[/latex]. Find [latex]k[/latex], [latex]y[/latex]-of vertex, by evaluating </0[> </0[> Find the vertex square function [latex]f\left(x\right)=2{x}^{2}-6x+7[/latex]. Rewrite the squares in standard form (vertex form). Given the [latex]g\left(x\right)=13+{x}^{2}-6x[/latex] equation, write the equation in its current general form in standard form. Finding the Domain and Range of any Number Quadratic Function can be the input value of a quadratic function. Therefore the domain of the quadratic function is all real numbers. Since parabolas have a maximum or minimum in vertex, the range is limited. Since the parabolic vertex will be maximum or minimum, the range will consist of all values [latex]y[/latex] greater than or equal to [latex]y[/latex]-vertex coordinates or less than or equal to [latex]y[/latex]-coordinates at the turning point, depending on whether the parabola is open or down. The domain of the quadratic function is all real numbers. A range of quadratic functions written in general form [latex]f\left(x\right)=a{x}^{2}+bx+c[/latex] with a positive value [latex]a[/latex] is [latex]f\left(x\right)\ge f\left(-\frac{b}{2a}\right)[/latex], or [latex]\left[f\left(-\frac{b}{2a}\right),\infty \right)[/latex]; a range of quadratic functions written in common form with negative values [latex]a[/latex] is [latex]f\left(x\right)\le f\left(-\frac{b}{2a}\right)[/latex], or [latex]\left(-\infty,f\left(-\frac{b}{2a}\right)\right][/latex]. A range of quadratic functions written in standard form [latex]f\left(x\right)=a{\left(x-h\right)}^{2}+k[/latex] with a positive value [latex]a[/latex] is [latex]f\left(x\right)\ge k[/latex]; the range of quadratic functions written in standard form with a negative value [latex]a[/latex] is [latex]f\left(x\right)\le k[/latex]. How to: Remember quadratic functions, find domains and ranges. The domain of any squares function as all real numbers. Specify whether [latex]a[/latex] is positive or negative. If [latex]a[/latex] is positive, the parabola has a minimum. If [latex]a[/latex] is negative, the parabola has a maximum. Specify the parabolic maximum or minimum value, [latex]k[/latex]. If parabola has a minimum, the range is given by [latex]f\left(x\right)\ge k[/latex], or [latex]\left[k,\infty \right)[/latex]. If the parabola has a maximum, the range is given by [latex]f\left(x\right)\le k[/latex], or [latex]\left(-\infty,k\right][/latex]. Find the domain and range [latex]f\left(x\right)=-5{x}^{2}+9x - 1[/latex]. Locate the domain and range [latex]f\left(x\right)=2{\left(x-\dfrac{4}{7}\right)}^{2}+\dfrac{8}{11}[/latex]. Do you have any ideas for improving this content? We'd like your input. Improve this pageLearn More Given: #color(red)(y = f(x) = x^2+6x+5# Vertex form of quadratic function given by: #color(blue)(f(x)=a(x-h)^2+k#, in #color (green)((h,k)# is vertex of parabola. #color(green)(x=h# axis symmetry. Use to solve the quadratic method to #color(red)(f(x)# into Vertex Shapes. #color(red)(y = f(x) = x^2+6x+5# Standard Form #rArr ax^2+bx+c=0# Consider #x^2+6x+5=0# #color(blue)a=1; b=6 and c=5# Step 1 - The constant move value to the right side. Subtract 5 from both sides. #x^2+6x+5-5 = 0-5# #x^2+6x+cancel 5-cancel5 = 0-5# #x^2+6x=-5# Step 2 - Add value to both sides. What value will be added? Add squares #b/2# Therefore, #x^2+6x+[(6/2)^2]=-5+[(6/2)^2]# #x^2+6x+9=-5+9# #x^2+6x+9=4# Step 3 - Write as Square Perfect. #(x+3)^2=4# #4# from both sides to get the vertex form. #(x+3)^2-4=cancel 4-cancel 4# #f(x)=(x+3)^2 - 4# Now, we have the vertex form. #color(blue)(f(x)=a(x-h)^2+k#, where #color(green)((h,k)# is the Vertex of the parabola. Therefore, Vertex is in #color(blue)((-3,-4)# Axis of Symmetry is in #color(red)(x=h# Note that #h=-3# color #rArr (blue)(x= -3# Step 4 - Write x, y interception. Consider #(x+3)^2=4# To find a solution, take the square root on both sides. #sqrt((x+3)^2)= +-sqrt(4)# #rArr x+3=+-2# There are two solutions. #x+3 = 2# #rArr x=2-3 = -1# Therefore, #x=-1# is one solution. Furthermore, #x+3=-2# #x=-2-3=-5# Therefore, #x=-5# is another solution. Therefore, we have two x-intercepts: #(-1,0) and (-5,0)# To find the y-intercept: Let #x=0# We have, #f(x)=(x+3)^2 - 4# #f(0)=(0+3)^2-4# #rArr 3^2-4 = 9-4 = 5 # Therefore, y-intercept is in #y = 5 # #rArr color(blue)((0,5)# Analysis of the chart image below: below: