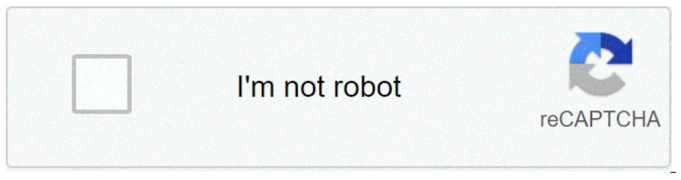

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Formula to find the axis of symmetry of a parabola

Axis of Symmetry : Maximum or Minimum of a Quadratic Function The axis of symmetry of a figure is a straight line drawn dividing the figure into two identical or congruent parts. See Transformation Geometry for more explanation. The axis of symmetry of a parabola can be obtained by drawing a vertical line passing through the center of the curve P(p,q). The equation of the axis of symmetry can then be obtained by reading off the x-coordinate of the line and equating. That is x = p, where MAXIMUM OR MINIMUM VALUE The vertex (or turning point) of a parabola occurs at the center of the curve. That is the point where the axis of symmetry and the parabola intersect. The maximum or minimum value occurs at the vertex. Case 1: When a is positive (i.e.) If a is positve the parabola opens upward (concave) and has a minimum value for y. Case 2: When a is negative If a is negative, then the parabola opens downward (convex) and has a maximum value for y. On completing the square: Thus the maximum or minimum value of the quadratic expression or function is given by: This maximum or minimum occurs when: Therefore Problem Set. 1. Verify the above argument. Learning Outcomes Identify the vertex, axis of symmetry, [latex]y[/latex]-intercept, and minimum or maximum value of a parabola from it’s graph. Identify a quadratic function written in general and vertex form. Given a quadratic function in general form, find the vertex. Define the domain and range of a quadratic function by identifying the vertex as a maximum or minimum. The graph of a quadratic function is a U-shaped curve called a parabola. One important feature of the graph is that it has an extreme point, called the vertex. If the parabola opens up, the vertex represents the lowest point on the graph, or the minimum value of the quadratic function. If the parabola opens down, the vertex represents the highest point on the graph, or the maximum value. In either case, the vertex is a turning point on the graph. The graph is also symmetric with a vertical line drawn through the vertex, called the axis of symmetry. The [latex]y[/latex]-intercept is the point at which the parabola crosses the [latex]y[/latex]-axis. The [latex]x[/latex]-intercepts are the points at which the parabola crosses the [latex]x[/latex]-axis. If they exist, the [latex]x[/latex]-intercepts represent the zeros, or roots, of the quadratic function, the values of [latex]x[/latex] at which [latex]y=0[/latex]. Determine the vertex, axis of symmetry, zeros, and y-intercept of the parabola shown below. Equations of Quadratic Functions The general form of a quadratic function presents the function in the form [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 upward. If [latex]a0[/latex], the parabola opens upward. The axis of symmetry 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. The vertex always occurs along the axis of symmetry. For a parabola that opens upward, the vertex occurs at the lowest point on the graph, in this instance, [latex]\left(-2,-1\right)[/latex]. The [latex]x[/latex]-intercepts, those points where the parabola crosses the [latex]x[/latex]-axis, occur at [latex]\left(-3,0\right)[/latex] and [latex]\left(-1,0\right)[/latex]. The standard form of a quadratic function presents the function in the form [latex]f\left(x\right)=a{\left(x-h\right)}^{2}+k[/latex] where [latex]\left(h,\text{ }k\right)[/latex] is the vertex. Because the vertex appears in the standard form of the quadratic function, this form is also known as the vertex form of a quadratic function. Given a quadratic function in general form, find the vertex of the parabola. One reason we may want to identify the vertex of the parabola is that this point will inform us where the maximum or minimum value of the output occurs, [latex]k[/latex], and where it occurs, [latex]h[/latex]. If we are given the general form of a quadratic function: [latex]f(x)=ax^2+bx+c[/latex] We can define the vertex, [latex](h,k)[/latex], by doing the following: Identify [latex]a[/latex], [latex]b[/latex], and [latex]c[/latex]. Find [latex]h[/latex], the [latex]x[/latex]-coordinate of the vertex, by substituting [latex]a[/latex] and [latex]b[/latex] into [latex]h=-\dfrac{b}{2a}[/latex]. Find [latex]k[/latex], the [latex]y[/latex]-coordinate of the vertex, by evaluating [latex]k=f\left(h\right)=f\left(-\dfrac{b}{2a}\right)[/latex] Find the vertex of the quadratic function [latex]f\left(x\right)=2{x}^{2}-6x+7[/latex]. Rewrite the quadratic in standard form (vertex form). Given the equation [latex]g\left(x\right)=13+{x}^{2}-6x[/latex], write the equation in general form and then in standard form. Finding the Domain and Range of a Quadratic Function Any number can be the input value of a quadratic function. Therefore the domain of any quadratic function is all real numbers. Because parabolas have a maximum or a minimum at the vertex, the range is restricted. Since the vertex of a parabola will be either a maximum or a minimum, the range will consist of all [latex]y[/latex]-values greater than or equal to the [latex]y[/latex]-coordinate of the vertex or less than or equal to the [latex]y[/latex]-coordinate at the turning point, depending on whether the parabola opens up or down. The domain of any quadratic function is all real numbers. The range of a quadratic function written in general form [latex]f\left(x\right)=a{x}^{2}+bx+c[/latex] with a positive [latex]a[/latex] value 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]; the range of a quadratic function written in general form with a negative [latex]a[/latex] value 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]. The range of a quadratic function written in standard form [latex]f\left(x\right)=a{\left(x-h\right)}^{2}+k[/latex] with a positive [latex]a[/latex] value is [latex]f\left(x\right)\ge k[/latex]; the range of a quadratic function written in standard form with a negative [latex]a[/latex] value is [latex]f\left(x\right)\le k[/latex]. How To: Given a quadratic function, find the domain and range. The domain of any quadratic function as all real numbers. Determine 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. Determine the maximum or minimum value of the parabola, [latex]k[/latex]. If the 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 of [latex]f\left(x\right)=-5{x}^{2}+9x - 1[/latex]. Find the domain and range of [latex]f\left(x\right)=2{\left(x-\dfrac{4}{7}\right)}^{2}+\dfrac{8}{11}[/latex]. Did you have an idea for improving this content? We’d love your input. Improve this pageLearn More Look again at the figure below. Do you see that we could fold each parabola in half and that one side would lie on top of the other? The ‘fold line’ is a line of symmetry. We call it the axis of symmetry of the parabola.We show the same two graphs again with the axis of symmetry in red. See the figure below.The equation of the axis of symmetry can be derived by using the Quadratic Formula. We will omit the derivation here and proceed directly to using the result. The equation of the axis of symmetry of the graph of \(y=a{x}^{2}+bx+c\) is \(x=-\frac{b}{2a}.\)So, to find the equation of symmetry of each of the parabolas we graphed above, we will substitute into the formula \(x=-\frac{b}{2a}\).Look back at the first figure above. Are these the equations of the dashed red lines?The point on the parabola that is on the axis of symmetry is the lowest or highest point on the parabola, depending on whether the parabola opens upwards or downwards. This point is called the vertex of the parabola.We can easily find the coordinates of the vertex, because we know it is on the axis of symmetry. This means its x-coordinate is \(-\frac{b}{2a}\). To find the y-coordinate of the vertex, we substitute the value of the x-coordinate into the quadratic equation.For a parabola with equation \(y=a{x}^{2}+bx+c\):The axis of symmetry of a parabola is the line \(x=-\frac{b}{2a}\).The vertex is on the axis of symmetry, so its x-coordinate is \(-\frac{b}{2a}\).To find the y-coordinate of the vertex, we substitute \(x=-\frac{b}{2a}\) into the quadratic equation.For the parabola \(y=3{x}^{2}-6x+2\) find: the axis of symmetry and the vertex. The axis of symmetry is the line \(x=-\frac{b}{2a}\).Substitute the values of a, b into the equation.Simplify.\(x=1\) The axis of symmetry is the line \(x=1\). The vertex is on the line of symmetry, so its x-coordinate will be \(x=1\). Substitute\(x=1\) into the equation and solve for y.Simplify.This is the y-coordinate.\(y=-1\) The vertex is \(\left(1,\text{−}1\right).\)[Attributions and Licenses] what is the formula to find the axis of symmetry of a parabola quizizz. how to find the axis of symmetry for a parabola. how to get the axis of symmetry of a parabola