Discriminant of a quadratic equation number of solutions

Læringsmål Definer diskriminanten og bruk den til å klassifisere løsninger på kvadratiske ligninger Den kvadratiske formelen genererer ikke bare løsningene på en kvadratisk ligning, forteller den oss om løsningenes natur. Når vi vurderer diskriminanten eller uttrykket under det radikale, [latex]{b}^{2}-4ac[/latex], forteller det oss om løsningene er reelle tall eller komplekse tall, og hvor mange løsninger av hver type du kan forvente. Tabellen nedenfor relaterer verdien av diskriminanten til løsningene til en kvadratisk ligning. Verdien for diskriminantresultater [latex]{b}^{2}-4ac=0[/latex] Én gjentatt rasjonell løsning [latex]{b}^{2}-4ac>0[/latex], perfekt firkant to rasjonelle løsninger [latex]{b}^{2}-4ac>0[/latex], ikke en perfekt firkant To irrasjonelle løsninger [latex]{b}^{2}-4ac<0[atex]= two= complex= solutions= for= [latex]a{x}^{2}+bx+c=0[/latex], where= [latex]a[/latex],= [latex]b[/latex],= and= [latex]c[/latex]= are= real= numbers,= the= discriminant= is= the= expression= under= the= radical= in= the= quadratic= formula:= [latex]{b}^{2}-4ac[/latex].= it= tells= us= whether= the= solutions= are= real= numbers= or= complex= numbers= and= how= many= solutions= of= each= type= to= expect.= use= the= discriminant= to= find= the= nature= of= the= solutions= to= the= following= quadratic= equations := [latex]{x}^{2}+4x+4=0[/latex] [latex]8{x}^{2}+14x+3=0[/latex] [latex]3{x}^{2}-5x= -= 2=0[/latex] [latex]3{x}^{2}-10x+15=0[/latex] we= have= seen that= a= quadratic= equation= may= have= two= real= solutions,= one= real= solution,= or= two= complex= solutions.= in= the= quadratic= formula,= the= expression= underneath= the= radical= symbol= determines= the= number= and= type= of= solutions= the= formula= will= reveal.= this= expression,= [latex]b^{2}-4ac[/latex],= is= called= the= discriminant= of= the= equation= [latex]ax^{2}+bx+c=0[/latex]. let's= think= about= how= the= discriminant= affects= the= evaluation= of= [latex]= \sqrt{{{b}^{2}}-4ac}[/latex],= and= how= it= helps= to= determine= the= solution= set.= if= [latex]b^{2}-4ac=>0[/latex], vil tallet under radikaleren være en positiv verdi. Du kan alltid finne kvadratroten av en positiv, så evaluering av kvadratisk formel vil resultere i to virkelige løsninger (en ved å legge til den positive firkantroten, og en ved å trekke den fra). Hvis [latex]b^{2}-4ac=0[/latex], vil du ta kvadratroten av [latex]0[/latex], som er [latex]0[/latex]. Siden det å legge til og trekke fra [latex]0[/latex] begge gir samme resultat, spiller ikke delen [latex]\pm[/latex] av formelen noen rolle. Det vil være en reell gjentatt løsning. Hvis [latex]b^{2}-4ac <0[/latex], then the number underneath the radical will be a negative value. Since you cannot find the square root of a negative number using real numbers, there are no real solutions. However, you can use imaginary numbers. You will then have two solutions, one by adding the imaginary square root and one by subtracting it. In the last example, we will draw a atex],= then= the= number= underneath= the= radical= will= be= a= negative= value.= since= you= cannot= find= the= square= root= of= a= negative= number= using= real= numbers,= there= are= no= real= solutions.= however,= you= can= use= imaginary= numbers.= you= will= then= have= two= complex= solutions,= one= by= adding= the= imaginary= square= root= and= one= by= subtracting= it.= in= the= last= example,= we= will= draw= a=></0[/latex], then the number underneath the radical will be a negative value. Since you cannot find the square root of a negative number using real numbers, there are no real solutions. However, you can use imaginary numbers. You will then have two complex solutions, one by adding the imaginary square root and one by subtracting it. In the last example, we will draw a > </0[> </0[> between the number and type of solutions of a square equation and the graph of the corresponding function. Use the following graphs of square functions to determine how many and what type of solutions the corresponding square equation [latex]f(x)=0[/latex] will have. Determine whether the discriminate will be greater than, less than or equal to zero for each. A.b.c. We can summarize our results as follows: Discriminatory number and type of solutions Graph over square function [latex]b^{2}-4ac<0[atex]= two= complex= solutions= will= will= will= cross= the= x-axis= [latex]b^{2}-4ac=0 [/latex] one= real= repeated= solution= will= touch= x-axis= once= [latex]b^{2}-4ac=>0[/latex] two real solutions will cross x-axis twice In the following video we show several examples of how to use the discriminatant to describe the type of solutions on a square equation. Summary The diskriminant of the square formula is the number under the radical ,latex{ {b}^{2}}-4ac[/latex]. It determines the number and type of solutions that a square equation has. If the discriminatant is positive, there are [latex]2[/latex] real solutions. If it is [latex]0[/latex], it is [latex]1[/latex] real repeat resolution. If the discriminatant is negative, there are [latex]2[/latex] complex solutions (but no real solutions). The discriminatant can also tell us about the behavior of the graph of a square function. The discriminatant is the part below the square root in the square formula, b^2-4ac. If there are more than 0, the equation has two real solutions. If it is less than 0, there are no solutions. If it equals 0, there is a solution. Quote Have you ever owned one of the Magic 8 Balls? They look like comically oversized pool balls, but have a flat window embedded in them, so you can see what's inside €a 20-sided die floating in disgusting opaque blue goo. Apparently, billiard ball has prognostic powers; All you have to do is ask it a question, give it a shake, and slowly, mysteriously, that a petroleum-covered seal coming from an oil spill will die rise to the small window and reveal the answer to your question. The square equation contains a Magic 8 Ball of sorts. The phrase b2 - 4ac from under the radical sign is called the discriminatant, and it can actually determine how many solutions a given square equation has, if you do not feel like actually calculating them. Considering that an unfactory square equation requires a lot of work to solve (tons of arithmetic abound in square formula, and a whole bunch of steps are needed in completing the square method), it is often useful to stare into the mystic outward to ensure that the equation itself has some real number solutions before spending any time actually trying to find them. The discriminate is the expression b2 - 4ac, which is defined for a square equation ax2 + </0[>+ c = 0. Based on the expression's characters, you can determine how many real number solutions the square equation has. Here's how the discriminate works. Given a square equation ax2 + bx + c = 0, connect the coefficients to the expression b2 - 4ac to see what results:If you get a positive number, the square will not have two unique solutions. If you get 0, the square will not have exactly a solution, a double root. If you get a negative number, the square will not have any real solutions, just two imaginary ones. (In other words, solutions will feature in you learned about in Wrestling with Radicals.) The discriminatant is not magic. It just shows how important the radical is in square formula. If radicand is 0, for example, then you will geta simple solution. However, if b2 - 4ac is negative, you will have a negative inside a square root character in square formula, which means only imaginary solutions. Example 4: Without calculating them, determine how many real solutions equation 3x2 - 2x = -1 has. Solution: Set the square equation equal to 0 by adding 1 on both sides. Problem 4: Without calculating them, determine how many real solutions equation 25x2 - 40x + 16 = 0 have. Put a = 3, b = -2 and c = 1, and evaluate treriminant.b2 - 4ac = (-2) 2 - 4 (3) (1) = 4 - 12 = -8Be as the discriminatant is negative, the square equation has no real number solutions, only two imaginary. Excerpted from The Complete Idiot's Guide to Algebra © 2004 by W. Michael Kelley. All rights reserved, including the right of reproduction in whole or in part in any form. Used by agreement with Alpha Books, a member of Penguin Group (USA) Inc.You can purchase this book at Amazon.com and Barnes & Noble. Algebra: The square formula If you see this message, it means that we are having trouble loading external resources on our site. If you are behind a Web filter, make sure that the domains *.kastatic.org and *.kasandbox.org are revoked. Use the square formula calculator to see square formula and discriminate in action! This calculator will solve any square equation you enter (even if the solutions are imaginary). To understand what the discriminator does, it is important that you have a good understanding of: Answer a parabola. Answer The solution can be conceived in two different ways. Algebraically, the solution occurs when y = 0. So the solution is where $$y = \ red axe ^ 2 + \ blue bx + \ color {green} c $ $ becomes $ $ $ becomes \ red axe ^ 2 + \ blue bx + \ color {green } c $. Graphically, since y = 0 is the x-axis, the solution is where the parabola captures the x-axis. (This only works for real solutions). In the image below, the left parable has 2 real solutions (red dots), the middle parabola has 1 real solution (red dot) and the right parabola has no real solutions (yes, it has imaginary). Answer It looks like .. a number. 2, 0, -1 - each of these numbers is discriminatory for 4 different square equations. Answer The discriminate is a number that can be calculated from any square equation. A square equation is an equation that can be written as $$ax^2 + bx + c $$ (where $$a e 0 $$). Answer The discriminator for a square equation of the form $$y =\red a x^2 + \blue bx + \color {green} c $$ is contained by the following formula, and it provides critical information about the roots/solutions of a square equation. $ boxed{Formula} \\ \text{Discriminant } = \blue b^2 -4 \red a \color{green} c $ $\boxed{Example} \\ \text{Equation :} y =\red 3 x^2 + \blue 9x + \color {green} 5 \\ \text{Discriminant } = \blue 9^2 -4 \cdot \red 3 \cdot \color{green} 5 \\ \text{Discriminant } = \boxed{ 6} $ Reply The discriminate tells us the following information about a square formula: If the solution is a real number or an imaginary number. If the solution is rational or if it is irrational. If the solution is one unique number or two different numbers. The value of the discriminator type and the number of solutions Example of graph $ b^2 - 4ac > 0 $ $ \text{Example :} \\ y = \red 3x^2 \blue{-6}x + \color{green} 2 \\ \text {Discriminant} \\ \blue{-6}^2 - 4 \cdot \red 3 \cdot \color{green} 2 \\ = boxed{12} \\ $ If the diskriminant is a positive number, the there are 2 real solutions. This means that the graph of the parabola interepts the x-axis at 2 different points. $ \text{Example :} \\ y = \red 3x^2 + \blue 4 x \color{green} {-4} \\ \text{Discriminant} \\ \blue 4^2 - 4 \cd \red 3 \cdot \color{green} {-4} \\ =boxed{64} \\ $ If the discriminate is positive and also a perfect square as 64, then there are 2 real rational solutions. $ \text{Example :} \\ y = \red 3x^2 \blue {-6} x + \color{green} 2 \\ \text{Discriminant} \\ \blue {-6}^2 - 2 \\ \text{Discriminant} \\ \blue {-6}^2 - 24 \cdot \red 3 \cdot \color{green} 2 \\ = \boxed{12 } \\ $ If the discriminate is positive and not a perfect square like 12, then there are 2 real irrational solutions. $ b^2 - 4ac = 0 $ $ \text{Example :} \\ y = \red 4 x^2 \blue{-28}x + \color{green} {49} \\ \text {Discriminated} \\ \blue{-28}^2 - 4 \cdot \red 4 \cdot \color{green} 49 \\ = \boxed{0} \\ $ $ b ^2 - 4ac < 0 $ $ \text{Example :} \\ y = \red x^2 \blue{-3}x + \color{green} 4 \\ \text{Discriminant } \\ \blue{-3}^2 - 4 \cdot \red 1 \cdot \color{green} 4 \\ = \boxed{-7}\$ There are only imaginary solutions. This means that the graph of the square never crosses the axes. Square formula: $$y =x^2 + 2x +1$$$a=\red 1\b=\blue 2\a=color{green}{1} $The discriminator for this formula is: $\text{Discriminant }=\blue b^2 -4\red a \color{green} c \\ \text{Discriminant } = \blue 2^2 -4 \cdot \red 1 \cdot \color{green} \cdot 1 \\ \text{Discriminant } = 4 -4 \\ \text{Discriminant } = \boxed{0} \\ $ Since the discriminate is zero, there be 1 real solution to this equation. Below is an image representing the graph and the one solution at $ $ y = x ^ 2 + 2x + 1 $ $. Calculate the discriminate to determine the number and nature of the solutions to the following square equation: $ $y = x^2 − 2x + 1 $ $. In this square equation, $$ y =\red 1 x^2 + \blue {-2} + \color {green} 1 $$ $ \text{Equation : } y =\red 1 x^2 + \blue {-2}x + \color {green} 1 \\ a = \red 1 \\ b = \blue{-2} \\ c = \color{green} 1 $ Use our general formula: $$ \text{Discriminant } \\ \begin{aligned} &= \blue b^2 - 4 \cdot \red a \cdot \color{green} c \\ & = \blue {-2}^2 -4 \cdot \red 1 \cdot \color{green} 1 \\ & \boxed{0} \end{adjusted} $$ Since the discriminate is zero , we should expect 1 real solution that you can see pictured in the graph below. Use the discriminate to determine the species and number of solutions: $ $y = x^2 − x − 2 $$. In this square equation, $$ y =\red 1 x^2 + \blue {-1}x + \color {green} 1 $$ \ text{Equation : } y =\red 1 x^2 + \blue {-1} + \color {green} 1 \\ a = \red 1 \\ b = \blue{-1} \\ c = \color{green} {2} $ Use our general formula: $$ \text{Discriminant } \\ \begin{aligned} & = \blue b^2 -4 \cdot \red a \cdot \color{green} c \\ & = \blue {-1}^2 -4 \cdot \red 1 \cdot \color{green} {-2} \\ &= 1 - -8 \\ &= 1 + 8 = \boxed 9 \end{aligned} $$ Since the discriminate is positive and rational, there should be 2 real rational solutions to this equation. As you can see below, if you use the square formula to find the actual solutions, you actually get 2 real rational solutions. Calculate the discriminate to determine the species and number of solutions: y = x^2 − 1. In this square equation, y = 1x^2 − 1. $$ \color{Red}{b^2} - 4\color{Magenta}{a}\color{Blue}{c} \\ \color{Red}{(0)^2} - 4\color{Magenta}{(1)}\color{Blue}{(-1)} = 4$$ Since the discriminate is positive and a perfect square, we have two real solutions that are rational. Again if you want to see the actual solutions and graph, just see below: Calculate the discriminate to determine the species and number of solutions: y = x^2 + 4x − 5. In this square equation, y = x^2 + 4x − 5. $$ \color{Red}{b^2} - 4\color{Magenta}{a}\color{Blue}{c} \\ \color{Red}{(4)^2} - 4\color{Magenta}{(1)}\color{Blue}{(-5)} \\ 16 - 4(-5) = 16 +20 \\ = 36 $$ Since this square equation's discriminate is positive and a perfect square, there are two real solutions that are rational. Calculate the discriminate to determine the species and number of solutions: y = x^2 - 4x + 5. In this square equation, y = x^2 - 4x + 5. $$ \color{Red}{b^2} - 4\color{Magenta}{a}\color{Blue}{c} \\ \color{Red}{(-4)^2} - 4\color{Magenta}{(1)}\color{Blue}{(5)} \\ = 16 - 20 = -4 $$ Since the discriminate is negative, there are no real solutions to this square equation. The only solutions are imaginary. Below is a picture of this Graph. Finding Find to determine the species and number of solutions: y = x^2 + 4 . y = x^2 + 4 $$ \color{Red}{b^2} - 4\color{Magenta}{a}\color{Blue}{c} \\ \color{Red}{(0)^2} - 4\color{Magenta}{(1)}\color{Blue}{(4)} = -16 $$ Since the deviants are negative, there are two imaginary solutions to this square equation. The solutions are 2i and -2i. Below is a picture of this equation graph. Find the discriminatant to determine the species and number of solutions: y = x^2 + 25. y = x^2 + 25 $$ \color{Red}{b^2} - 4\color{Magenta}{a}\color{Blue}{c} \\ \color{Red}{(0)^2} - 4\color{Magenta}{(1)}\color{Blue}{(25)} = -100 $$ Since the diskriminant is negative, there are two imaginary solutions to this square equation. The solutions are 5i and -5i. This page: Discriminant Formula Nature of the Roots Roots