LESSON MAKER PRO

Quadratic Clues

Use equations to predict what a parabola does.

HIGH SCHOOL · FA.F.30

FA.F.30 "Understand the relationship between the constants of a quadratic equation and the attributes of the graph. Recognize the relationship between the value of the discriminant and the type and number of solutions (i.e...."

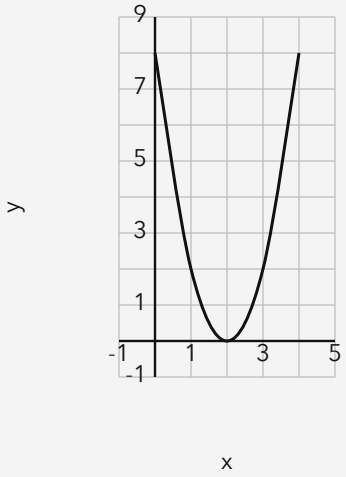
NAME _____ DATE _____

READ THE CONSTANTS

For $y = ax^2 + bx + c$, the sign of a tells you whether the parabola opens up or down, and c gives its y-intercept. The discriminant is $D = b^2 - 4ac$. If D is positive, the graph has two x-intercepts; if D is zero, it has one; if D is negative, it has none.

WORKED EXAMPLE

Look at the graph of $y = 2x^2 - 8x + 8$. How many x-intercepts do you see? Verify your answer with the discriminant.

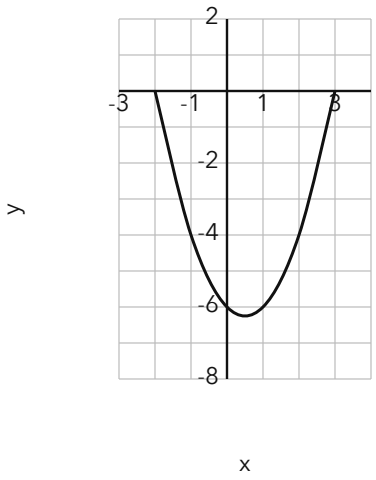


1. The graph touches the x-axis once.
2. Identify $a = 2$, $b = -8$, and $c = 8$.
3. $D = (-8)^2 - 4(2)(8) = 64 - 64 = 0$.

Answer: One x-intercept. The discriminant of 0 confirms it.

PRACTICE 6 problems

1 Look at the graph of $y = x^2 - x - 6$. How many x-intercepts do you see? Compute the discriminant.



ANSWER _____

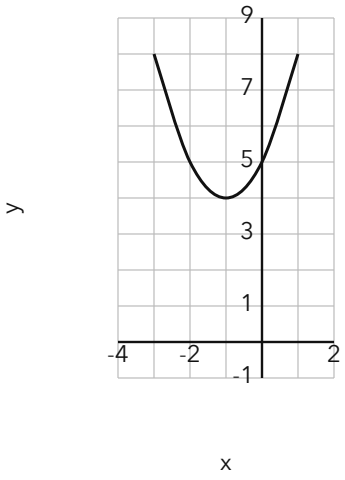
2 For $y = -3x^2 + 6x + 1$, does the parabola open up or down? How many x-intercepts does it have?

ANSWER _____

3 For $y = 4x^2 + 12x + 9$, find the discriminant and the x-coordinate where the graph touches the x-axis.

ANSWER _____

4 Look at the graph of $y = x^2 + 2x + 5$. Does it cross the x-axis? Compute the discriminant.



ANSWER _____

5 For $y = 3x^2 - 12x + 9$, find the axis of symmetry and the y-intercept.

ANSWER _____

6 For $y = -x^2 - 2x + 15$, compute the discriminant and tell whether the parabola opens up or down.

ANSWER _____

APPLY IT Show your work

1 A basketball's height in feet after t seconds is $h(t) = -t^2 + 4t + 5$. Compute the discriminant and find both zeros. Which zero tells when the ball hits the ground?

WORK SPACE

ANSWER _____

2 A school club models its ticket-sale profit, in hundreds of dollars, by $P(x) = -x^2 + 6x - 5$, where x is the ticket price in dollars. At what ticket prices does the club break even? Between which prices does it make a profit?

WORK SPACE

ANSWER _____

CHALLENGE One step up

The graph of $y = x^2 + bx + 25$ has exactly one x-intercept, and that intercept is to the right of the y-axis. Find b and the x-intercept. Explain why the other possible value of b does not work.

WORK SPACE AND ANSWER

ANSWER KEY

Quadratic Clues

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Look at the graph of $y = x^2 - x - 6$. How many x-intercepts do you see? Compute the discriminant.	**Two x-intercepts; D = 25.**
2	For $y = -3x^2 + 6x + 1$, does the parabola open up or down? How many x-intercepts does it have?	**It opens down and has two x-intercepts because D = 48.**
3	For $y = 4x^2 + 12x + 9$, find the discriminant and the x-coordinate where the graph touches the x-axis.	**D = 0; x = -3/2.**
4	Look at the graph of $y = x^2 + 2x + 5$. Does it cross the x-axis? Compute the discriminant.	**No; D = -16.**
5	For $y = 3x^2 - 12x + 9$, find the axis of symmetry and the y-intercept.	**Axis of symmetry: x = 2; y-intercept: (0, 9).**
6	For $y = -x^2 - 2x + 15$, compute the discriminant and tell whether the parabola opens up or down.	**D = 64; it opens down.**

PART 2 · APPLY IT

1. **D = 36. The zeros are t = -1 and t = 5; the ball hits the ground after 5 seconds.** Use a = -1, b = 4, and c = 5 to get D = 16 + 20 = 36. Factor h(t) = -(t - 5)(t + 1); only the nonnegative time describes the ball's flight.
2. **The club breaks even at $1 and $5 per ticket. It makes a profit when the ticket price is greater than $1 and less than $5.** Set P(x) = 0 and factor: -(x - 1)(x - 5) = 0. The downward-opening parabola is above the x-axis between its zeros.

CHALLENGE

$D = b^2 - 100 = 0$, so b = 10 or b = -10. If b = -10, the x-intercept is x = 5. If b = 10, it is x = -5, which is left of the y-axis.

Accept equivalent descriptions of the number of real zeros and x-intercepts. For the profit problem, accept $1 < x < 5$ as the interval of profitable ticket prices.