LESSON MAKER PRO

Conic Clues

Use equation structure to identify a conic.

HIGH SCHOOL · A.SSE.A.2.a

A.SSE.A.2.a "Analyze the structure of the general form of a second degree equation, $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$, to identify the conic section represented by the equation."

NAME _____ **DATE** _____

CHECK THE COEFFICIENTS

In $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$, calculate $B^2 - 4AC$. A negative result means an ellipse, a zero result means a parabola, and a positive result means a hyperbola. A circle is a special ellipse with A = C and B = 0. These rules assume the equation represents a nondegenerate conic.

WORKED EXAMPLE

Identify the conic: $13x^2 + 10xy + 17y^2 - 26x + 34y - 91 = 0$.

1. Identify A = 13, B = 10, and C = 17.
2. Calculate $B^2 - 4AC = 10^2 - 4(13)(17) = 100 - 884 = -784$.
3. The result is negative, so the conic is an ellipse.

Answer: Ellipse

PRACTICE 6 problems

1 Identify the conic: $x^2 + y^2 - 4x + 2y - 20 = 0$.

ANSWER _____

2 Identify the conic: $4x^2 + 9y^2 - 16x + 18y - 11 = 0$.

ANSWER _____

3 Identify the conic: $y^2 - 6x + 2y + 7 = 0$.

ANSWER _____

4 Identify the conic: $2x^2 - 3y^2 + 8x + 6y - 13 = 0$.

ANSWER _____

5 Identify the conic: $5x^2 + 4xy + 5y^2 - 6x + 2y - 9 = 0$.

ANSWER _____

6 Identify the conic: $x^2 + 6xy + y^2 - 2x + 4y - 7 = 0$.

ANSWER _____

APPLY IT Show your work

1 A video game uses x and y to mark positions on a map. The edge of a player's radar range follows $9x^2 + 9y^2 - 36x + 18y - 36 = 0$. What conic is the edge? Use the coefficients to justify your answer.

WORK SPACE

ANSWER _____

2 A concert app marks positions x and y, in meters, on the floor. The boundary between two speaker zones follows $4x^2 - 9y^2 - 8x - 18y - 41 = 0$. What conic forms the boundary? Show the value of $B^2 - 4AC$.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Find both values of k for which $x^2 + kxy + y^2 - 4x + 6y + 1 = 0$ represents a parabola. Show your discriminant calculation.

WORK SPACE AND ANSWER

Conic Clues

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Identify the conic: $x^2 + y^2 - 4x + 2y - 20 = 0$.	**Circle**
2	Identify the conic: $4x^2 + 9y^2 - 16x + 18y - 11 = 0$.	**Ellipse**
3	Identify the conic: $y^2 - 6x + 2y + 7 = 0$.	**Parabola**
4	Identify the conic: $2x^2 - 3y^2 + 8x + 6y - 13 = 0$.	**Hyperbola**
5	Identify the conic: $5x^2 + 4xy + 5y^2 - 6x + 2y - 9 = 0$.	**Ellipse**
6	Identify the conic: $x^2 + 6xy + y^2 - 2x + 4y - 7 = 0$.	**Hyperbola**

PART 2 · APPLY IT

1. **Circle** $A = C = 9$ and $B = 0$, so the conic is a circle.
2. **Hyperbola; $B^2 - 4AC = 144$** $A = 4$, $B = 0$, and $C = -9$. Thus $B^2 - 4AC = 0 - 4(4)(-9) = 144$, which is positive.

CHALLENGE

$B^2 - 4AC = k^2 - 4$. Set $k^2 - 4 = 0$, giving $k = 2$ or $k = -2$. Both equations represent nondegenerate parabolas.

For the fifth practice problem, $A = C$ does not make a circle because B is not zero. In the challenge, accept $k = \pm 2$ with a correct discriminant calculation.