

correction livre de maths seconde hyperbole

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Introduction

For students tackling the second-year mathematics curriculum in France, the hyperbola is one of the most challenging yet fascinating topics. Whether you're working through the *livre de maths seconde* or preparing for the Baccalauréat, a clear, step by step correction guide can make all the difference. This article offers a comprehensive overview of hyperbola theory, common pitfalls, and practical solutions that align with the correction style expected in the French high school math workbook. By combining rigorous explanations with real world examples, you'll gain the confidence to solve hyperbola problems accurately and efficiently.

Understanding the Hyperbola Concept in Second Year Mathematics

Definition and Key Features

A hyperbola is a type of conic section that arises when a plane cuts through a double cone at an angle that is not perpendicular to the cone's axis. Mathematically, it is defined as the set of points whose absolute difference of distances to two fixed points (the foci) is constant. In Cartesian coordinates, a hyperbola takes one of two standard forms:

- Horizontal hyperbola: $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$
- Vertical hyperbola: $\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$

Here, (h, k) denotes the centre, while a and b are semi axes lengths that determine the shape's spread.

Standard Forms

Students often encounter the need to convert a general quadratic equation into one of the standard forms. The process involves completing the square for both x and y terms, identifying the centre, and isolating the constant term on the right hand side. A common mistake is to forget to factor the sign of the constant when moving terms across the equality sign, which can lead to an incorrect identification of the hyperbola's orientation.

Geometric Interpretation

Visualizing a hyperbola helps in understanding its asymptotes, vertices, and foci. The asymptotes are straight lines that the hyperbola approaches infinitely closely but never crosses. For a horizontal hyperbola, the asymptotes are given by:

- $y - k = \pm \frac{b}{a}(x - h)$

These lines are crucial for sketching the graph and for solving problems that involve distances or angles related to the hyperbola.

Common Challenges Students Face with Hyperbola Problems

Identifying the Correct Equation

Students sometimes misinterpret the sign of the quadratic terms, leading them to think a given equation represents an ellipse or a parabola instead of a hyperbola. The key is to check whether the x^2 and y^2 terms have opposite signs after moving all terms to one side. If they do, the curve is a hyperbola.

Manipulating Algebraic Expressions

When simplifying the equation, algebraic errors such as incorrect distribution, sign mistakes, or miscalculations in completing the square can derail the entire solution. Careful step by step verification, especially when handling fractions or negative numbers, is essential.

Graphing the Hyperbola

Plotting a hyperbola accurately requires knowledge of its vertices, asymptotes, and the direction of opening. Students often forget to scale the graph properly, leading to distorted representations that can mislead subsequent calculations.

How to Approach the Correction Livre de Maths Seconde Hyperbole

Step by Step Problem Solving

1. Read the problem carefully: Identify the type of hyperbola, the known quantities, and what needs to be found.
2. Rewrite the equation: Bring all terms to one side and simplify.
3. Complete the square: For both (x) and (y) to isolate the centre.
4. Determine the standard form: Identify (a) , (b) , and the orientation.
5. Compute derived parameters: Find vertices, foci, asymptotes, and any requested distances.
6. Verify the solution: Plug the values back into the original equation to confirm consistency.

Checking Work and Common Mistakes

After solving, it's vital to re-examine each step:

- Did you correctly identify the signs of the quadratic terms?
- Were the completed squares accurate?
- Did you properly compute $(c = \sqrt{a^2 + b^2})$ for the foci distance?
- Is the final answer dimensionally consistent with the problem's context?

Addressing these checkpoints reduces the likelihood of lingering errors.

Sample Problems and Their Corrections

Problem 1: Equation of a Hyperbola

Question: Transform the equation $(4x^2 - 9y^2 + 8x + 18y - 5 = 0)$ into its standard form and identify its centre, vertices, and asymptotes.

Solution:

1. Move the constant term: $(4x^2 + 8x - 9y^2 + 18y = 5)$.
2. Divide by 4 to simplify (x) terms: $(x^2 + 2x - \frac{9}{4}y^2 + \frac{9}{2}y = \frac{5}{4})$.
3. Complete the square for (x) : $((x + 1)^2 - 1)$.
4. Complete the square for (y) (after multiplying the (y) equation by $(-\frac{9}{4})$): $(-\frac{9}{4}[(y - 1)^2 - 1])$.
5. Combine terms: $((x + 1)^2 - \frac{9}{4}(y - 1)^2 = \frac{5}{4} + 1 + \frac{9}{4} = 4)$.
6. Divide both sides by 4: $(\frac{(x + 1)^2}{4} - \frac{(y - 1)^2}{\frac{4}{9}} = 1)$.
7. Thus, the centre is $(-1, 1)$, $(a^2 = 4)$ $(a = 2)$, $(b^2 = \frac{4}{9})$ $(b = \frac{2}{3})$.
8. The asymptotes: $(y - 1 = \pm \frac{b}{a}(x + 1) = \pm \frac{1}{3}(x + 1))$.

Problem 2: Asymptotes of a Vertical Hyperbola

Question: Find the equations of the asymptotes for the hyperbola $(\frac{(y - 2)^2}{9} - \frac{(x + 3)^2}{4} = 1)$.

Solution:

1. Identify orientation: vertical hyperbola.
2. Compute slope: $\frac{b}{a} = \frac{2}{3}$.
3. Asymptotes: $(y - 2 = \pm \frac{2}{3}(x + 3))$.
4. Final equations: $(y = \frac{2}{3}x + \frac{12}{3} + 2 = \frac{2}{3}x + 6)$ and $(y = -\frac{2}{3}x - 2)$.

Problem 3: Distance Between Foci

Question: For the hyperbola $(\frac{x^2}{25} - \frac{y^2}{9} = 1)$, calculate the distance between its foci.

Solution:

1. Identify $(a^2 = 25)$ $(a = 5)$ and $(b^2 = 9)$ $(b = 3)$.
2. Compute $(c = \sqrt{a^2 + b^2} = \sqrt{25 + 9} = \sqrt{34})$.
3. Distance between foci $(2c = 2\sqrt{34})$ units.

Problem 4: Real World Application – Satellite Orbits

Question: A satellite follows a hyperbolic trajectory described by $(\frac{(x - 4)^2}{16} - \frac{(y + 2)^2}{9} = 1)$. Determine the coordinates of the vertices and the asymptotes.

Solution:

1. Centre: $(4, -2)$.
2. Vertices along the horizontal axis: $(4 \pm a, -2)$ where $(a = 4)$. Thus vertices: $(0, -2)$ and $(8, -2)$.
3. Compute slope: $(\frac{b}{a} = \frac{3}{4})$.
4. Asymptotes: $(y + 2 = \pm \frac{3}{4}(x - 4))$.

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