

## Tutorial: Writing the Equation of a Hyperbola

### Slide 1:

In this tutorial we will go through examples of how to write the equation of a hyperbola.

### Slide 2:

When you are asked to write the equation of a hyperbola, you will be given various pieces of information. Based on those pieces of information, you will need to generate the rest of what you need to write the equation.

The first thing you need to know is whether the hyperbola is horizontal or vertical. This will tell you which form of the equation you will use. Remember that if the hyperbola is horizontal, the vertices and the foci lie horizontally from the center.

The next thing you need to know is where the center point is.

The next thing you will need to know is the value of 'a'. This is the distance the vertices are away from the center. The length of the transverse axis is equal to two a.

The last thing you will need to know is the value of 'b'. This is the distance the co-vertices are away from the center. The length of the conjugate axis is equal to two b.

Keep in mind that some of this information will be given to you in the problem and some of this information will need to be generated using the equation  $a^2 + b^2 = c^2$ .

### Slide 3:

Let's go through an example of writing the equation of a hyperbola. As with ellipses, this is the easiest way to see how to solve these kinds of problems.

Find the equation of the hyperbola that has co-vertices at zero, negative two and zero, two and foci at negative three, zero and three, zero.

Solution

This hyperbola is centered at the origin. Notice the zeros in the points for both the co-vertices and the foci. Graph these points to see where the center is located.

Co-vertices are defined as zero, negative b and zero, b for horizontal hyperbolas. This means that b is equal to two.

Foci are defined as negative c, zero and c, zero for horizontal hyperbolas. This means c is equal to three.

Since we know b and c, our next step is to find a. Let's use the equation  $a^2 + b^2 = c^2$ .

Plug in the values of b and c.

$a^2 + 2^2 = 3^2$

$a^2 + 4 = 9$

A squared equal five and a is equal to square root of five.

We can use the general equation of a horizontal hyperbola.  $X^2$  over  $a^2$  minus  $y^2$  over  $b^2$  is equal to one.

Plugging in our values of  $a^2$  and  $b^2$  we have the final equation  $x^2$  over five minus  $y^2$  over four is equal to one.

**Slide 4:**

Now you try

Answer the following question. Click on solution to check your work.

Find the equation of a hyperbola if the co-vertices are  $(-1, 0)$  and  $(1, 0)$  and the foci are  $(0, -2)$  and  $(0, 2)$ .

**Solution**

$Y^2$  divided by 3 minus  $x^2$  divided by 1 equals 1.

**Slide 5:**

Remember

Read each problem carefully. Write down the information that is given and solve for the missing  $a$  or  $b$  values.