

Name \_\_\_\_\_

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## Finding the Equation of a Parabola- Step-by-Step Lesson

If the focus of a parabola is (3, 5) and the directrix is  $y=1$ , find the equation of parabola.

### Explanation:

Step 1) We should know what we have to be find out.

“Find the Equation of parabola?”

Step 2) The distance between  $(x_0, y_0)$  and (3, 5) is  $\sqrt{(x_0-3)^2 + (y_0-5)^2}$

The distance between  $(x_0, y_0)$  and the directrix,  $y=1$  is  $|y_0-1|$ .

Equate the two distance expressions and square on both sides.

$$\sqrt{(x_0-3)^2 + (y_0-5)^2} = |y_0-1|$$

$$(x_0-3)^2 + (y_0-5)^2 = (y_0-1)^2$$

Simplify and bring all terms to one side:

$$x_0^2 - 6x_0 + 33 - 8y_0 = 0$$

Write the equation with  $y_0$  on one side:

$$y_0 = \frac{x_0^2}{8} - \frac{3}{4}x_0 + \frac{33}{8}$$

This equation in  $(x_0, y_0)$  is true for all other values on the parabola and hence we can rewrite with  $(x, y)$ .

So, the equation of the parabola with focus (3, 5) and directrix is  $y= 1$  is

$$y = \frac{x^2}{8} - \frac{3}{4}x + \frac{33}{8}$$

Step 3) So the answer is  $y = \frac{x^2}{8} - \frac{3}{4}x + \frac{33}{8}$

