Date _____

Finding the Equation of a Parabola- Guided Lesson Explanation

Explanation#1

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 (0, -2) is $\sqrt{(x_0-0)^2 + (y_0-(-2))^2}$

The distance between (x_0, y_0) and the directrix, y=2 is $y_0=2$

Equate the two distance expressions and square on both sides.

$$\sqrt{(x_0-0)^2 + \{(y_0-(-2)\}^2 = |y_0-2| \\ (x_0-0)^2 + \{(y_0-(-2)\}^2 = (y_0-2)^2 \\ \end{bmatrix}}$$

Simplify and bring all terms to one side:

$$x_0^2 + 8y_0 = 0$$

Write the equation with y_0 on one side:

$$y_0 = \frac{-x_0 2}{8}$$

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 (0, -2) and directrix is y=2 is

$$y = \frac{-x^2}{8}$$

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

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Explanation#2

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 (5, -1) is $\sqrt{(x_0-5)^2 + (y_0-(-1))^2}$

The distance between (x_0, y_0) and the directrix, y=3 is $y_0=3$

Equate the two distance expressions and square on both sides.

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

Simplify and bring all terms to one side:

$$x_0^2 - 10x_0 + 17 + 8y_0 = 0$$

Write the equation with y_0 on one side:

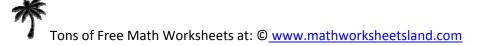
$$\mathbf{y}_{0} = -\frac{\mathbf{x}_{0}\,^{2}}{8} + \frac{5}{4}\,\mathbf{x}_{0} - \frac{17}{8}$$

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 (5,-1) and directrix is y=3 is

$$y = -\frac{x^2}{8} + \frac{5}{4}x - \frac{17}{8}$$

Step 3) So the answer is $y = -\frac{x}{8} + \frac{5}{4}x - \frac{17}{8}$



Name _____

Date _____

Explanation#3

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 (4, -4) is $\sqrt{(x_0-4)^2 + (y_0-(-4))^2}$

The distance between (x_0, y_0) and the directrix, y=6 is $|y_0-6|$.

Equate the two distance expressions and square on both sides.

$$\sqrt{(x_0-4)^2 + (y_0-(-4))^2} = |y_0-6|$$
$$(x_0-4)^2 + (y_0-(-4))^2 = (y_0-6)^2$$

Simplify and bring all terms to one side:

$$x_0^2 - 8x_0 - 4 + 20y_0 = 0$$

Write the equation with y_0 on one side:

$$\mathbf{y}_{0} = -\frac{\mathbf{x}_{0}\,2}{20} + \frac{2}{5}\,\mathbf{x}_{0} + \frac{1}{5}$$

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 (4, -4) and directrix is y=6 is

$$y = -\frac{x^2}{20} + \frac{2}{5}x + \frac{1}{5}$$

Step 3) So the answer is $y = -\frac{x^2}{20} + \frac{2}{5}x + \frac{1}{5}$

