

## How to Complete the Square (create a perfect square trinomial)

$x^2 + \frac{10x}{2} + \frac{25}{(5)^2}$ $(x+5)^2$	$x^2 - \frac{12x}{2} + \frac{36}{(-6)^2}$ $(x-6)^2$	$x^2 - \frac{2x}{2} + \frac{1}{(-1)^2}$ $(x-1)^2$	$x^2 + \frac{14x}{2} + \frac{49}{(7)^2}$ $(x+7)^2$
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Transformational

## WRITING EQUATION OF A PARABOLA IN STANDARD FORM BY COMPLETING THE SQUARE

$$(x-h)^2 = 4p(y-k)$$

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①  $y^2 + 3x + 4y + 7 = 0 \rightarrow -3x - 7$

$$y^2 + \frac{4y}{2} + \frac{4}{(2)^2} = -3x - 7 + \frac{4}{2}$$

$$(y+2)^2 = -3x - 3$$

$$(y+2)^2 = -3(x+1)$$

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Which variable is squared? y Move all terms WITHOUT that variable to the other side (keep squared term positive)

Complete the Square on SQUARED side  
(Remember to ADD constant to BOTH sides of equation)

Combine Like Terms on other side and FACTOR (GCF) ☺  
(non squared side)

Rewrite the parabola in standard form by completing the square.

a)  $x^2 - 10x + 12y + 49 = 0 \rightarrow -12y - 49$

$$x^2 - \frac{10x}{2} + \frac{25}{(-5)^2} = -12y - 49 + \frac{25}{2}$$

$$(x-5)^2 = -12y - 24$$

$$(x-5)^2 = -12(y+2)$$

$$(x-5)^2 = -12(y+2)$$

opens down, vertex (5, -2), p = -3

b)  $y^2 - 8y - 2x + 16 = 0 \rightarrow 2x - 16$

$$y^2 - 8y + \frac{16}{2} = 2x - 16 + \frac{16}{2}$$

$$(y-4)^2 = 2x$$

$$(y-4)^2 = 2(x-0)$$

opens RIGHT, vertex (0, 4), p = 1/2

c)  $x^2 + 14x - 12y + 97 = 0$

$$(x+7)^2 = 12(y-4)$$

opens up

$$p = 3$$

vertex: (-7, 4)

d)  $x^2 - 4x - 8y + 28 = 0$

$$(x-2)^2 = 8(y-3)$$

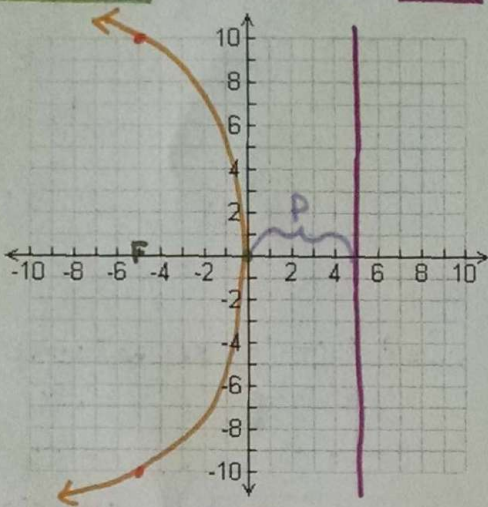
opens up

$$p = 2$$

vertex (2, 3)

Write the equation of each parabola in standard form, based on its description. Then given the domain and range.

a. vertex at (0,0) and directrix at  $x=5$



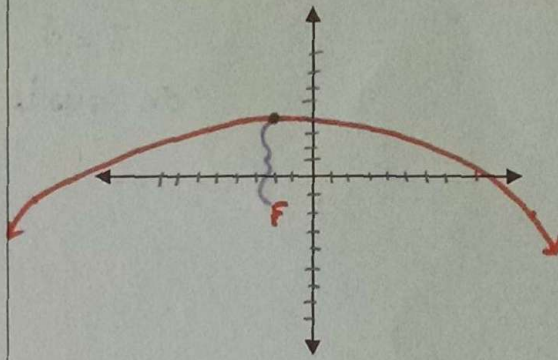
Direction it opens: LEFT Value of  $p$ : -5

Equation in Standard Form:

$$(x-0)^2 = -20(x-0)$$

Domain:  $x \leq 0$  Range:  $\mathbb{R}$

b. vertex at (-2,4) and focus at (-2,-2)



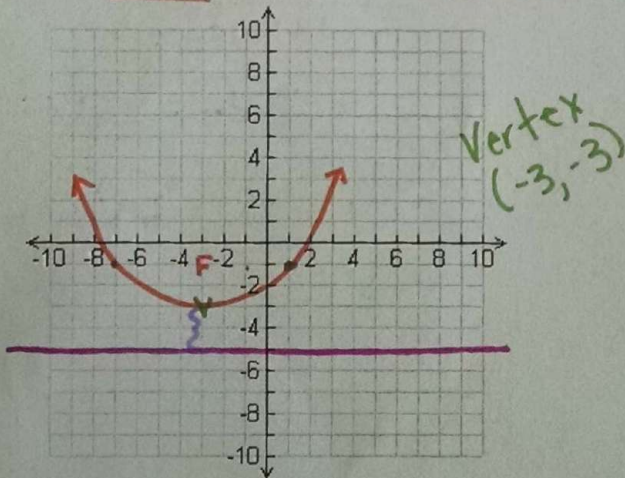
Direction it opens: down Value of  $p$ : -6

Equation in Standard Form:

$$(x+2)^2 = -24(y-4)$$

Domain:  $\mathbb{R}$  Range:  $y \leq 4$

c. focus at (-3,-1) and directrix at  $y=-5$



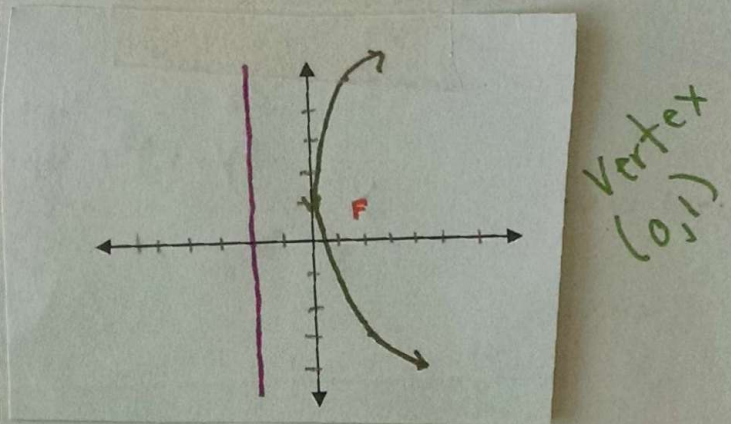
Direction it opens: UP Value of  $p$ : +2

Equation in Standard Form:

$$(x+3)^2 = 8(y+3)$$

Domain:  $\mathbb{R}$  Range:  $y \geq -3$

d. focus at (2,1) and directrix at  $x=-2$



Direction it opens: RIGHT Value of  $p$ : 2

Equation in Standard Form:

$$(y-1)^2 = 8(x-0)$$

Domain:  $x \geq 0$  Range:  $\mathbb{R}$