

I. Complete the Square then write as (side length)<sup>2</sup>.

$(-14/2)^2 = (-7)^2$   
1.  $x^2 - 14x + \underline{49}$   
 $(x-7)^2$

$(40/2)^2 = (20)^2$   
2.  $x^2 + 40x + \underline{400}$   
 $(x+20)^2$

$(-3/2)^2$   
3.  $x^2 - 3x + \underline{9/4}$   
 $(x-3/2)^2$

$(18/2)^2 = (9)^2$   
4.  $x^2 + \underline{18}x + 81$   
 $(x+9)^2$

II. Write the equation of a parabola with the following transformations in Vertex Form.

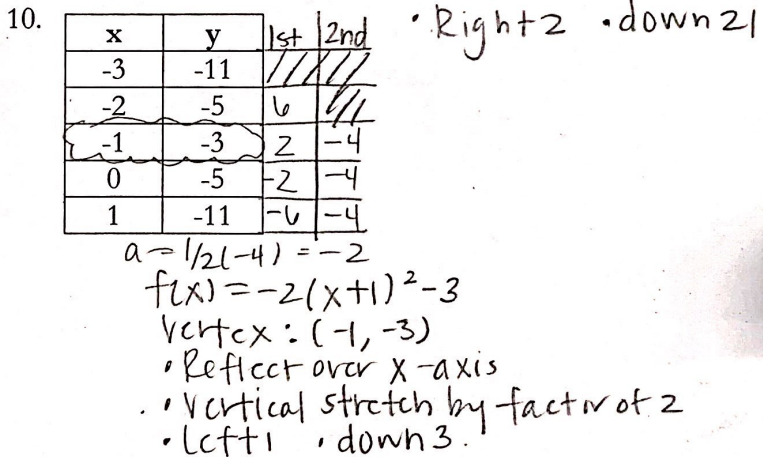
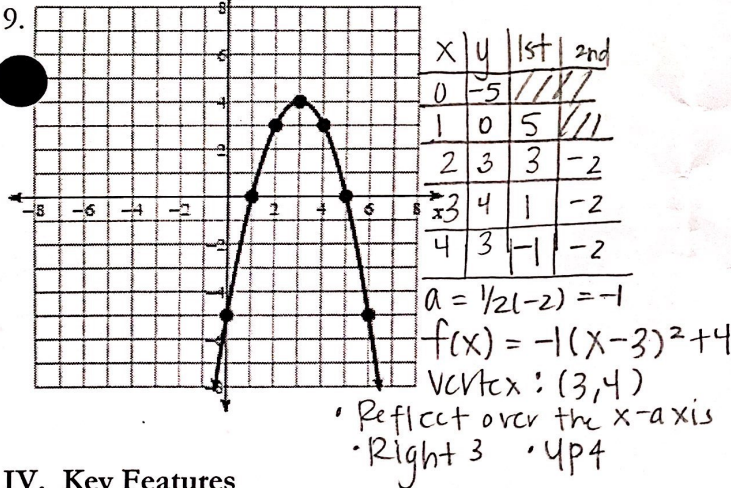
5. Shifted right 3, Reflected over the x-axis, vertical stretch by a factor of 4, up 7  $f(x) = -4(x-3)^2 + 7$

6. Vertical compression by a factor of  $\frac{2}{3}$ , shifted down 3 units and left 5 units.  $f(x) = \frac{2}{3}(x+5)^2 - 3$

III. Write in Vertex Form, state the vertex, and list all the transformations

7.  $x^2 + 24x + 56$   
 $f(x) = x^2 + 24x + 144 + 56 - 144$   
 $(24/2)^2 = (12)^2 = 144$   
 $f(x) = (x+12)^2 - 88$   
Vertex:  $(-12, -88)$   
• Left 12  
• down 88

8.  $4x^2 - 16x - 5$   
 $f(x) = 4(x^2 - 4x + 4) - 5 - 16$   
 $(-4/2)^2 = (-2)^2 = 4$   
 $f(x) = 4(x-2)^2 - 21$   
Vertex:  $(2, -21)$   
• Vertical stretch by a factor of 4  
• Right 2  
• down 21



IV. Key Features

11. Use question #9 above to answer the following questions:

Axis of Symmetry:  $x = 3$       Vertex:  $(3, 4)$       y-intercept:  $(0, -5)$   
# of x-intercepts: 2      Max or Min? Max      Second Difference: -2

12. Use question #10 above to answer the following questions:

Axis of Symmetry:  $x = -1$       Vertex:  $(-1, -3)$       y-intercept:  $(0, -5)$   
# of x-intercepts: none      Max or Min? Max      Second Difference: -4

V. Expand to write the Vertex Form equation in Standard Form.

13.  $f(x) = (x - 6)^2 + 15$

$$\begin{aligned} f(x) &= (x-6)(x-6) + 15 \\ &= x^2 - 6x - 6x + 36 + 15 \\ &= x^2 - 12x + 51 \end{aligned}$$

14.  $f(x) = -3(x - 1)^2 + 7$

$$\begin{aligned} &= -3(x-1)(x-1) + 7 \\ &= -3(x^2 - x - x + 1) + 7 \\ &= -3x^2 + 3x + 3x - 3 + 7 \\ &= -3x^2 + 6x + 4 \end{aligned}$$

VI. Factor Completely

15.  $x^2 + 9x + 20$

$$(x+4)(x+5)$$

16.  $x^2 - 36$

$$(x+6)(x-6)$$

17.  $2x^2 + 8x - 42$

$$2(x^2 + 4x - 21)$$

$$2(x+7)(x-3)$$

18.  $3x^2 - 23x - 36$

$$(3x+4)(x-9)$$

19.  $-x^2 + 7x + 8$

$$-1(x^2 - 7x - 8)$$

$$-1(x-8)(x+1)$$

20.  $5x^2 - 125$

$$5(x^2 - 25)$$

$$5(x+5)(x-5)$$