Vertex to Standard Form of a Quadratic

Standard form of a quadratic:

$$y = ax^2 + bx + c$$

a is the vertical stretch/compression (the same as vertex form)

c is the y-intercept

The x^2 always goes first, followed by x, and the constant is last.

The x-coordinate of the vertex of a parabola in standard form can be found by using:

$$x = \frac{-b}{2a}$$

Find the x-coordinate of the vertex for the equation: $y = 3x^2 - 4x + 1$

$$x = \frac{-b}{2a}$$

$$x = \frac{-(-4)}{2(3)}$$

$$x = \frac{4}{6} = \frac{2}{3}$$

Use order of operation (PEMDAS) to convert from vertex to standard form:

1) Square the parenthesis (Exponents)
2) Distribute the a (Multiplication)
3) Combine like terms (Add/Subtract)

Convert to standard form: $y = -2(x - 4)^2 + 3$

$(x - 4)(x - 4)$

$x^2 - 4x - 4x + 16$

$x^2 - 8x + 16$

Re-write $(x - 4)^2$ as $(x - 4)(x - 4)$ and FOIL

$y = -2(x^2 - 8x + 16) + 3$

Substitute $x^2 - 8x + 16$ in for $(x - 4)^2$

$y = -2x^2 + 16x - 32 + 3$

Distribute the -2

$y = -2x^2 + 16x - 29$

Combine like terms

Convert to standard form: $y - 4 = \frac{1}{2}(x + 3)^2$

$(x + 3)(x + 3)$

Re-write $(x + 3)^2$ as $(x + 3)(x + 3)$ and FOIL

$x^2 + 3x + 3x + 9$

$x^2 + 6x + 9$

$y - 4 = \frac{1}{2}(x^2 + 6x + 9)$

Substitute $x^2 + 6x + 9$ in for $(x + 3)^2$

$y - 4 = \frac{1}{2}x^2 + 3x + 4.5$

Distribute the $\frac{1}{2}$

$y = \frac{1}{2}x^2 + 3x + 8.5$

Add 4 to both side

Convert to standard form: $y = \frac{-1}{3}(2x - 6)^2 - 6$

$(2x - 6)(2x - 6)$

Re-write $(2x - 6)^2$ as $(2x - 6)(2x - 6)$ and FOIL

$4x^2 - 12x - 12x + 36$

$4x^2 - 24x + 36$

$y = \frac{-1}{3}(4x^2 - 24x + 36) - 6$

Sub. $4x^2 - 24x + 36$ in for $(2x - 6)^2$

$y = \frac{-4}{3}x^2 + 8x - 12 - 6$

Distribute the $\frac{-1}{3}$

$y = \frac{-4}{3}x^2 + 8x - 18$

Combine like terms