Goal: to convert a polynomial like **y = ax2+bx+c** to the form **y-k = a(x-h)2** which has vertex(h,k).

Example 1: Convert y= 5x2-6x-3 to vertex form.

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|  | **Step** | **Why and What** |
| 1 | y= 5x2-6x-3 | Given |
| 2 | y = 5x2-6x -3 | Move the constant term far to the RHS |
| 3 | y = 5[ x2- $\frac{6}{5}$x ] -3 | Factor the coefficient of x2 from the 1st 2 terms of the RHS. Use “BIG PARENTHESES, or ‘[ ]’ . |
| 4 | y = 5[ x2 - $\frac{ 6}{ 5}$ x + ($ \frac{ 3}{5}$ )2 – ($\frac{3}{ 5 }$)2 ] - 3 | Complete the square INSIDE the “[ ]”. 1. Half of $\frac{6}{5}$ = $\frac{6}{10}$ = $\frac{3}{5}$
2. Square the result. Add and subtract it inside the “[ ]”. You have added ZERO to the RHS.
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| 5 | y = 5[( x– $\frac{ 3}{ 5}$ )2 – ($\frac{3}{5}$)2 ] - 3 | Replace the first 3 terms inside the “[ ]” by the square of a binomial. |
| 6 | y = 5(x– $\frac{ 3}{ 5}$ )2 – 5 ($\frac{3}{5}$)2 - 3 | Distribute the coefficient (5) to the two terms inside the “[ ]”. |
| 7 | y = 5(x– $\frac{ 3}{ 5}$ )2 - $\frac{9}{5}$ - $\frac{15}{5}$ = 5(x– $\frac{ 3}{ 5}$ )2 - $\frac{24}{5}$ | Simplify the term on the right. |
| 8 | y + $\frac{24}{5}$ = 5(x - $\frac{ 3}{ 5}$ )2  | Move the constant term on the right to the LHS. |
| 9 | y - - $\frac{24}{5}$ = 5(x– $\frac{ 3}{ 5}$ )2 ***= ANSWER*** | Rewrite in vertex form (need “-“ signs). |
| 10 | Vertex = ( $\frac{ 3}{ 5} , $- $\frac{24}{5} )$. Steepness = 5. | Find the vertex and the steepness |

Example 2: Convert y= ax2 + bx + c to vertex form.

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|  | **Step** | **Why and What** |
| 1 | y= ax2+bx+c | Given |
| 2 | y = ax2+bx + c | Move the constant term far to the RHS |
| 3 | y = a[ x2- $\frac{b}{a}$x ] + c | Factor the coefficient of x2 from the 1st 2 terms of the RHS. Use “BIG PARENTHESES, or ‘[ ]’ . |
| 4 | y = a[ x2 - $\frac{b}{a}$ x + ($\frac{b}{2a}$)2 – ($\frac{b}{2a}$)2 ] + c | Complete the square INSIDE the “[ ]”. 1. Half of $\frac{b}{a} $= $\frac{b}{2a}$
2. Square the result. Add and subtract it inside the “[ ]”. You have added ZERO to the RHS.
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| 5 | y = a[( x- $\frac{b}{2a}$)2 – ($\frac{b}{2a}$)2 ] + c | Replace the first 3 terms inside the “[ ]” by the square of a binomial. |
| 6 | y = a(x- $\frac{b}{2a}$ )2 – a ($\frac{b}{2a}$)2 + c | Distribute the coefficient (5) to the two terms inside the “[ ]” |
| 7 | y = a(x- $\frac{b}{2a}$ )2 – $\frac{b^{2}}{4a}$ + $\frac{4ac}{4a}$ y = a(x- $\frac{b}{2a}$ )2 – $\frac{b^{2}-4ac}{4a}$ | Simplify the term on the right. |
| 8 | y + $\frac{b^{2}-4ac}{4a}$= a(x- $\frac{b}{2a}$ )2  | Move the constant term on the right to the LHS. |
| 9 | y - - $\frac{b^{2}-4ac}{4a} $= a(x- $\frac{b}{2a}$ )2 ***= ANSWER*** | Rewrite in vertex form (need “-“ signs). |
| 10 | Vertex = (- $\frac{b}{2a}$ , - $\frac{b^{2}-4ac}{4a} )$Steepness = a. | Find the vertex and the steepness |