

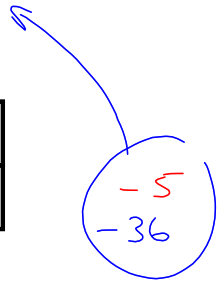
## 5.5B Completing the Square II

Ex. 1 Determine the vertex of  $y = x^2 + 12x - 5$  using the box method.

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

$$= (x+6)^2 - 41$$

$x^2$	$6x$
$6x$	$36$



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

$$= x^2 + 12x + 36 - 36 - 5$$

$$= (x+6)^2 - 41$$

$\therefore V(-6, -41)$

Ex. 2 Convert  $y = 2x^2 - 12x + 7$  to vertex form.

**Box Method**

$$y = 2x^2 - 12x + 7$$

$$= 2(x-3)^2 - 11$$

$x^2$	$-3x$
$-3x$	$9$

$x^2$	$-3x$
$-3x$	$9$



What happens when we have  $2x^2$ ?

- make 2 squares
- $x^2$  in each square
- split  $x$  terms into 4 (upper right, lower left each square)
- complete the square
- balance by subtracting any #'s added

**Algebraically**

$$y = 2x^2 - 12x + 7$$

$$y = 2(x^2 - 6x) + 7$$

$$= 2(x^2 - 6x + 9 - 9) + 7$$

$$= 2(x^2 - 6x + 9) - 9(2) + 7$$

$$= 2(x-3)^2 - 11$$

Ex. 3 Determine the vertex of  $y = 3x^2 - 6x - 5$ .

Box Method

$$y = 3x^2 - 6x - 5$$

$$= 3(x-1)^2 - 8$$

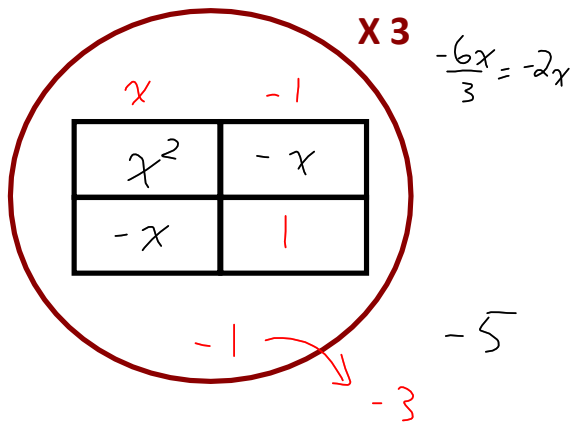
Algebraically

$$y = 3x^2 - 6x - 5$$

$$= 3(x^2 - 2x + 1 - 1) - 5$$

$$= 3(x^2 - 2x + 1) - 3 - 5$$

$$= 3(x-1)^2 - 8$$



**Algebraic Method Steps**

- Steps:
1. Remove factor of "a" from first 2 terms.
  2. Determine "3rd term" to make a perfect square trinomial...subtract at the same time.
  3. Remove the 4th term from the bracket, multiplying it by the "a" value.
  4. Factor the trinomial and collect last 2 terms.

Ex. 4 Write each of the following in vertex form.

a)  $y = 5x^2 - 30x + 12$   
 $= 5(x-3)^2 - 33$

Box Method	Algebraically
	$y = 5(x^2 - 6x + 9 - 9) + 12$ $= 5(x^2 - 6x + 9) - 45 + 12$ $= 5(x-3)^2 - 33$

b)  $y = -3x^2 - 12x + 5$   
 $= -3(x+2)^2 + 17$

Box Method	Algebraically
	$y = -3(x^2 + 4x + 4 - 4) + 5$ $= -3(x^2 + 4x + 4) + 12 + 5$ $= -3(x+2)^2 + 17$

Ex. 4 Determine the maximum or minimum point of each parabola.

a.  $y = x^2 - 14x + 20$   
 $= (x-7)^2 - 29$

b.  $y = 5x^2 + 10x - 11$   
 $= 5(x^2 + 2x + 1 - 1) - 11$   
 $= 5(x^2 + 2x + 1) - 5 - 11$   
 $= 5(x+1)^2 - 16$

c.  $y = -4x^2 + 24x - 3$   
 $= -4(x-3)^2 + 33$

challenge

d.  $y = 3x^2 - 9x + 4$

$y = 3\left(x - \frac{3}{2}\right)^2 - \frac{11}{4}$

Ex. 5 Determine the equation in vertex form, then sketch.

$$y = -2x^2 + 12x - 11$$

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

$$V(3, 7)$$

