## EXPRESSING A QUADRATIC FUNCTION IN ANOTHER FORM USING THE h AND k FORMULA

*Example 1:* a. Express  $2x^2 + 8x - 6$  in the form  $a(x + h)^2 + k$ , where *a*, *h* and *k* are real numbers.

Solution (Using a Formula):  
a) First identify the values of a, b and c of 
$$2x^2 + 8x - 6$$
.  
That is  $a = 2$ ,  
 $b = 8$   
 $c = -6$   
Second calculate the values of  $h$  and  $k$ 

$$\mathbf{h} = \frac{b}{2a}$$
$$= \frac{8}{2(2)}$$
$$= \frac{8}{4}$$
$$= 2$$
$$\mathbf{k} = \frac{4ac - b^2}{4a}$$
$$= \frac{4(2)(-6) - 8^2}{4(2)}$$
$$= \frac{-48 - 64}{8}$$
$$= \frac{-112}{8}$$

= -14

$$a(x+h)^{2} + k$$
  
Therefore  $2x^{2} + 8x - 6 = 2(x+2)^{2} - 14$ .

- b. Using the answer from above, or otherwise, calculate
  - i. The minimum value of  $2x^2 + 8x 6$  (Solution: y = -14)
  - ii. The value of x for which the minimum occurs (*Solution:*  $x = -2 \leftarrow$  Notice that the sign is changed for the *h* value. In other words x = -h)
  - iii. The vertex or coordinates of the minimum point (Solution: (-2, -14))

Note: the vertex is (-h,k) using the formula in part a

iv. The value of the y- intercept (Solution:  $y = -6 \leftarrow If x = 0$  in the equation

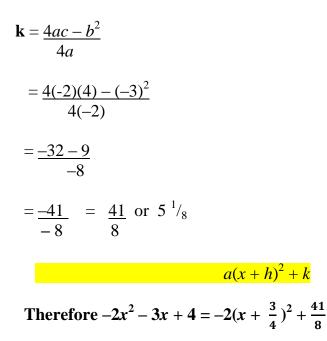
 $y = 2x^2 + 8x - 6$  then y = -6)

## Example 2:

2a. Express  $-2x^2 - 3x + 4$  in the form  $a(x + h)^2 + k$ , where a, h and k are real numbers.

**Solution (Using a Formula):** For  $-2x^2 - 3x + 4$ , *a* = -2, *b* = -3 and *c* = 4.

$$\mathbf{h} = \frac{b}{2a}$$
$$= \frac{-3}{2(-2)}$$
$$= \frac{-3}{-4}$$
$$= \frac{3}{4}$$



- 2b. Using the answer from above, or otherwise, calculate
  - v. The minimum value of  $-2x^2 3x + 4$  (Solution:  $y = \frac{41}{8}$ )
  - vi. The value of x for which the minimum occurs (Solution:  $x = -\frac{3}{4} \leftarrow Notice$  that the sign is changed for the h value. In other words x = -h)

vii. The vertex or coordinates of the minimum point (Solution:  $(-\frac{3}{4}, \frac{41}{8})$  or  $(-\frac{3}{4}, 5\frac{1}{8})$ 

Note: the vertex is (-h,k) using the formula in part a

viii. The <u>value</u> of the y- intercept (Solution:  $y = 4 \leftarrow If x = 0$  in the equation

$$y = -2x^2 - 3x + 4$$
 then  $y = 4$ )

## **ACTIVITY**

- a. Express  $3x^2 8x + 2$  in the form  $a(x + h)^2 + k$ , where a, h and k are real numbers.
- b. Using the answer from above, or otherwise, calculate i. The minimum value of  $3x^2 8x + 2$ 

  - ii. The value of *x* for which the minimum occurs
  - iii. The coordinates of the minimum point
  - iv. The value of the y- intercept