$$f(x) = 3 + 4x - x^2$$

A Find the vertex

Put it in vertex form → $y - k = a(x-h)^2$

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

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

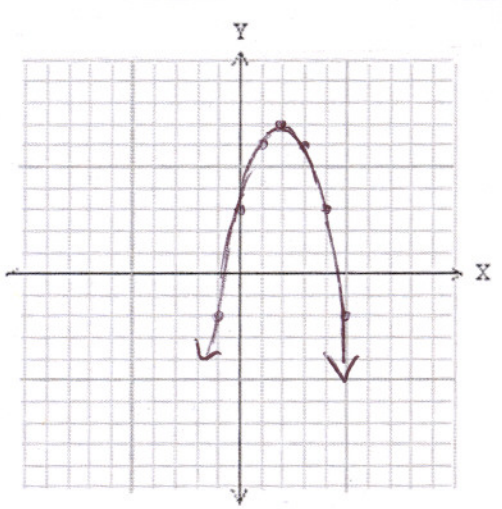
$$y - 3 = -(x^2 - 4x \quad)$$

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

$$\boxed{y - 7 = -(x-2)^2}$$

vertex is $(2, 7)$

B Find the domain and range



1) make a rough sketch
2) Put vertex on graph (h, k)
3) Look at a to determine if graph looks like  or 

DOWN UP

4) Domain is all real numbers
(you can go as far left & right as you wish)

5) Range if maximum $y \leq k$

Range if minimum $y \geq k$

Domain: All real #s

Range: $y \leq 7$

[C] Find the zeros

Let's go back to the original equation and set $f(x) = 0$

$f(x) = 3 + 4x - x^2$

$\downarrow$

$0 = 3 + 4x - x^2$ OR $-x^2 + 4x + 3 = 0$

Looks like a job for the quadratic formula!

$a = -1 \quad b = 4 \quad c = 3$

$$x = \frac{-(4) \pm \sqrt{(4)^2 - 4(-1)(3)}}{2(-1)}$$

$$x = \frac{-4 \pm \sqrt{16+12}}{-2}$$

$$x = \frac{-4 \pm \sqrt{28}}{-2}$$

$$x = \frac{-4}{-2} \pm \frac{2\sqrt{7}}{-2}$$

$$x = 2 \pm \sqrt{7}$$